Spatial Data Sharing: From Theory to Practice

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Network of Acknowledgements
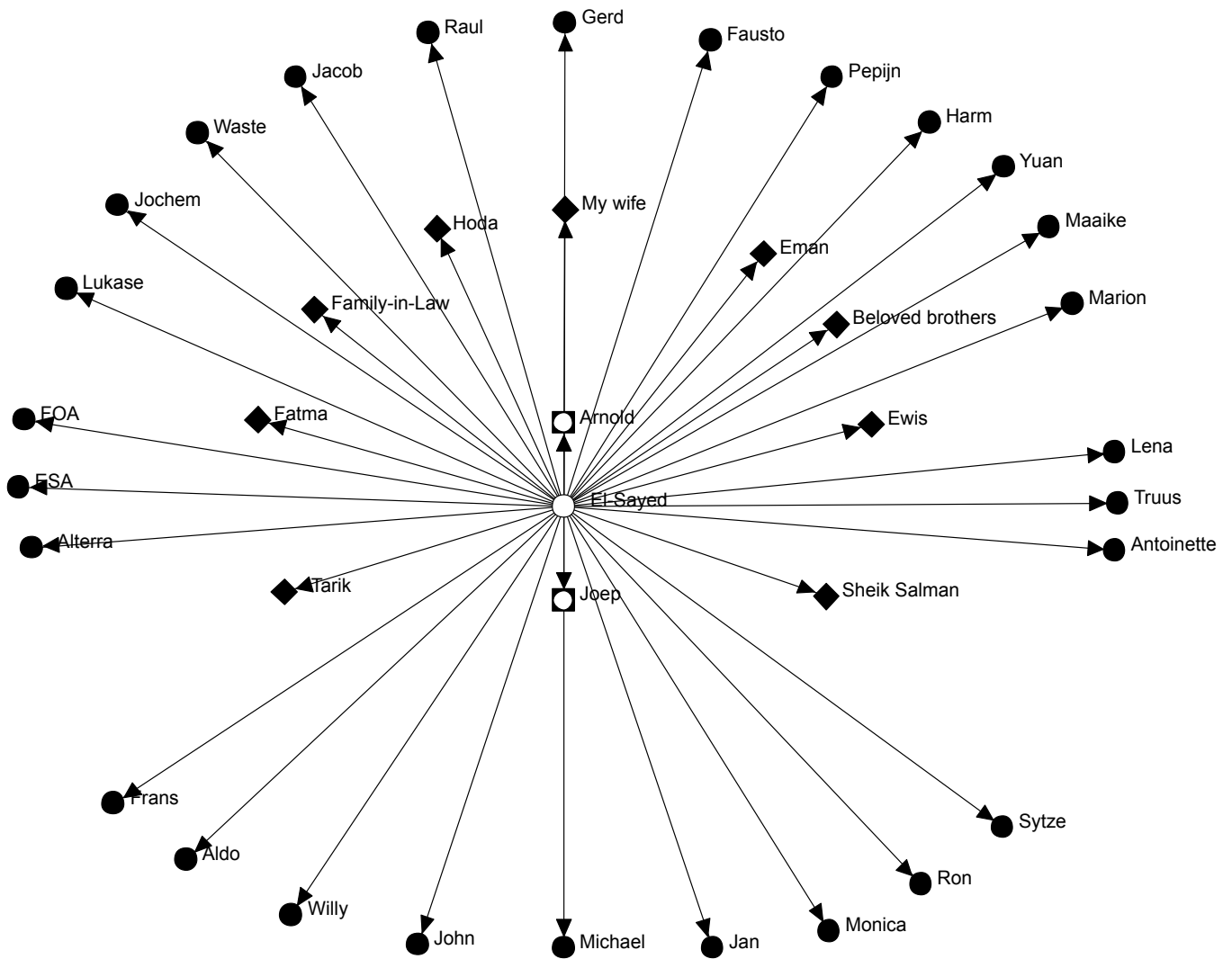
◻ Group of reflection, knowledge, and criticism.

◆ Group of love, worship, support and motivation.

● Group of inspiration, coffee and help.

El-Sayed Ewis Omran

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Chapter 1

General Introduction

1.1 SPATIAL DATA SHARING: PROBLEM STATEMENT

Over the last decade, the production and use of digital spatial data has increased rapidly. This strong growth has caused duplication of data collection efforts and a suboptimal uses of resources (Warnecke et al. 1998; Wehn de Montalvo 2003; Omran et al. 2006). Spatial Data Infrastructures (SDIs) play an important role in optimizing the organization and use of spatial data. SDIs are supposed to facilitate Spatial Data Sharing (SDS) among organizations, which is a basic condition for data access and multiple use at all levels (Crompvoets et al. 2004; Harvey and Tulloch 2006).

While technical aspects in spatial data sharing receive much attention (Bishr 1998; Stoimenov et al. 2005), it cannot be expected that all spatial data sharing obstacles can be solved by technical solutions. The technical aspect has been addressed to solve problems of data integration (interoperability) (Harvey 2002; Goodchild et al. 1998). For SDS not only technical interoperability, but also "soft interoperability" is important for successful SDIs. Nedovic-Budic and Pinto (2001) introduce the term "soft interoperability" to draw attention to the human and behavior aspects of SDS, which is an inherently social phenomenon. The challenge of improving SDS is in a better understanding of the human (individual and organization) behavior.

There are many examples of SDS failure. A short introduction to these cases may help the reader to get an impression of the importance and nature of the problem and set the stage for the remainder of this dissertation.

The first example is from the Egyptian Survey Authority (ESA). ESA is executing the Egyptian Cadastral Information Management (ECIM) Project, which involves the management of spatial data. The ECIM project started in March 2002 to support the computerization of the cadastral system in Egypt. This project aims to improve the links between the land information system for cadastral services and the systems for land registration and taxation. In order to achieve this goal, ESA collaborates with the Real Estate Publicity Department (REPD) of the Ministry of Justice (responsible for the land registry) and the Real Estate Taxation Department (RETD) of the Ministry of Finance. The system that is managed within the ECIM Project consists of ESA's own cadastral data and workflows, and the information exchange links with REPD's land registration system and RETD's land taxation system (Elrouby et al. 2005). Many of the challenges to the ECIM Project have been caused by the lack of cooperation between these organizations. The relationship between ESA and REPD deteriorated in the course of the project, 2002 and 2005 (Elrouby et al. 2005).

The second example is from National Authority for Remote Sensing and Space Sciences (NARSS) in Egypt. NARSS has a core of eight different divisions: 1) geology and mineral resources; 2) agriculture applications, soils, and marine; 3) engineering studies and water resources; 4) environmental studies and land use; 5) space sciences and strategic studies; 6) image processing, computer and ground receiving station; 7) aerial photography, aviation and surveying; and 8) scientific training and continuous studies.

Spatial data are fragmented across multiple systems and databases, and linkages are lacking (Omran 2005; Omran et al. 2006). This lack of linkages also precludes effective updating of the data, to maintain a high-level of accuracy, or to do any serious reporting. The main problem is the lack of cooperation between the eight divisions.

The third example is from the Egyptian national government. The national plan for communication and information technology paved the way for the initiation of the Egyptian Information Society Initiative (EISI). Connectivity and access have become a major part of the government's action in the last 7 years (30 billion Egyptian Pound invested in ICT companies) to overcome various shortfalls in infrastructure (MCIT 2004). The government is relying heavily on collaborative efforts in the form of public private partnerships and outsourcing schemes. Under such partnerships, a new e-Government Portal has been developed. This Portal is managed by a team from the Ministry of Communication and Information Technology (MCIT) and the Ministry of State for Administrative Development (MSAD). The team is working with relevant ministries, authorities, and organizations to integrate automated spatial data and services into the Portal. The project is still facing many major cooperation barriers between these organizations.

The fourth and final example is from National Spatial Data Infrastructure (NSDI) projects. The project "potentials and pitfalls of the NSDI for local Governments" (Harvey 2000), conducted with UCGIS/FGDC support, indicated two main problems in the development of the NSDI: 1) lack of awareness and 2) lack of data sharing and coordination. The other project, "exploratory studies of the NSGIC/FGDC framework survey: Looking at the State of the Nation" (Tulloch 2000), showed the need to improve (spatial) data sharing and better understand the ways in which sharing practices occur.

What do these examples tell us? Spatial data infrastructures are much more than only the 'hard' infrastructure. Spatial data sharing is a crucial element in successful SDIs. SDS is essentially a social process; it involves also human behavior that is shaped by socio-cultural conditions. Spatial data sharing networks are made up of people and the relationships between those people (Omran and van Etten 2007). Any system relying on people and relationships is subject to the complexity of social coordination and motivation of involved individuals. One of the most difficult factors to address or change may be the fundamental beliefs or attitudes of individuals with authority over decisions regarding data sharing. As Nedovic-Budic and Pinto (1999) write, "resistance to data sharing is typically not related to technical issues. […] Rather, we continue to find that these challenges are first and foremost "people" challenges. The challenge of improving SDS rests firstly on our better understanding of individuals and organizations behavior and their social and cultural aspects."

It follows from these examples that data sharing is easier to advocate than to practice (Azad and Wiggins 1995). Action should ideally be based on understanding. To the best of author's knowledge, studies on socio-cultural aspects of spatial data sharing are very rare and a challenge for new theory development. Most of what has been written on the topic of data sharing has focused on organizational issues (Craig 2005). Onsrud and Rushton's book, *Sharing Geographic Information* (1995), with 29 separately authored chapters, is almost exclusively about organizational issues.

This thesis focuses on the socio-cultural aspects of spatial data sharing.

1.2 SPATIAL DATA SHARING: DEFINITION

It is worth now defining the terms employed in this study. What does *Spatial Data Sharing (SDS)* mean? *Spatial data* is a sub-set of information that represents some features, attributes and objects of the world; typically it includes both physical (e.g. land cover, soil type) and socio-economic (e.g. land use, soil capability) facets (Comber et al. 2003). *Sharing* means unselfishly willing to share with others. Webster (1960) defines *to share* as "to divide and distribute in portions; to apportion; divide; to partake of, use, experience, or enjoy with others". The primary meaning of sharing is that it is freely given for no return. *Spatial data sharing* means allow data to be used repeatedly for many purposes, thus increasing their value without increasing their cost (Mackaay 1982). The value and social utility of spatial data comes from its use. The more spatial data is shared, the more it is used, and the greater becomes society's ability to evaluate and address the problems to which such information may be applied (Onsrud and Rushton 1995). Sharing of spatial data necessarily presupposes the existence of relationships among individuals and organizations (Tosta 1995). The major difference between *spatial data sharing* and *data sharing* is the need to have common definitions and standards for the spatial data (Calkins and Weatherbe 1995). In this sense spatial data can be seen as strongly socially and culturally constructed.

Sharing of spatial data may take many forms, ranging from the sale of data by one organization to another to simultaneous access of a single data set by many persons or organizations (Kevany 1995). Wehn de Montalvo (2003b) and Tulloch and Harvey (2006) define spatial data sharing as the (normally) electronic transfer of spatial data/information between two or more organizational units where there is independence between the holder of the data and the prospective user. The transfer may be in the form of periodic bulk transfers, routine daily transfers, or on-line access driven by individual transactions.

In the light of these clarifications, "Spatial Data Sharing" is defined in this thesis as those transactions in which individuals, organizations or parts of organizations obtain access from other individuals, organizations or parts of organizations to spatial data. These transactions may or may not include financial payment.

1.3 SPATIAL DATA SHARING: FROM THEORY TO PRACTICE

It is quite common that people ask a question about the relevance of Spatial Data Sharing (SDS) theory as exemplified by the saying of a person from the Egyptian organizations: "SDS theory is one thing, but practice is something completely different". Another one stated: "To me, SDS theories are something that do not work in practice." Somehow it is an implicit underlying assumption that SDS theories should be able to stimulate a better practice. But this relationship is often questioned. Harvey and Tulloch (2006) argue that sharing and cooperation are good ideas in theory, but involve some significant assumptions about the use of technologies and policies in practice. From a "parallel-worlds" perspective it seems to be common sense that there are differences between SDS theory and practice (Woolgar 1988; Gergen 1992; Latour 1993, 1999; Gergen and Thatchenkery 1996; Van de Ven 2000). The question is "How to bridge the gap between theory and practice?"

Instead of two "parallel-worlds", re-conceptualization the relationships between SDS theory and practice is proposed. This re-conceptualization of SDS (from the angles of psychological and socio-cultural domain) takes the individual behavior as a basis. The underlying line of reasoning is that understanding the attitudes and beliefs (*theory*) of the individuals plays a crucial role in actual level (*practice*) of SDS. Individual behavior and attitude is caused and affected by socio-cultural aspects. If the intention of key individuals inside organization towards SDS changed, also the overall organizational attitude will change. Through theory new possibilities for SDS can be constructed. Through practice the SDS resistance can be changed in reality. The author proposes to integrate different theories from socio-cultural domain and converted them into a spatial data sharing model. This model helps to explain and understand the socio-cultural patterns that characterize individual and organizational behavior. Based on this understanding, individual behavior might be changed.

1.4 AIM AND SCOPE

The overall research objective of this thesis is *to examine the theoretical and practical aspects of spatial data sharing behavior from a socio-cultural perspective*. To achieve the overall objective, the following five specific objectives have been formulated:

1- To identify the main socio-cultural theories relevant for spatial data sharing behavior;
2- To develop a cross-cultural conceptual model for understanding spatial data sharing behavior;
3- To validate the cross-cultural model developed;
4- To determine the actual spatial data sharing behavior in an Egyptian project; and
5- To change and assess the actual spatial data sharing behavior.

Figure 1.1 presents the relationship between the thesis specific objectives as well as chapters. *Objective 1* identifies the main socio-cultural theories relevant for spatial data sharing behavior (chapter 2). Some of these theories are adopted and used as a basis to develop a cross-cultural conceptual model for understanding spatial data sharing behavior under *objective2* (chapter 3). O*bjective 3* (chapter 4) is to validate the cross-cultural model developed under *objective 2*. In order to achieve *objective 4* (chapter 5), some of the theories identified under *objective 1* are used with the cross-cultural model developed under *objective 2* to determine the actual spatial data sharing behavior in an Egyptian project. To change and assess the actual spatial data sharing behavior (*objective 5,* chapter 6); the author used the previous products: the conceptual model (*objective 2*), its validation (*objective 3*) and a study actual SDS behavior (*objective 4*).
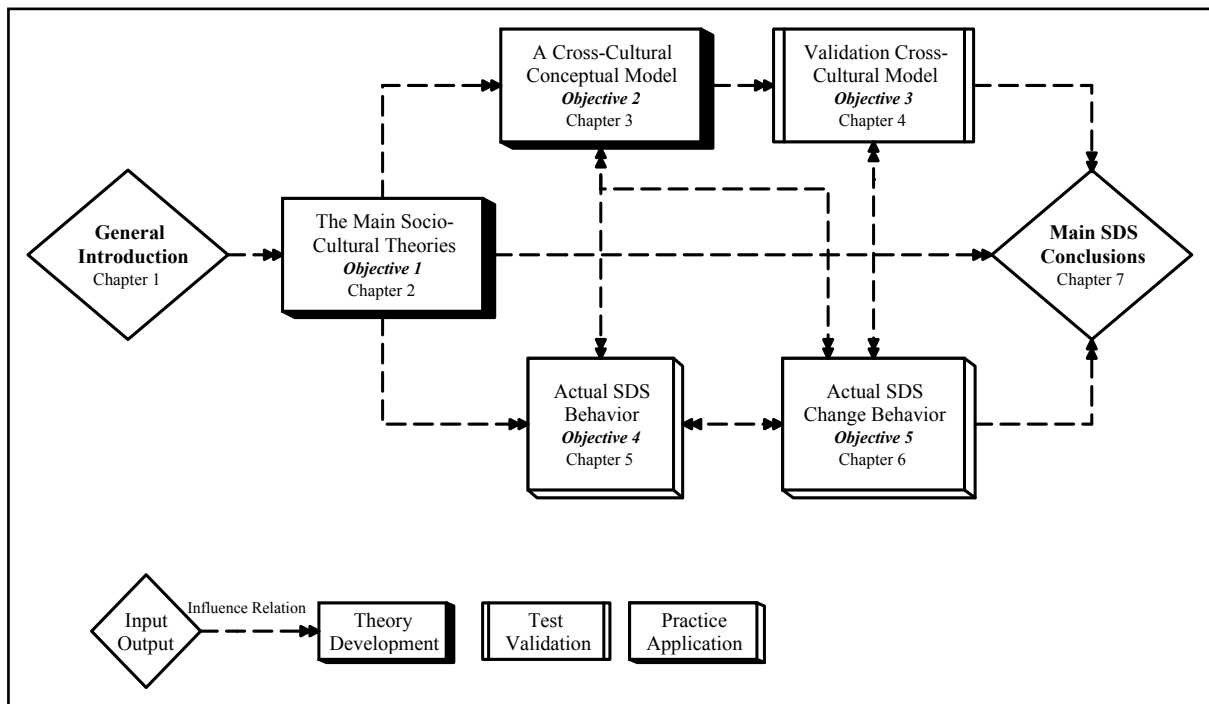
Figure 1.1 Main research framework setting.

1.5 OUTLINE OF THE THESIS

The core of this thesis (chapters 2-6) is based on a series of five papers that have been published in, or submitted to internationally reviewed journals or books. The content is the work of the author of this thesis El-Sayed Ewis Omran. These chapters cover the spatial data sharing from theory to practice. Each chapter focuses on a sub-objective as discussed earlier. Figure 1.1 outlines the relationship between the chapters.

Chapter 2 investigates the conceptual and theoretical gaps in previous research on spatial data sharing over the last 17 years (1990-2006). This chapter identifies the main socio-cultural theories relevant for spatial data sharing behavior. These socio-cultural theories provide a theoretical basis for the spatial data sharing behavior.

Chapter 3 attempts to develop a cross-cultural SDS conceptual model by grounding new variables in well-accepted theories which are identified in chapter 2. Based on this model, the hypotheses are formulated for understanding spatial data sharing behavior at the individual and organizational level.

Chapter 4 attempts to validate the cross-cultural model developed. The hypotheses formulated in chapter 3 are validated and tested in a different social and cultural context (Egypt and the Netherlands). A revised spatial data sharing model was proposed.

Chapter 5 determines the actual spatial data sharing behavior in an Egyptian project. This chapter introduces social network analysis through an empirical study of a subdivision of one particular organization, the Egyptian Survey Authority (ESA) of Egypt.

Chapter 6 changes and assesses the actual spatial data sharing behavior. This chapter determines the types of SDS behavior change that occurred at the individual and organizational level.

Finally, chapter 7 concludes the thesis with the main conclusions and recommendations for future research.

Chapter 2

Spatial Data Sharing: Bridging the Gap

Omran, El.E., 2007. Spatial data sharing: Bridging the gap. Urban and Regional Information Systems Association Journal, (under review).

2.1 INTRODUCTION

The overall trend in thinking about Spatial Data Infrastructure (SDI) has been toward a complex structure. This complexity reflects both changes in the nature of SDI and their external environment (Chan 2001; Rajabifard et al. 2003; De Man 2006). These dynamic environments (more complexity and faster change) present uncertainty for organizations. Uncertainties make the organizations face contingencies about how and where they will capture organizational resources. Complexity and uncertainty leads organizations to focus on cooperation relationships to smooth out environmental change (Oliver 1990) and to have more certainty with regard to resource acquisition (Galaskiewicz 1985). Organizations have different objectives when they participate in cooperation relationships and consequently they create different types of relationships (Bensaou and Venkatraman 1995; Grandori 1997). One of these relationships is spatial data sharing. Spatial Data Sharing (SDS) is defined as transactions in which individuals, organizations or parts of organizations obtain access from other individuals, organizations or parts of organizations to spatial data. These transactions may or may not include financial payment (Omran and van Etten 2007).

Two areas of concern are identified relating to SDS research. First, the factors considered in the literature are mostly conceptualized in terms of facilitators and constraints (Stage 1995; Tosta 1995), costs and benefits (Alfelor 1995; Dangermond 1995; Dueker and Vrana 1995), or antecedents and consequences (Obermeyer and Pinto 1994; Pinto and Onsrud 1995) of spatial data sharing. Yet, the individual, institutional, theoretical and behavioral aspects of SDS have not been investigated (Omran et al. 2007a). Second, the numbers of SDS cooperation that fail to meet their founders' expectations are impressive. Porter (1987) argued that the failure rate in cooperation is approximately 50 percent. Park and Ungson (1997) gave the same ratio for joint ventures. Miles and Snow (1992) argue that organizations are continuing to form cooperation relationships and as a result failures of these relationships are expected to increase. One reason might be that the current theories used can not predict SDS behavior that determines the success or failure of cooperation relationships. This situation will not be improved until we can find a theory addressing SDS behavior. So the current study is motivated by the questions: What are the main organizational, theoretical, and methodological gaps related to SDS? What are the main theories that might explain SDS? How can these theories in turn influence the SDS behavior?

To address these questions, first, a comprehensive multi-approach review of the existing literature (over the last 17 years) to identify the underlying research gaps of SDS is conducted. Second, this study draws upon extensive literature in social and cultural theories to propose theories that could explain and predict SDS behavior. To the best of the author knowledge, the scientific contributions in SDS research have not been carried out with a socio-cultural approach.

The main contribution of this chapter is to support the development of a framework for SDS behavior by a detailed analysis of current SDS gaps. This chapter identifies factors and motives that have been reported in the literature which could lead to successful SDS relationships. In addition, it is a basis for understanding how the social and cultural aspects of SDS can be addressed more effectively. Understanding the influences of individual and

organizational behavior on SDS can greatly assist in evaluating the extent to which SDS in one organization can be validly used to inform policy choices in another organization.

In next section the research methodology is presented. After that, the results and discussion are presented; first, the results of the literature review on the SDS gaps, followed by the potential social and cultural theories for explanation and solution. The chapter concludes with a discussion of the relevance of this research and issues for further study.

2.2 METHODOLOGY

A review to study the existing SDS literature was carried out. A multi-approach review examines existing literature to expose researchers' underlying and often taken-for-granted assumptions about the phenomenon being studied (Lewis and Kelemen 2002). This review includes almost all refereed articles from 1990 through 2006[1] on the topic of SDS dealing with some aspect of cooperation relationships. The articles were identified by searching all peer-reviewed articles in "ISI Web of Science", "SCOPUS" and "GEOBASE" using the search terms "Spatial Data Sharing", "Inter-Organizational Relationship" or "Organizational Collaboration". The author reviewed each retrieved article's title, abstract, and key words to ensure that it addressed SDS in the context of cooperation relationships. The articles that focused on security, standards or other issues not directly related to cooperation relationships were eliminated. The final sample consisted of 43 articles from 28 journals. The complete list of the articles' topic, reference and journal published can be found in table 2.1. The sample includes articles from a wide range of countries: e.g. Australia, Canada, China, Denmark, Finland, Japan, The Netherlands, United Kingdom and United States.

In order to analyze the current gaps, three approaches (see part 2.2.1, 2.2.2, 2.2.3) that have been used in the literature were chosen (Elgarah et al. 2005). These approaches were causal organization (Markus and Robey 1988), Inter-Organizational Relationship (IOR) typology (Hall 1999), and cooperation relationship motives (Oliver 1990). These approaches were used to identify the organizational gaps related to SDS. Theoretical gaps related to SDS were identified based on classification the papers on the bases of current theories used. Methodological gaps were identified based on study the focus of each paper and the type of data collection and research methods used. Using these approaches, a coding sheet was developed (appendix 1). This coding sheet was used to classify the data extracted from the articles.

In order to bridge the SDS gaps, the current social and cultural theories were explored and reviewed. These theories are reviewed with the individual and organizational behavior in mind. The criteria for selecting a potential social and cultural theory for SDS are: widely accepted and applied; received strong empirical support; relevant for SDS behavior; and predict individual and organizational behavior.

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[1] The articles appeared in 2006 are analyzed and the results added to the paper in the beginning of 2007

Table 2.1 Spatial data sharing discipline, references and list of journals that published analyzed articles.

Discipline	References to	Journal Name
Outcome/ benefits/ costs/ saving resources	Stickel et al. 1994; Nicolaou 2000; Damsgaard and Lyytinen 2001; Teo et al. 2003; Alfelor 1995; Dangermond 1995; Dueker and Vrana 1995; Calkins and Weatherbe 1995; Nedovic-Budic and Pinto 2000, 2001; Nedovic-Budic et al. 2004.	- Transaction in GIS - International Journal of Accounting Information Systems - Information & Management - Information Society - Decision Support Systems - International Journal of Strategic Cost Management - Information Systems - Sharing Geographic Information, Eds. H J Onsrud, G Rushton (Center for Urban Policy Research, New Brunswick, NJ) - Environment and Planning B-Planning & Design - Urban and Regional Information Systems Association Journal - MIS Quarterly
Trust/risk/power	Stage 1995; Geyskens et al. 1996; Hart and Saunders 1997; Adobor 2005, 2006; Harvey 2003; Obermeyer 1995; Harvey and Tulloch 2006.	- Organization Science - Journal of Strategic Information Systems - Journal of Retailing - Canadian Geographer - Leadership & Organization Development Journal - International Journal of Geographic Information Science
Inter-organizational collaboration	Harrigan and Newman 1990; Azad and Wiggins 1995; Dueker and Vrana 1995; Kevany 1995; Andersen 1999; Nedovic-Budic and Pinto 2000, 2001; Lee et al. 2003; Williams 2005.	- Spatial Science - Information & Management - Journal of Strategic Information Systems - Journal of Management Studies - Research Policy - American Journal of Community Psychology - Sharing Geographic Information, Eds. H J Onsrud, G Rushton (Center for Urban Policy Research, New Brunswick, NJ) - International Journal of Applied Earth Observation and Geoinformation - Environment and Planning B-Planning & Design
Adoption and implementation	Cavaye 1996; Finnegan et al. 1999; Pienaar and van Brakel 1999; Jun et al. 2000; Kurnia and Johnston 2000; De Man and Den Toorn 2002; Liblit et al. 2003; Son et al. 2005; Nedovic-Budic and Pinto 2001; Nedovic-Budic and Godschalk 1996.	- International Journal of Applied Earth Observation and Geoinformation - Journal of Management Information Systems - European Journal of Information Systems - International Journal of Technology Management - Electronic Library - Journal of Strategic Information Systems - Static Analysis, Proceedings - Public Administration Review
Antecedents and consequences	Pinto et al. 1993; Obermeyer and Pinto 1994; Pinto and Onsrud 1995; Castle 2004.	- Management Science - Environment and Planning B-Planning & Design
Behavioral approach	Wehn de Montalvo 2003a.	- Urban and Regional Information Systems Association Journal

The theories identified were classified based on the type of behavior studied to four categories: individual, organizational, cultural and cognation domain. Identifying and bridging the SDS gaps enable the formulation of theoretically grounded, methodologically sound, and empirically robust insights into SDS that have strong potential for future research.

Finally, ISI[2] citation analysis is used as indicator to investigate how national culture affects variety of issues (Ford et al. 2003).

2.2.1 Causal Organizational Change for SDS

To understand the underlying organizational change for SDS, the three causal structures (i.e., technological, organizational and emergent perspective) proposed by Markus and Robey (1988) were adopted. This approach was chosen because (cited 476 times in the ISI) it has been widely used in previous information system research (George and King 1991, Pinnsoneault and Kraemer 1993; Jasperson et al. 2002). Markus and Robey (1988) identified three perspectives underlying causal organization. The technological perspective shows that change is caused by external forces (i.e., technology). Technology determines or constrains the behavior of both individuals and organizations. Technology is seen as the primary driver of organizational cooperation. However, the organizational perspective posits that people act purposefully to accomplish intended objectives, therefore determining organizational change. The emergent perspective views change as emerging from complex interactions between technology and its organizational users over time.

2.2.2 Inter-Organizational Relationship Typology

The second approach adopted for analysis was the Inter-Organizational Relationships (IOR) typology presented by Hall (1999). This approach (cited 488 times in the ISI) was chosen to identify the types of IORs most studied in data sharing research. Hall (1999) identified three types of IORs: dyadic (pair wise) relationships, inter-organizational sets, and inter-organizational networks. A dyad displays a relationship between just two individuals or organizations. A set places emphasis on a focal organization and all of its dyadic relationships with other organizations. Networks consist of multiple individuals or organizations linked by a specified type of relation to achieve certain goals or resolve specific problems.

2.2.3 Motivation for Adopting Spatial Data Sharing Relationships

The question most widely asked in the field of inter-organizational relationships is why organizations enter into cooperation relationships. Oliver (1990) articulates this question as discoveries of the contingencies that motivate organizations to establish relationships. There are a number of strategic reasons that motivate individuals or organizations to share data. To examine the motives for adopting SDS, the third approach (cited 451 times in the ISI) used in this chapter was driven from Oliver (1990). Oliver integrated the work of more than 160 articles (from 1960 till 1990) related to the determinants of inter-organizational relationships and suggested six determinants (see Table 2.2). Since individuals often have multiple reasons for turning to SDS, all motives that were mentioned in an article were coded.

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[2] The citation analyses are tracked over long time. The final measures are in 10/2/2007

Table 2.2 Determinant for spatial data sharing behavior (adopting from Oliver 1990).

Factors	Definition
Necessity	An organization exchanges with other organizations in order to meet necessary legal or regulatory requirements. For example, loss of resources will determine that mandated relations occur.
Asymmetry	Exchange relationships are established in response to power or control of another organization. The reluctance to loss of autonomy and the desire for control reflect asymmetrical motives to interact.
Reciprocity	Motives of reciprocity emphasize cooperation among organizations to pursue commonly beneficial goals.
Efficiency	Formation of cooperation is prompted to improve the internal input/output ratio of an organization and internal efficiency.
Stability	Formation of data sharing relations is an adaptive response to environmental uncertainty (generated by resource scarcity or lack of perfect knowledge) in order to achieve stability.
Legitimacy	Data sharing is established to appear in agreement with the prevailing norms, rules or expectations of external constituents and/or to improve the image, reputation, and prestige.

2.3 RESULTS AND DISCUSSION

The results and discussion will be present first by SDS gaps followed by identified the main potential social and cultural theory to solve SDS gaps.

2.3.1 Spatial Data Sharing Gaps

Organizational, theoretical and methodological issues in spatial data sharing are the main results presented and discussed in the next part.

Organizational Issues in Data Sharing

Table 2.3 shows that the number of studies of each type of data sharing type decreased with the level of complexity: 45.2 % dyads, 35.7 % sets, and 19.1 % networks. "Dyads" represent the relationship that develops between two organizations sharing spatial data. When considering long-term relationships, dyads may be especially important. "Set" is important when considering a "hub and spoke" relationships. A powerful hub, typically a larger organization seeks to establish SDS relations with all its partners. Based on the results of literature review, a very high percentage of articles adopted are based purely upon the technological perspective (90 %). Six percent used an emergent perspective. Four percent adopted an organizational perspective method.

Individuals and organizations often had several reasons for SDS. Since there is an overriding concern in discovering the benefits of SDS, it could be anticipated that the motives for SDS vary substantially over this global sample. Table 2.3 shows that efficiency is mentioned as a motive for SDS in 47.6 percent of the studies. Clearly the anticipation of cost savings underlies almost all decisions to share data. Asymmetry was cited as a motive in 20.0 % of the studies. Reciprocity was identified as a motive in 14.3 % studies. Necessity was infrequently discussed as a motive for SDS. One of the studies that focused on necessity is Damsgaard and Lyytinen (2001) which looked at the role of industry associations in

compelling organizations to share data. This study used a set typology and encountered two deficiencies of data sharing research: Failing to consider institutional forces behind SDS and failing to consider the international context of data sharing behavior. When SDS is an adaptive response to environmental uncertainty and its purpose is predictability and dependability of the relationship, stability as a motive applies. In fact, stability is found in 7.2 % of the studies examined. Only one study highlighted legitimacy motives.

Table 2.3 Frequency of spatial data sharing motives and types.

Spatial Data Sharing Types	Spatial Data Sharing Motives						
	Necessity	Asymmetry	Reciprocity	Efficiency	Stability	Legitimacy	Frequency (%)
	Frequency						
Dyads	1	4	3	10	1	0	19 (45.2)
Sets	1	3	2	6	2	1	15 (35.7)
Networks	2	1	1	4	0	0	8 (19.1)
Frequency (%)	4 (8.6)	8 (20)	6 (14.3)	20 (47.6)	3 (7.2)	1 (2.3)	42 (100)

Not surprisingly, efficiency is a motive for SDS across all types of relations (dyads network and sets). Asymmetry appears to be less of a motive in networks. This might be due to the nature of networks where there is no one dominant organization and SDS are less likely to be formed in response to power and control of an organization. In contrast, asymmetrical power relationships may not only be clear but also very important in persuading less-powerful partners to adopt data sharing in dyads or in set relationships. Additionally, reciprocity is most often cited as a motive in dyads. This result could be interpreted in two different ways. One interpretation could be that dyads are easier to study than sets or networks. Another interpretation is that in dyadic relationships, reciprocity is a motive because it is easier to focus on relationships with one organization.

Theoretical Issues in Spatial Data Sharing

Table 2.4 provides results of theoretical issues that are used within the data sharing literature. Transaction Cost Economic (TCE) has received significant attention (28.5 %) within data sharing literature as it focuses on how organizations minimize the sum of its production and transaction costs. TCE has been used to study the impact of data sharing on production and transaction costs. The second is the organization theory (21.4 %). The third highest theory is resource dependence (16.7 %). The fourth theory mentioned is incomplete contracts (16.7 %). The fifth theory found is adoption theory (9.5 %). The adoption and use of SDS is dependent on three main groups of factors. First, the nature of SDS technology being adopted as some technologies can create difficulties that inhibit successful SDS adoption. Second, the adopting organization as it is mainly the organization that needs to initiate and execute the

adoption. Finally, the relationship with other organizations as the use of the data sharing can have a major impact on the organization. Political economy theory has received 4.8 %. Political economy draws one's attention to the importance of economic and political institutions. The theory with the lowest (2.4 %) percentage is the theory of planned behavior.

Table 2.4 Current theories used in data sharing relationships.

Theory of	Frequency (%) Used in Literature
Transaction Cost Economic (TCE)	12 (28.5)
Incomplete Contracts	7 (16.7)
Adoption	4 (9.5)
Organizational theory	9 (21.4)
Resource Dependence	7 (16.7)
Planned Behavior	1 (2.4)
Political Economy	2 (4.8)
Total sample	42 (100)

Methodological Issues in Spatial Data Sharing

Table 2.5 and table 2.1 explore the topic that was the focus of each particular article. The result shows that highest percentage of literature focused on outcomes/benefits, adoption and implementation, inter-organizational collaboration, trust and power compared to antecedents and consequences (25.6 %, 23.3 %, 20.9 % and 18.6 vs. 9.3 %, respectively). A very small number of articles (only 2.3 %) try to figure out specific aspects of the relationship such as SDS behavior.

Table 2.5 Topic areas and distribution of the data sharing sample studied.

Area of the Study	Number of Article Published (%)
Outcome/ benefits/costs	11 (25.6)
Trust/risk/power	8 (18.6)
Inter-organizational collaboration	9 (20.9)
Adoption and implementation	10 (23.3)
Antecedents and consequences	4 (9.3)
Behavioral approach	1 (2.3)
Total sample	43 (100)

Table 2.6 shows that 55.3 % of the literature used surveys as a research method that in comparison with the 31.6 % that used case study. 73.7 % of the literature used single data collection, as compared to only 18.4 % that took a more long-term approach using longitudinal data collection. All the five field studies and 18 of the total 21 survey studies are used single approach for data gathering. In contrast, the case studies used a combination of longitudinal, single, and multiple data collection.

Table 2.6 Frequency of the research approaches and data collection type.

Data Collection Type	Case study	Survey	Field study	Conceptual	Review	Frequency (%)
			Frequency			
Single	5	18	5	0	0	28 (73.7)
Multiple	3	0	0	0	0	3 (7.9)
Longitudinal	4	3	0	0	0	7 (18.4)
Frequency (%)	12 (31.6)	21 (55.3)	5 (13.1)	0 (0)	0 (0)	38 (100)

Table 2.7 shows that theoretically grounded is the dominant method in data sharing research. 61.1 % are theoretically grounded while another 31.9 % are descriptive. Only 6 % interpretive studies are represented in this sample. All interpretive studies adopted either a case study or a field study research approach, whereas the theoretically grounded studies used a variety of approaches. The most dominant research approach among the theoretically grounded studies is surveys (55.2 %).

Table 2.7 Frequency of the research approaches and research methods.

Research Methods	Case study	Survey	Field study	Conceptual	Review	Frequency (%)
			Frequency			
Descriptive	3	4	0	3	1	11 (31.9)
Theoretically Grounded	1	15	2	3	0	21 (61.1)
Interpretive	1	0	1	0	0	2 (6.0)
Frequency (%)	5 (14.6)	19 (55.2)	3 (8.8)	6 (17.5)	1 (2.9)	34 (100)

Discussions of Spatial Data Sharing Gaps

The results suggest four areas where the gaps may inhibit our full understanding of spatial data sharing.

First, focus on technological perspective could mask the individual and organizational SDS effectiveness. Most studies employed the technological perspective to understand the benefits and shortcomings of data sharing. These studies to date do not address the more progressive or evolving nature of the SDS behavior.

Second, the analysis of the theoretically grounded studies reveals that the most frequently-used theories in understanding the benefits of SDS are transaction cost economics, organizational theory, incomplete contracts, adoption, political economy and resource dependence. These theories do not always provide a sufficient explanation for the success or failure of SDS relationships. These theories can not predict SDS behavior because they deal mainly with the economic aspects.

Third, the results reveal the main methodological gaps that need to be addressed in further research to provide a better understanding of the SDS behavior. Many longitudinal studies are case studies that suffer from generalization limitations.

Fourth, the following factors are cited as motivating the individuals and organizations to share data: incentives and resource scarcity (Pinto and Onsrud 1995); authority (O'Toole and Montjoy 1984); cost saving and data availability (Nedovic-Budic and Pinto 2000).

What have been missing from the current literature are systematic attempts to develop a framework that can foster SDS relationships between individuals and organizations. Obermeyer and Pinto (1994); Kevany (1995); Azad and Wiggins (1995); Nedovic-Budic and Pinto (1999); and Wehn de Montalvo (2001, 2003a,b) have developed frameworks. There are some limitations for these models: 1) These frameworks are not well grounded (except Wehn de Montalvo and Nedovic-Budic framework) in previous research and theory on spatial data sharing. Most of the frameworks draw on the authors' extensive understanding of and experience with data sharing; 2) The relation between factors has not been properly investigated; 3) The proposed experimental frameworks are not verified; and 4) Social and culture aspect of SDS is not considered.

Overall, a critical question that can not be answered from existing literature is what are the main social and cultural theories that might explain SDS behavior? There is a need to find theories to address SDS behavior. The differences in behavior between individuals as organization members and as individual as such are not explained by the existing theories and literature. Individual and organizational behaviors are the crucial factor for SDS. Social and culture theories could be used for SDS behavior. So, in the next section, promising social and cultural theories will be discussed.

2.3.2 Bridging the Spatial Data Sharing Gap

Digging in the Socio-cultural Theories

In order to propose possible theories for SDS, Scott (1987, 1992) and Morgan (1997, 2006) propose two main organizational models. These are closed and open models. Closed models are oriented toward the establishment of bureaucratic organizational control to achieve a specific goal. Organizations emphasize on organizational control, structure of organizations, and the formalization of rules rather than the characteristics of participants. These mechanistic organizations are characterized by large-scale, low-complexity work activities and are best suited to stable environments that do not require adaptive change and innovation. Closed models ignore the impact of the environment, the effect of the larger social, cultural, and technological context on the structure of the organization.

However, open models are characterized by process, power, politics as well as structures oriented. These organic (organization's interaction with its external environment) organizations are characterized by small-scale, high-complexity work and are better suited to changing environments that do require adaptation and innovation. Organizations work on concepts such as input, throughput, and output production flows. The organization as an arrangement of roles and relationships is not the same today as it was yesterday or will be tomorrow. To survive is to adopt, and to adopt is to change.

Reeve and Petch (1999) and De Man and Den Toorn (2002) address the need to integrate personal and technical issues (socio-technical view) into the organizational development processes. Thompson (1967) distinguishes three organizational levels: 1) The technical level, that part of the organization carrying on the productive function. 2) The managerial level comprises those activities relating to the control of the production function. 3) The institutional level consists of those activities relating the organization to the larger community. Organizations with routine production processes might attempt to seal off the technical level, protecting it from external uncertainties to the extent possible. Thus, the closed system perspective would be most relevant to this level. At the other extreme, the open system perspective of organizational effectiveness would most apply to the institutional level in most organizations. As highlighted in the introduction, the current dynamics in the environment present uncertainty for the organization. These uncertainties in SDS call for open models perspective. So, the author believes that spatial data sharing behavior will be achieved through open models. Based on this perspective, Table 2.8 proposes the most promising theories that address SDS. Theories that are strongly related are sorted by the same symbols.

Promising Theories Explaining Spatial Data Sharing

Table 2.8 reviews the main social and cultural theories. Each of the theories reviewed contributes in some way to explain strategies for SDS behavior. A central factor in the theory of planned behavior is the individual's intention to perform a given behavior (e.g. SDS). Intentions are assumed to capture the motivational factors that influence a behavior. The stronger the intention to engage in a behavior, the more likely should be its performance.

Social exchange theory assumed that if "spatial data" is a private good then it is up to the owner of that good to decide whether to share it or not. To attract people to share their data, in terms of exchange transaction, these actors need to be persuaded it is worth entering into a transaction in exchange for some kind of resource. Organizations should explicitly offer to repay individuals who engage in sharing activity (Samitt 1999). The reward might be in the form of a "hard" tangible benefit, such as enhanced pay or a bonus. The resource dependence highlights the significance of unique resources (data) to sustaining a competitive advantage. It emphasizes the dependence of partner organizations on external resources and socio-political forces to share data.

The new institutionalism theory re-addressed Weberian issues of legitimacy and directed attention toward external norms towards SDS. The assumptions underlying transaction cost theory emphasize the importance of cost minimization by SDS and efficiency rather than issues related to quality and risk in decision-making. Game theory has become

increasingly used to investigate the cooperative behavior to share data. The strategic management theory draws attention to power relationships within organizations and their relations for generic organization strategies for profit. The four social patterns: hierarchy, individualism, egalitarianism and fatalism are the basic types of the grid-group theory.

Hofstede's cultural dimensions have received strong empirical support. Hofstede separates cultures on the basis of the dimensions of: masculinity-femininity, individualism-collectivism, power distance, uncertainty avoidance, and long-term orientation. Social network theory suggests that collaborations are embedded in social networks, consisting of individuals and organizations that are reproduced as a result of their strategic decisions and the unintended outcomes of their actions. Social network theory views social relationships in terms of nodes and ties. Nodes are the individual actors within the networks, and ties are the relationships between the actors. This network shows the distinction between the three most popular individual network measures degree, betweenness, and closeness centrality. Finally, the ecosystem view is not dissimilar from the network view in that competition takes place not only between individual organizations, but between collections of cooperating organizations. Organization profitability becomes contingent on the ability to cooperate with other organizations in the larger ecosystem.

Table 2.9 offers a distinctive summary of the most important promising theories for SDS grounded in socio-cultural literature. The criteria for a theory selection from table (2.8) are: widely accepted and applied; received strong empirical support; relevant for SDS behavior; and predict individual and organizational behavior. These theories can be used to explain and predict SDS behavior.

Discussion the Solution of Spatial Data Sharing

The results have raised some essential concern about individual and organizational SDS behavior. First, the benefits of SDS can not be fully realized unless the adoption of technology is accompanied by organizational, institutional, and behavioral changes. So, if the organization has a better fit between their technology and their social and culture, they would be more efficient and thus more profitable. Second, the determinants of whether and why organizations may be willing (or not) to engage in SDS with other organizations should be established empirically. Third, the more generalization surveys and field studies may be augmented with case studies to add richness to our understanding of the evolving nature of SDS behavior. To fully understand such an evolving behavior of SDS, study an individual and organizational behavior using a survey and case study approach is needed.

Table 2.8 Classification of the social and cultural theories promising to explain Spatial Data Sharing (SDS) Behavior.

Theory of	Reference to	Would Predict that (stress on)	Compar-ability [a]
		Individual Behavior Domain	
Collective action and implementation	Olson 1971; Pressman and Wildavsky 1984	- Data sharing would be very difficult to achieve and sustain because all collective action is difficult. Decision-making has to reach agreement on data sharing. Where large numbers of organizations are to be involved, SDS problems will be worse. In many cases a single organization's veto will effectively end cooperation. Driving forces shaping SDS are collective action and individualism.	No data
Rational choice	Aoki et al. 1990	- The behavior of managers is necessarily wholly self-interested or rational. Managers' preferences and constraints affect SDS behavior. The form of SDS is shaped and managed by the maximization of individual utility subject to the balance of transaction costs. The results of individual and organization pursuit of interests will typically be efficient, save for very special circumstances. Driving forces shaping SDS are transaction costs, cognitive and noncognitive factors influence the decision-making process.	●
Planned Behavior (TPB)	Ajzen 1988; 1991	- How we can change the individual behavior. Attitudes toward SDS, subjective norms, and perceived control over the behavior are usually found to predict SDS behavioral intentions with a high degree of accuracy. TPB predicts planned behavior, because behavior can be deliberative and planned. Certain skills, resources, or opportunities play a role in determining whether individuals can engage in spatial data sharing or not.	►
Reasoned action	Ajzen and Fishbein 1980	- SDS behavior is subject to volitional control and a part from attitudes. Volitional control is achieved when a person is able to express their will. When volitional control is low, the intention-behavior relationship is reduced.	►
Smart-practice (craftsmanship)	Bardach 1998	- Data sharing will emerge in response to the initiative of managers who see it as a tool for the pursuit of individual and organizational opportunities. The theory differs from rational choice theory in that it does not assume that the behavior of these managers is either necessarily wholly self-interested or rational, but experimental and innovative in response to uncertainty.	▲ ○ ●
New-Simmelian	Granovetter 1985; Burt 1992; 1997	- Stress on the ties between individuals or organizations. As an organization embedded in networks of inherently social, individual influencing SDS depends on influencing networks of individuals. Driving forces shaping SDS are institutional constraints, path-dependence and inertia. Power of SDS can be exercised effectively by ties between individuals or organizations. SDS management within the organization can be exercised by informal network. Informal network will emerge to get around formal restrictions imposed by governance, because there are limited means available for governance using informal means.	▲
Social Exchange	Emerson 1976; Alexander 1990; Cook 2000	- Reciprocity (data exchange) is a function of reward and punishment. What motives reciprocity is its reverse (autonomy)? Mauss (1990) saw reciprocity as a gift that forces the recipient to make a return. So, one gives because of the expectation of return and one return because of the threat that one's partner may stop giving.	► ●
		Organizational Behavior Domain	
Ideal-Typical "rational" organizations	Weber 1958	- When activities and practices are mandated from those with legitimate authority, they will be followed as far as practicable, and not resisted (because postholders in the ideal-type case do not own their activities). Power of SDS can be exercised effectively by the use of rational regulation. Driving forces shaping SDS are legitimate authority and hierarchy. The theory represents a limiting case in which formal institutions would dominate informal ones. Classify network forms are according to their different institutional forms.	◊
Street-level bureaucracy	Lipsky 1980	- The priority type of SDS will be a) that enables frontline professionals to control their clients in order to limit the demands of those clients, and b) that enables professional staff to hoard resources over which they can exercise control. Power of SDS can be exercised effectively by informal networks.	●

[a] The same symbols mean these theories are strongly related to one another.

Table 2.8 (continued) Classification of the social and cultural theories promising to explain Spatial Data Sharing (SDS).

Theory of	Reference to	Would Predict that (stress on)	Compar-ability [a]
		Organizational Behavior Domain	
Resource-dependency	Pfeffer and Salancik 1978	- Data sharing is attractive when it provides desirable resources that organization can not develop within an acceptable time frame. The more demanding those other organizations which control its access to data, the more the organization will have to respond. Power of SDS can be exercised effectively by adoption resources and engage in exchanges with the environment. SDS management within the organization can be exercised by the pattern of dependencies that the organization has with others for key resources such as funds, legitimate authority to act, or skilled personnel.	●
Neo-Durkheimian	Douglas and Ney 1998; Hood 1998; Thompson 1996	- Formal institutions will be dominant only in the special circumstances that the existing informal institutions afford strong social regulation and strong integration- that is, a hierarchical form. Otherwise, they are likely to be less important than informal institution. Power of SDS can be exercised effectively when informal institution is undertaken working on formal institutions. SDS management within the organization can be exercised by basic forms of social networks which rooted in distinct informal institutions.	▲
New-institutionalist	DiMaggio and Powell 1983; Zucker 1988; Fligstein 2001	- Path-dependency will determine willingness and ability to share data. Spatial data sharing will be very difficult to cultivate when organizations have long institutionalized practices of not sharing data or of sharing only with similarly institutionalized organizations. Power of SDS can be exercised effectively by institution which they are accustomed to sharing data and interpret legal and ethical constraints.	▲
Transaction Cost Economic (TCE)	Williamson 1981; 1985; 1991; 2000	- Organizations and markets are alternative governance structures with differing transaction costs. Data sharing is formed because it is the most efficient and least costly means. Organizations exist to minimize transaction costs. TCE is similar to resource-based perspective theory because asset specificity is related to the nature of resources. However, resource-based theory takes a broader view of resources, focusing on the firm's competencies and capabilities of coordinating productive resources that are not transaction specific. Power of SDS can be exercised effectively by analyzing the efficiency of inter-organizational boundary decisions. The consideration for an organization in choosing whether to collaborate with another and the form of the cooperation are determine the level of transaction cost involved. Performance is enhanced when there is congruence between a firm's governance structure and transactional attributes in a way that minimizes costs. Driving forces shaping SDS are transaction cost, uncertainty, complexity and market power.	●
Agency	Berle and Means 1932	- Any collaboratiotive relationship is one in which each partner becomes an agent for, and principal of the other. Power of SDS can be exercised by establish mutual trust between organizations. SDS management within the organization can be exercised by enabling researcher to examine linkages among different transactions. Driving forces shaping SDS are trust, human behavior and market power.	●
Game model	No data	- When and when not the organization should enter into cooperation. Power of SDS can be effectively exercised where incentives for collaborations are virtually existent making self-interested behavior optimal. SDS management within the organization can be exercised by draws attention to tit-for-tat games played out in real-life alliances.	●
Strategic Management	Porter 1980; 1985	- Selection of a suitable partner is of fundamental importance and is heavily dependent the success of the partnership. Power of SDS can be exercised effectively by motives of managers for adopting cooperative strategy for entering a specific partnership. SDS management within the organization can be exercised by equal-partner networks. Driving force shaping SDS can be as strategic alliance.	No data

[a] The same symbols mean these theories are strongly related to one another.

Table 2.8 (continued) Classification of the social and cultural theories promising to explain Spatial Data Sharing (SDS).

Theory of	Reference to	Would Predict that (stress on)	Compar-ability [a]
		Organizational Behavior Domain	
Symbolic-order	Meyer and Rowan 1977	- Organizations share data principally to serve legitimating functions, and not principally for instrumental reasons to do with the pursuit of organizational or individual interests. However, the theory cannot determine whether organizations are likely to emphasize their limitation of data sharing for reasons of legitimacy where the basis of trust between their clients and themselves rests on the quality of privacy protection. Power of SDS can be effectively exercised when privacy commitments are equally likely to be unsystematic but carried out in a high-profile way. It is important to use these claims in order to legitimate the existence or operations of the agencies.	◊ ○
Blame-avoidance	Challis et al. 1988; Hood 2002	- Individuals' willingness to share data will be a function of their managers' or key professionals' fears of being blamed for operational failures. Operational failures may result from failure to collaborate and share data, or of the loss of direct and exclusive professional control over critical data. SDS can be exercised by individuals. They may be inclined either to share data, or to claim that sharing is legally forbidden, according to where they perceive risks to be greater.	◊ ▲
Concentration /diffusion	Wilson 1968; Marmor 1977	- Incentives for sharing data and for compliance with data protection will be a function of the concentration and diffusion of the costs and benefits of sharing taking account of the interests of clients, professionals, managers and politicians.	▼
Macro-economic and technological determinist	Castells 1996	- Data sharing is relations of production that change when the forces of production change, and that the information economy is calling for a new dominant network for. Power of SDS is limited, because governance bodies can have limited power over wider trends in network forms. SDS can be exercised by standard economic competition for relative position and for absolute quantities of resource. There is limited scope for management.	▼
Technological environment	Zuboff 1988	- As Information Technology becomes "core" technologies in organizations, organizations will take their imperatives from the capabilities designed to share data. SDS management within the organization can be exercised by privacy. Privacy concerns about data sharing are inexorably being undermined by the development of technologies.	▼
Strategic contingency	Hickson et al. 1971	- Political explanation of organizational structure. Organizations are coalitions, not monolithic actors. Individuals in organizations vary in their interests. Power of SDS can be exercised effectively by groups. Groups are able to make greater contributions to the stability and survival of the organization. SDS can be exercised by open organizations that respond to variable challenges and opportunities in their environment. Different parts of the environment pose varying challenges. Organizational subunits differ not only in their interests but in their power.	●
Grid-Group	Douglas 1978; Wildavsky 1991; Douglas and Wildavsky, 1982; Thompson et al., 1990	- SDS in the organization can be described in terms of four basic forms, which singly or in combination can be found in all societies and organizations. These forms are: individualism, hierarchy, enclave, and isolate. Power of SDS can be exercised by active cultures (Individualism, hierarchism and egalitarianism). Any society or organization will contain all types, and will exhibit specific SDS relationships among all types. SDS can be managed by strength of the "grid" and "group" characteristics of their social relations. Driving forces shaping SDS are loosely-bonded markets, authority, and networks.	▲
Actor-network	Callon 1986a, b; Cooper 1992; Law 1986; Law and Hassard 1999	- All actors in consideration. Technologies, natural persons, and organizations all as nodes in "actor networks". SDS management is rather limited. Whether human or non-human, Actor network makes no distinction in approach between the social, the natural and the technological. Driving force shaping SDS can be socio-technology.	▼

[a] The same symbols mean these theories are strongly related to one another.

Table 2.8 (continued) Classification of the social and cultural theories promising to explain Spatial Data Sharing (SDS).

Theory of	Reference to	Would Predict that (stress on)	Compar-ability [a]
		Organizational Behavior Domain	
Organization competency and learning	Powell et al. 1996; Powell and Smith-Doerr 1994	- Organizations make intelligent judgments of the competence requirements of their future cooperation. The links they will seek to form with other organizations will be ones that enable them to enhance their own core competences and to be more efficient and effective. Power of SDS is limited because of the limited capacity of those outside the networks of organizations. SDS can be exercised by defining key competences and learning benefits to be sought. Driving forces shaping SDS are minimization of costs, maximization of benefits, benefits of enhanced competences and capabilities.	▼
Ecological perspective	Hannan and Freeman 1989	- Making choices between specialist, generalist, growth and stabilization strategy on the basis of assessment of niche lifecycles and stage in the cycle of the community of organizations. Power of SDS can be exercised effectively by using regulatory power to define available resources. Data sharing is fundamentally driven by the need to control niches which are defined as vectors of resources. SDS can be exercised by interests in controlling vectors of resources. Network forms are selected in "niches" or temporarily combined. Changing the structure of niches is the key to managing SDS.	▲
Technology contingency	Galbraith 1973; Perrow 1999	- Data sharing would ideally be shaped to solve particular problems with prevailing technology. Power of SDS can be exercised to some extent by regulatory control of available technologies. Driving forces shaping SDS are structures of resources and institutions.	▼
		National Culture Domain	
Organizational culture	Martin 1992; Schein 1992; Doz and Hamel 1998	- When professional cultures are dominant and emphasize professional confidentiality, compliance with strong privacy norms will be more easily sustained, and then data sharing less readily undertaken. SDS management within the organization can be exercised where organizations share common styles of management, motivation, and tacit understandings of problems. Culture is the primary source of SDS resistance.	☼
Hofstede's culture	Hofstede 1980, 1997; Hofstede and Hofstede 2005	- Data sharing depends to a large extent on the particular culture. The deep-rooted occurrence of culture explains the resistance in data sharing. Power of SDS can be exercised effectively by Power distance, Individualism/Collectivism, Uncertainty Avoidance, Masculinity/Femininity, and Long-Term Orientation	☼
		Cognitive Analysis Domain	
Social network	Blau 1967; Jones et al. 1977; Scott 1991; Wasserman and Faust 1994	- SDS behavior of individual and organization can be explained in the context of their position in a network. Social Network Analysis (SNA) provides systematic means of assessing informal SDS networks by mapping and analyzing relationships among individuals, departments and organizations. SNA can provide an X-ray of the way in which SDS is or is not occurring in these informal networks. Power of SDS can be exercised by social network diagrams. Analyzing relationships among individuals and organizations to visualize and understand the relationships that can either facilitate or impede data sharing. Driving forces shaping SDS are centrality, betweenness degree centrality and closeness centrality.	§
Ecosystems (network)	No data	- The incentives for SDS are embedded in the perceived potential value of core capabilities and a reinvestment of returns into this ecosystem to produce a ground for future services or product. Power of SDS can be effectively exercised by managing relationships and fostering trust. SDS can be exercised by organization's profitability. Organization's profitability is contingent on its ability to manage relationships within the ecosystem (or network), its centrality within this network, and the ability of this community of organization to compete effectively with similar constellations. Driving force shaping SDS can be as centrality within the network.	§

[a] The same symbols mean these theories are strongly related to one another.

Theories in Table 2.9 are widely applied and tested with considerable proven explanatory and predictive value for the behavior of individuals, organizations and even countries. Quiun (1988) argues that too much emphasize up on any one model will lead to failure. No one model is the one best way to organize. Scott (1987, 1992) recommended that intelligent strategies for future theory development should seek to preserve valuable insight from each. So, these theories can be used for modeling SDS behavior, both for individuals and for organizations.

Table 2.9 Promising social and cultural theories relevant for spatial data sharing behavior.

Domain	Theory of	Number of ISI Citations[3]				Factors that shape SDS behavior
		01/ 07/ 2005	10/ 02/ 2006	01/ 07/ 2006	10/ 02/ 2007	
Individual Behavior	Planned Behavior	1148	1492	1807	2158	Attitude/Subjective norm/Perceived behavior control
Organizational Behavior	Grid-Group	275	338	396	442	Hierarchy/Individualism/Egalitarianism/Fatalism
National Culture	Organizational Culture	2120	2552	3051	3433	Culture is the primary source of SDS resistance
	Hofstede's Culture Dimension	2237	3282	3759	4334	Masculinity-femininity/Individualism-Collectivism/Power distance/Uncertainty avoidance/Long-term orientation
Cognitive Analysis	Social Network	1130	1421	1703	2398	Degree centrality, betweenness centrality, and closeness centrality

2.4 CONCLUSIONS AND OUTLOOK

The first purpose of this chapter is to outline the theoretical, methodological and organizational gaps of the existing SDS literature. This chapter draws on the review of 43 papers that have appeared in literature from 1990 through 2006. In the methodology used in this chapter, the author try to ensure the representation of the major themes of research that have characterized SDS. The results show that studies on SDS behavior are in its infancy, and are of theoretical interest for the individual and organizational behavior. The study of SDS behavior is currently a challenge that aims for new empirical data and theory building. Individual and organizational behavior makes it most challenging to get a data sharing works.

Recall that the second purpose of this chapter is to identify the most promising theories that explain individual and organizational SDS behavior as a solution. This chapter suggests that there is a need for multi-theory in which individual and organization is regarded as a complex phenomenon. It would be unwise to assume any aspect of reality is quantifiable by a single measure. That is why we rely on multiple theories to understand the individual and organizational behavior. The following theories seem to be among the most promising to

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[3] Ford et al. (2003) has been used citation analysis as indicator to investigate how national culture affects variety of issues.

explain individual and organizational SDS behavior: Theory of Planned Behavior, Cultural Theory, Hofstede's Culture Dimensions and Social Network Theory.

There are certain limitations to this research that need to be addressed. The list of articles that were included in the analysis is not exhaustive. Articles published in other languages than English were not included, due to the difficulty of obtaining access to them. Because there was not much variance in the data, the author was not able to run a more statistical analysis. In addition, the results could have been shaped by the researcher's biased. The author used his own judgment when coding the articles when authors of the articles did not explicitly state their position with regards to the approach studied. Although this chapter has attempted to propose some theories explain SDS behavior, it is believed that there are many fertile areas for future research. Next few issues that can be used to build future research on spatial data sharing are discussed.

First, studies on socio-cultural aspects of SDS are rare. SDS model development is needed on explaining the relationships between individual and organizational behavior of SDS and its socio-cultural context. Theory of Planned Behavior, Culture Theory, Hofstede's Cultural Dimensions and Social Network Theory are robust and rigorous theories for future SDS research. These theories provide a rich and systematic means of assessing SDS by understanding, analyzing and mapping relationships among individuals and organizations. It is recommended that future SDS research use these theories as a tool to provide an X-ray of the way in which SDS is or is not occurring between the individuals and the organizations.

Second, there are six critical factors of SDS behavior are proposed: rules, trust, resource scarcity, autonomy, uncertainty and incentives. These factors could motivate the organizations and individuals to establish sharing relationships. These factors explain the reasons why organizations choose to enter into cooperation with one another. Such factors may be expected to increase the likelihood that individuals in different organizations will have a greater tendency to engage in SDS. It is recommended that these motivational factors have to be addressed in future SDS research.

Finally, it is important to consider the international context of SDS behavior. This requires not only studying and examines the individual and organizational behavior of the institutions, but also understanding the culture of the wider context, and interactions between them.

Chapter 3

Spatial Data Sharing: A Cross-Cultural Conceptual Model

Omran, El.E., Bregt, A.K., and Crompvoets, J., 2007. Spatial data sharing: A cross-cultural conceptual model. In Research and Theory in Advancing Spatial Data Infrastructure Concepts, H.J. Onsrud (Ed.), pp. 79-97.

INTRODUCTION

Many countries are developing Spatial Data Infrastructures (SDIs) in order to better manage their spatial datasets (Rajabifard and Williamson 2004) for supporting various applications. The development of these datasets is often done with little coordination among various organizations, and as a consequence duplication of effort and wasting of resources occur (Warnecke et al. 1998; Wehn de Montalvo 2003a,b; Omran et al. 2006). In order to reduce this duplication, Spatial Data Sharing (SDS) is essential. In many instances individuals and organizations are unwilling to share data across and within organizations. SDS behavior is strongly related to sociocultural context. Understanding and changing individual and organizational behaviors could be the key to improving spatial data sharing.

Individual spatial data sharing behavior has not received adequate attention in either research or practice. Even when social issues are considered, the focus is mainly on people as participants in the implementation process (Eason 1993), political issues (Buchanan 1993), or better design of decision support tools (Medyckyj-Scott and Hearnshaw 1993) rather than on psychological factors related to data sharing. Based on sociocultural theories, personal factors that strongly influence the individual decision to share data include attitudes, experiences, self-confidence, empathy, fatalism, motivation, behavior, trust, ability to cope with uncertainty, and incentives. In our assessment, the influences of these factors on SDS have not been sufficiently investigated. The current study was motivated by the question, "What factors influence individual SDS behavior?"

Another issue germane to SDS is the question of organizational resistance to sharing data. Resistance to share data may be due to a lack of motivation. Organizations are motivated by organizational needs and capabilities (Calkins and Weatherbe 1995), the advantages of synergisms (Craig 1995), and appeals to professionalism and common goals (Obermeyer 1995). These common or "superordinate" objectives are among the noneconomic reasons for sharing (Tjosvold 1988; Pinto and Onsrud 1995). Appropriate organizational motivation is required for data sharing; incentives can also motivate the organizations to share their data. The current study was also motivated by the question, "What factors influence organizational SDS behavior?"

To answer these two questions, Tayeb (1988) proposed two lines of research. The first line is "institutionalism" which deals with structural aspects of organizations. The second line is "ideationalism" which focuses on the intentions, attitude, and values of organization members. The relationship between individual and organizational behaviors and data sharing is very complex (Dueker and Vrana 1995).

Many socio-cultural theories (e.g., theory of planned behavior and culture theory) can be used to characterize individual and organizational behaviors and describe relationships between them. Hofstede (1991, 2001) and Hofstede and Hofstede (2005) argue that five dimensions can be used to classify societies according to their culture: power distance, uncertainty avoidance, individualism/collectivism, masculine/feminine, and long-term/short-term orientation. Power distance (PD) represents the extent of adherence to formal authority and the degree to which less powerful members will accept unequal distribution of power. This dimension addresses how a society handles inequalities among people. Uncertainty avoidance (UNA) refers to how much people feel threatened by ambiguity, as well as the felt

importance of rules and standards. This dimension addresses how a society reacts to the fact that the future is unknown, e.g., whether it tries to control the future or lets it happen. Power distance and uncertainty avoidance have consequences for the way people build their institutions and organizations.

Individualism/collectivism refers to the basic level of behavior regulation. It refers to the degree of interdependence a society maintains among individuals. In an individualistic society, the ties between individuals are loose. In a collectivist society people integrate into strong, cohesive groups and tend to do what is best for the group. Masculine cultures emphasize work and material accomplishments. In contrast, feminine cultures put human relationships at the forefront, and work is seen as a way to support the more important things in life. A long-term orientation (LTO) means that people are more concerned with the long-term effects of their decision. A short-term orientation (STO) tends toward consumption and maintaining materialistic status.

Although Hofstede made a major contribution to the study of organizations within a cultural setting, he did not empirically investigate the relationships between the five dimensions and the attitudes and behaviors of individuals and organizations. So, it is important to discern in what ways individuals and organizations are influenced by Hofstede's dimensions. How does national culture influence the attitudes of individuals and organizations toward SDS?

Although the bulk of the literature focuses on technical aspects of spatial data sharing, the emphasis of this chapter is on individual and organizational aspects. The objective of this chapter is to develop a conceptual model that describes the willingness of individuals and organizations to share spatial data. Data sharing by individuals and organizations in a socio-cultural context serves as a starting point. The approach is to ground the assessment of variables in well-accepted theories. The innovative aspect of the model is the integration of different theories and concepts. Such a model increases our insight into the SDS behaviors of individuals and organizations and might potentially be used to explain differences between societies and organizations.

After an overview of SDS concepts and gaps, we propose a SDS model, describe the theoretical foundation and hypothesis development, and discuss the merits of the model.

3.2 SPATIAL DATA SHARING: CONCEPTS AND GAPS

Spatial data sharing is generally considered problematic. A considerable number of SDS relationships have failed to meet their founders' expectations. Porter (1987) and Park and Ungson (1997) report that the failure rate in interorganizational relationships is approximately 50 %. Organizations, however, continue to form these relationships, and as a result failures are expected to continue or even increase (Miles and Snow 1992).

Calkins et al. (1991) present factors that could influence institutional data sharing: bureaucratic procedures, cooperation, organizational structure, corporate culture, and political environment. Kevany (1995) explores factors that may create a sharing environment and identifies opportunities, incentives, impediments, and resources as the main factors that influence SDS. Pinto and Onsrud (1995) state that, under conditions of resource scarcity, organizations tend to be driven by the desire to maintain some form of control over other

organizations. As risks increase, so does the need for trust. Trust is mostly connected to risks and risk taking (Mayer et al. 1995; Coulter and Coulter 2002) and influences both individuals and organizations (Doney and Cannon 1997).

Most of the SDS frameworks in the literature are based on the authors' experiences with data sharing. An exception is the work done by Wehn de Montalvo (2001, 2003a,b), who proposed a model of SDS perceptions and practices in South Africa from a social psychological perspective. Also, Nedovic-Budic et al. (2004) proposed a model that includes the motivation behind sharing. These two examples move towards a more widely grounded theoretical approach to SDS. However, if we consider all the literature on SDS, the following research gaps are still observed:

1- No comprehensive theory-based framework for analyzing relevant factors exists;
2- The relationships between factors has not been adequately investigated;
3- The proposed experimental frameworks have not been verified;
4- Socio-cultural aspects of SDS have not been adequately considered; and
5- No systematic analysis of SDS between individuals and organizations has been performed.

The literature identifies uncertainty, incentives, resource scarcity, autonomy, rules, and similar factors within particular socio-cultural settings as explaining, predicting, or modeling SDS. However, the integration of such factors in an overall model is missing, and little is known about the influences of these factors on the reasons that individuals and organizations are willing or not willing to share data. Socio-cultural perspectives provide a useful point of departure for exploring this issue.
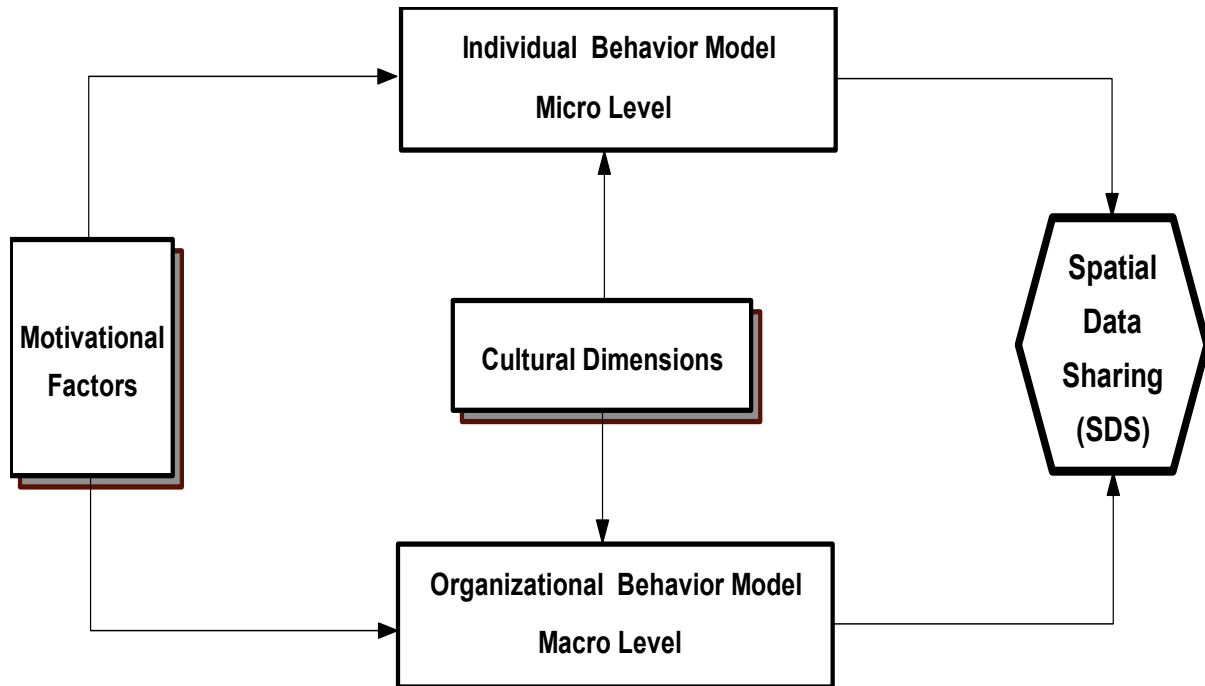
3.3 PROPOSED SPATIAL DATA SHARING MODEL

Interactions among and between individuals and organizations are a complex phenomena, and SDS behaviors across contexts cannot be described by a single theory. Our proposed model integrates insights from three theories: theory of planned behavior (Ajzen 1991), culture (grid-group) theory (Douglas 1970; Thompson et al. 1990), and Hofstede's (1980) culture dimensions. These theories are strong candidates for developing a more generalizable approach to assessment of SDS because they have already been investigated and identified by other researchers as having relevancy in this domain. These theories have received strong empirical support in the social sciences, having been widely applied and tested with considerable proven explanatory and predictive value for the behaviors of individuals, organizations, and even countries. We expect that these theories can also be used for modeling spatial data sharing, both for individuals and for organizations.

3.3.1 Overall Description of SDS Model

Figure 3.1 shows the main components of the proposed SDS model. SDS is influenced by individual and organizational behaviors. Individual behavior (micro level) is analyzed by employing the major concepts of the theory of planned behavior (TPB). Organizational

behavior (macro level) is studied by using the culture (grid-group) theory. The individual and the organizational levels are linked within the model in two ways: by the cultural dimensions of Hofstede and by motivational factors derived from literature. Nakata and Sivakumar (2001) argue that Hofstede's cultural dimensions serve as the most powerful culture theory for social research. In addition, there are potential motivational factors (trust, uncertainty, incentives, resource scarcity, rules, and autonomy) that affect individual and organizational SDS behaviors. We argue that cultural dimensions in combination with motivational factors could be used as a link between the two sub-models described below.


Figure 3.1 Main components of the spatial data sharing model.

3.3.2 Individual Behavior Sub-Model (micro level)

The individual sub model is based mainly on TPB (Figure 3.2). Ajzen (1991) and Ford et al. (2003) indicate that TPB has been developed with individuals as units of analysis. Ajzen (1991) argues that a central factor in TPB is the intention of individuals to demonstrate a particular behavior. The intention of individuals to engage in SDS is closely linked to actual behavior. Ajzen (1988, 1991) proposes that intentions are assumed to capture the motivational factors that influence a behavior. The stronger the intention for a particular behavior, the more likely is the behavior itself. At the level of the individual, we measure willingness to share spatial data. Ajzen (1985, 1988, 1991) argues that the behavioral, normative, and control beliefs are influenced by a wide variety of cultural, personal, and situational factors.

The intention of each individual is based on the attitude, subjective norm (SN), and perceived behavior control (PBC) relative to data sharing. In order to predict the spatial data sharing intention of an individual, we need to predict these three underlying factors. Attitude is defined as the degree of positive or negative value for SDS. Subjective norm is defined as the social pressure for sharing felt by the individuals. Subjective norm is based on societal norm and social influence. Societal norm refers to norms of the larger societal community, while social influence reflects opinions from family, friends, and peers. PBC is the extent to which the individual controls the sharing procedures for a particular spatial data set. PBC is influenced by the individual's judgment of his own capabilities (self-efficacy) and by his confidence in the data sharing process (controllability). By understanding and estimating these three factors, we can assess an individual's intention for SDS.
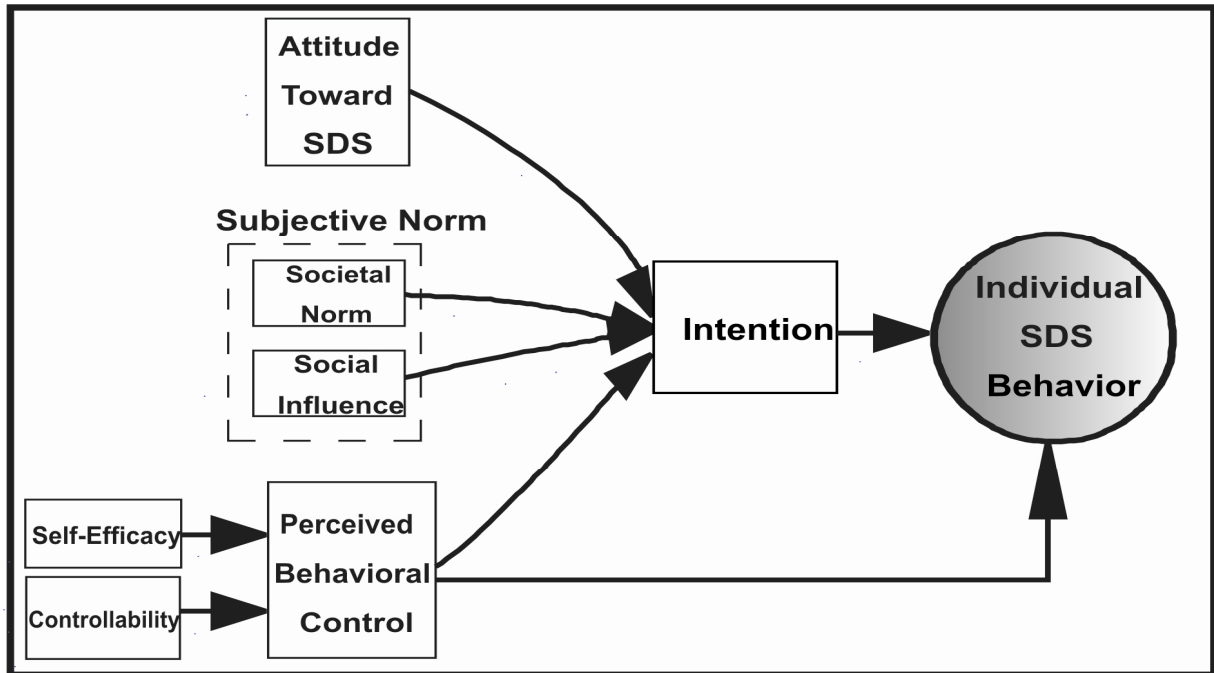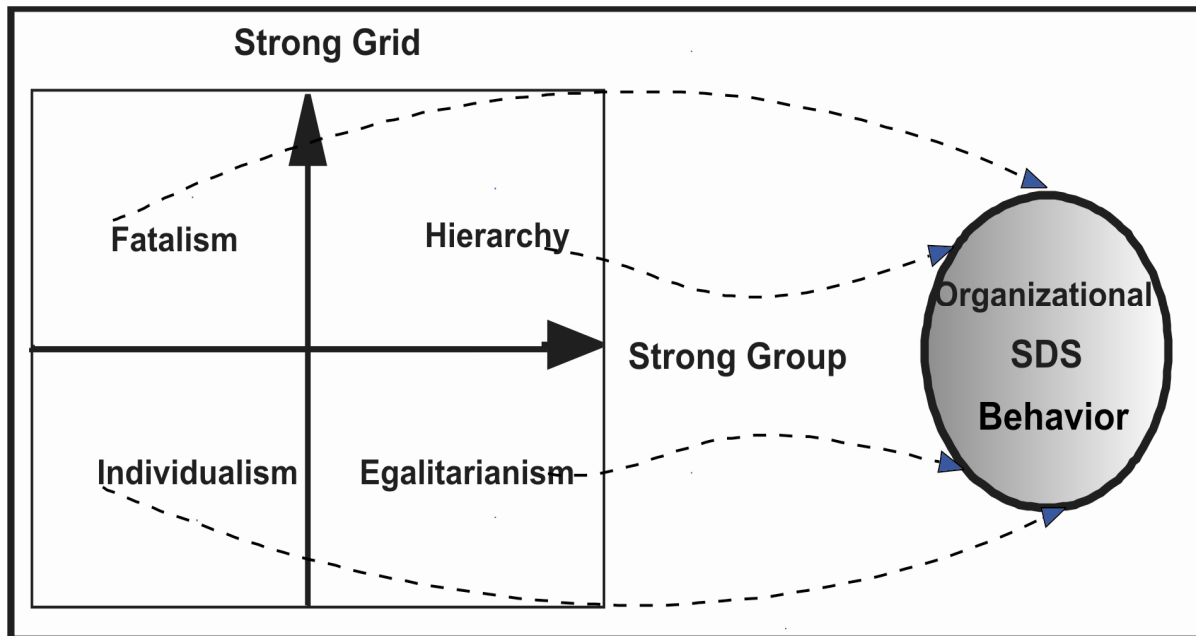

Figure 3.2 Individual behavior sub-model.

3.3.3 Organizational Behavior Sub-Model (macro level)

The organizational sub model is based on culture theory. Thompson et al. (1990) propose that any organizational setting consists of two dimensions: grid (action) and group (identity) (Figure 3.3). Adapting the theory to SDS requires specific definitions of the grid and group concepts. "Grid" refers to the degree of individual freedom in SDS and rules of authority that limit how people behave toward one another. In cultures with strong grids, everyone has a well-defined place in his or her organization. Institutions classify individuals and restrict their transactions. Moving away from a strong grid, dependence decreases and autonomy, control, and competition open up (Douglas 1978). This paves the way for freedom of transactions. "Group" refers to the degree to which individuals are member of groups or networks (social boundedness). The more an individual is incorporated into bounded units, the more his choice is subject to group determination (Douglas 1978). In combination, these two key

dimensions can produce four organizational settings (Thompson et al. 1990; 6 2005) for SDS—hierarchy, egalitarianism, individualism, and fatalism (always potentially present in any group or organization).

Figure 3.3 Organizational behavior sub-model.

3.3.4 Linkage Individual with Organizational Behavior Sub-Models

The proposed model combines Hofstede's cultural dimensions with the motivational factors to link the two sub models.

First, Hofstede's cultural dimensions play an important role in combining the individual and organizational sub models. For the individual behavior model, we assume that cultural dimensions influence the values and weights of the predictors for intention (attitude, SN, and PBC). Ajzen (1991), Straub et al. (1997), and Ford et al. (2003) expect that national culture influences the weighting of the predictors of intention in TPB. For example, in a culture that is more individualistic the effects of subjective norms are low and the effects of attitude and perceived behavioral control are high (i.e., the individual's own opinions are more important). Likewise, in the organizational behavior model, egalitarianism within organizations is expected in such a culture.

Second, motivational factors (e.g., trust) can influence individual and organizational behaviors. For example, Weick et al. (1999) argue that the relationships between individuals and organizations based on trust are characterized by strong ties. These strong ties lead to a more cooperative attitude towards spatial data sharing. Another important reason for adding motivational factors is that the cultural dimensions of Hofstede probably do not explain all relations. The exact relationship between Hofstede's cultural dimensions and motivational factors on the one hand and the variables in the model on the other has not yet been empirically tested. Hypotheses on the nature of these relations are discussed below.

3.4 Theoretical Foundation and Hypothesis Development

The proposed model and the hypotheses are presented in Figure 3.4. The theoretical foundation and hypothesis development are presented in the next part based on Hofstede's cultural dimensions and motivational factors.

3.4.1 Hofstede's Cultural Dimensions

The individualism–collectivism dimension represents a continuum. Hofstede and Hofstede (2005) explain that in an individualist society people are expected to look after themselves. In contrast, a collectivist society finds people integrated into strong, cohesive groups. Hofstede and Bond (1988) demonstrate that collectivistic societies have strong relations within in-groups. In-group relations focus on maintaining harmony (Bond and Smith 1996). Once collectivistic societies have established a positive attitude toward data sharing, they tend to internalize it and take it into their in-group circle. Pavlou and Chai (2002) found that the relationship between attitude and transaction intention is stronger in collectivist societies than in individualist societies. Thus, we would expect that a higher level of collectivism leads to a more positive attitude towards SDS. *Hypothesis 1:* The positive relationship between attitude and the intention for SDS is stronger in collectivist cultures than in individualist cultures.

The intentions of people to engage in data sharing are a function of societal norms and social influence. Hofstede (1991) argues that members of individualistic societies prefer self-sufficiency while those in collectivistic cultures acknowledge their interdependent nature and obligations to the group. Hofstede and Hofstede (2005) indicate that an individualist culture is one in which the ties between individuals are loose. *Hypothesis 2:* The positive relationship between social norms and the intention for SDS is stronger in collectivist cultures than in individualist cultures.

The cultural dimension of masculinity/femininity relates to one's self-concept: who am I, and what is my task in life? A society is called masculine when emotional gender roles are clearly distinct. In feminine cultures, emotional gender roles overlap (Hofstede and Hofstede 2005). We see the influence of cultural masculinity in the emphasis on competitiveness and SDS success. In highly masculine environments, individuals are driven toward cooperation and innovation in order to prove their worthiness. This creative energy can be expected to result in higher levels of SDS. Chiasson and Lovato (2001) report that a subjective (social) norm is a significant antecedent of the intention for information system adoption. The higher the level of cultural masculinity, the higher the intention for SDS. *Hypothesis 3:* The positive relationship between social norms and the intention for SDS is stronger in masculine cultures.

The second relevant cultural dimension is power distance (PD), which is the extent to which people accept a hierarchical system with an unequal power distribution. In cultures high in power distance, SDS decisions are made by superiors without consulting their subordinates, and employees fear disagreements with their superiors (Hofstede 1980, Hofstede and Hofstede 2005). Superiors tend to be autocratic, and subordinates willingly do as they are told (Hofstede 1991). Thus, PD is closely related to societal norm. Cultures higher in PD are likely to impede SDS. Lower level employees tend to wait for instructions. In

contrast, cultures low in power distance have a more cooperative relationship between superiors and subordinates. Pavlou and Chai (2002) found that the relationship between subjective norm and online transaction intention is stronger in cultures with high power distance. Thus, high PD can be expected to result in lower levels of SDS. *Hypothesis 4:* The negative relationship between societal norm and the intention for SDS is stronger in cultures with high power distance.

Ajzen (1991) suggests that PBC reflects beliefs regarding access to resources and opportunities required to facilitate a behavior and emphasizes (Ajzen 2002) that PBC denotes a subjective degree of control over a behavior (e.g., the perceived ease or difficulty of sharing data). Mathieson (1991) showed that behavioral control influences the intention to use an information system. A positive relationship between control and intentions was found by Taylor and Todd (1995) for users in a computer resource center. Pavlou (2002) found the same results for e-commerce behavior. High PBC should have a positive effect on SDS intentions, since individuals do not fear opportunistic behavior from bosses, and is likely to reduce barriers to SDS.

According to Hofstede and Hofstede (2005), LTO plays an important role in day-to-day decisions, giving people more control over their actions. Cultures with LTO focus on future rewards. Pavlou and Chai (2002) found that the positive relationship between perceived behavior control and transaction intention is stronger in societies characterized by long- versus short-term orientation. Therefore, an LTO environment would foster the intention for SDS. The higher the level of LTO, the higher the intention for SDS. *Hypothesis 5:* The positive relationship between PBC (self-efficacy) and the intention for SDS is stronger in long-term-oriented cultures.

Uncertainty avoidance (UNA) is "related to anxiety, need for security and dependence upon experts" (Hofstede 1980). Under conditions of high levels of uncertainty, individuals avoid unfamiliar situations and tend to develop a conservative attitude. A culture that is high in uncertainty avoidance would exhibit a rule orientation and employment stability. In such a society, change and innovation are not valued. SDS would not be sought or welcomed. As a result, individuals are likely to have no incentive to share spatial data. Individuals feel that "what is different is dangerous." *Hypothesis 6:* The negative relationship between PBC (controllability) and the intention for SDS is stronger in cultures characterized by high uncertainty.

All of the above cultural dimensions influence an individual's intention for SDS. Ajzen (1988, 1991) assumed that intention captures the motivational factors that influence behavior (which indicate how much effort individuals plan to exert to perform the behavior). Cultures high in individualism are likely to value personal time and personal accomplishments, whereas cultures high in collectivism value group integration more than individual desires. Collectivist cultures believe that it is best for the individual if the group is cohesive (Hofstede 1980; Hofstede and Hofstede 2005). In addition, cultures with high PD are likely to impede SDS by weakening the two-way communication between individuals that is necessary for high levels of SDS. In high-PD cultures, employees tend to wait for instructions from managers, who do not welcome innovative ideas about data sharing from below. In contrast, low-PD cultures allow for a more participative and egalitarian relationship between superiors and subordinates. Karahanna et al. (1999) found that the high intention of

top management, and supervisors significantly influenced adoption of technology. So, the stronger the intention to engage in a SDS, the more likely should be its achievement. *Hypothesis 7:* The positive relationship between intention and SDS behavior is stronger in cultures high in collectivism, masculinity, and LTO and low in PD and uncertainty avoidance.

Thompson et al. (1990) propose that any organizational setting falls into one of four types: hierarchy (strong grid/strong group), egalitarianism (strong group/weak grid), individualism (weak group/weak grid), and fatalism (strong grid/weak group). In a hierarchy, an individual has strong binding internal regulations and strong group boundaries. In individualism, members have a loose personal network and no strong binding to any group. An egalitarian organization is a closed sectarian community that has elaborate rules for keeping individuals equal (Rayner 1988); because of strong boundaries between groups, members have no external contacts other than in or via the group. In fatalism, individuals have fewer social resources for participation, and the isolation creates dependency on others (Gross and Rayner 1985). SDS behavior depends on organizational culture. *Hypothesis 8:* The negative relationship between hierarchical organizations and SDS is stronger in cultures low in collectivism, masculinity, and LTO and high in PD and UNA. *Hypothesis 9:* The negative relationship between fatalistic organizations and SDS is stronger in cultures low in collectivism, masculinity, and LTO and high in PD and UNA. *Hypothesis 10:* The positive relationship between individualistic organizations and SDS is stronger in cultures low in individualism, femininity, PD, and UNA and high in LTO. *Hypothesis 11:* The positive relationship between egalitarian organizations and SDS is stronger in cultures low in individualism, femininity, PD, and UNA and high in LTO.

3.4.2 Motivational Factors

Trust in data sharing is a behavioral belief that directly influences attitude, and it indirectly affects behavioral intentions for SDS. The relationship between trust and attitude can be explored by viewing trust from the perspective of TPB as a behavioral belief (Pavlou 2002). Trust is related to positive feelings, beliefs, and attitudes (McKnight and Chervany 2002; Adobor 2005, 2006). Trust creates positive feelings towards SDS. Moreover, trust in SDS creates confidence in the behavior of another party. Trust does not directly influence control through self-efficacy (SE), but it can be a facilitating condition. Bandura (1986) defines SE as individual judgment of a person's capabilities to perform a behavior. Self-efficacy beliefs could influence choice of activities, effort expended, as well as thought patterns and emotional reactions (Bandura 1982, 1991). The concept of SE can be applied to an individual's judgment of his capabilities to engage in SDS. Trust gives the individuals perceptual resources (trust beliefs) to gain control over their activities. A belief that a person will behave in accordance with expectations is likely to increase SDS behavior. *Hypothesis 12:* Trust positively influences favorable attitude toward SDS. *Hypothesis 13:* Trust positively influences perceived behavioral control for SDS.
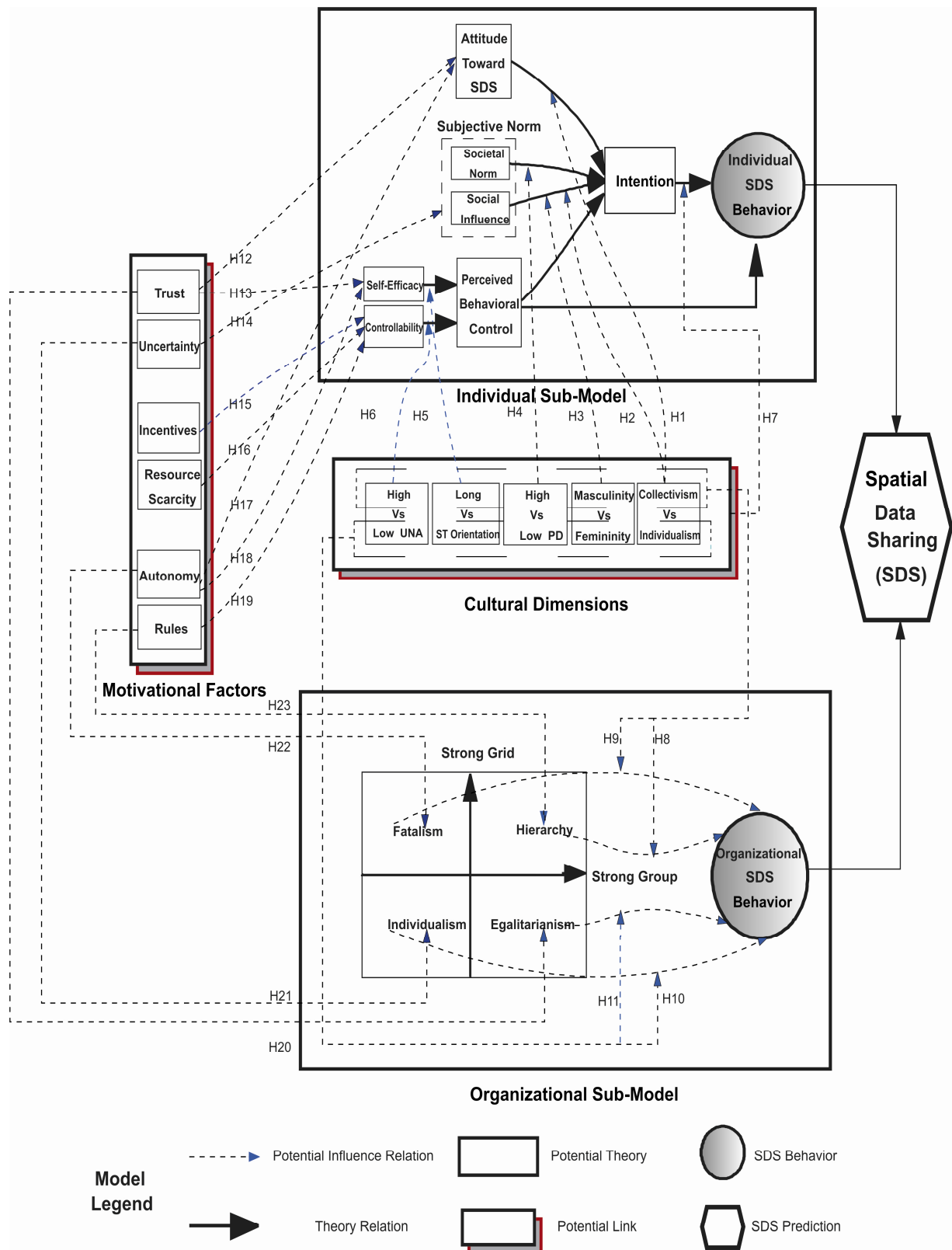
Figure 3.4 Proposed spatial data sharing behavior model.

According to Hofstede (1980), some cultures foster greater uncertainty in people than others do. Societal rules, rituals, religious orientations, and technologies are cultural forces that shape an individual's response to uncertainty. The more uncertain the task, the harder it is to schedule work activities in advance and the greater the reliance on ad hoc arrangements. Smith (1973) points out that social influence plays a role as people seek to reduce uncertainty. Oliver (1990) and Pfeffer and Salancik (1978) argue that individuals and organizations try to establish relationships in order to achieve stability. *Hypothesis 14:* Uncertainty positively influences subjective norms for the intention for SDS.

SDS is encouraged where an incentive for sharing exists. This argument captures the question frequently asked before a person makes a commitment: "What's in it for me?" (Pinto and Onsrud 1995). From this perspective, an organization or its key members must expect a payment or some other incentives for the establishment of an SDS relationship. Craig (1995) sees "institutional inertia" as a major problem. If everyone is focused on the mission and mandates of the agency, there may be no incentives for activities like sharing data. So, the willingness of an organization to participate in SDS is directly related to the perceived reward (e.g., money, access to data, and so forth). Economic exchange relationships between organizations can stimulate SDS. *Hypothesis 15:* Individual's incentives have a positive influence on SDS.

Ajzen (2002) defined controllability as individual judgment about the availability of resources and opportunities to perform the behavior. Resource scarcity motivates individuals and organizations to cooperate with one another. When resources are scarce and organizations are unable to generate them, it is the organizations are more likely to establish ties with each other (Molnar 1978). Pfeffer and Salancik (1978) argue that resource scarcity prompts organizations to attempt to exert power, influence, or control over organizations that possess the required scarce resources. Thus, perceived resource scarcity is likely to influence the intention for SDS in a positive way. *Hypothesis 16:* Perceived resource scarcity has a positive influence on the intention for SDS.

Any decision to engage in SDS influences the autonomy of the stakeholders. Organizational reluctance to share data due to loss of autonomy and control over information sources and organizational power is widely acknowledged (Azad and Wiggins 1995; Meredith 1995; Provan 1982). Spatial data can be viewed as a form of power. Individuals and organizations are less likely to share their data if they are losing power in the relationship. *Hypothesis 17:* Autonomy negatively influences attitudes towards SDS. *Hypothesis 18:* Autonomy negatively influences perceived behavioral control for SDS.

Enhancement of organizational legitimacy has been cited as a motivation for organizations to cooperate. Galbraith and Nathanson (1978) demonstrate that rules and procedures are central to any interorganizational cooperation. McCann and Galbraith (1981) also discuss rules and procedures as techniques for coordinating activities, controlling behavior, and maintaining organizational structure. Ruekert and Walker (1987) report that written or formalized rules and procedures have a significant positive relationship with the perceived effectiveness of organizational relations. *Hypothesis 19:* Organizational rules positively influence perceived behavioral control for SDS.

Organizational trust is "the subjective belief with which a population of organizations performs transactions according to their confident expectations" (McKnight and Chervany

2002; Bhattacharya et al. 1998; Doney and Cannon 1997). Trust is a driver for cooperation (Morgan and Hunt 1994; Adobor 2005, 2006) and contributes to organizational performance by enabling people to share valuable information with each other (Mayer et al. 1995; Kramer and Tyler 1996). Tulloch and Harvey (2006) argue that institutions share data with people they know and trust. The groups have strong boundaries between them, and individuals have no external contacts other than in or via the group (egalitarian structure). *Hypothesis 20:* Trust positively influences egalitarian organizations to share spatial data.

Organizations have different objectives when they participate in interorganizational relationships, and these relationships can therefore take different forms (Bensaou and Venkatraman 1995; Grandori 1997). Uncertainty can affect organizational relationships by keeping institutions small and stimulating organizational individualism. Individualistic organizations have loose personal networks, without strong binding to any group. Bradley and Nolan (1998) argue that the high pace of change has pressured organizations to cooperate more and demands more rapid information sharing. *Hypothesis 21:* Uncertainty positively influences individualistic organizations to share spatial data.

Autonomy limits relations between organizations (fatalism). Fatalists operate in isolation, and as a consequence they have a more negative attitude towards data sharing (Gross and Rayner 1985). Organizational reluctance to share data due to a fear of losing autonomy and control over information sources is widely acknowledged (Pinto and Azad 1994; Meredith 1995). *Hypothesis 22:* Autonomy negatively influences fatalistic organizations in sharing spatial data.

It is important to distinguish between the concept of bureaucratic control and the effects of bureaucracy on SDS. With strong bureaucratic control, organizations tend to become protective and to actually inhibit the flow of information across organizational borders. However, bureaucracy overall may have a positive effect on the sharing of information. Deshpande and Zaltman (1987) and Moenaert and Souder (1990) suggest that increased formalization produces a more harmonious influence on the development of cooperation and information sharing. *Hypothesis 23:* Organizational rules positively influence hierarchical organizations to share spatial data.

3.5 DISCUSSION

Many decisions are based on spatial data. The development and maintenance of these data have become large cost components in the use of technology to address today's problems. Billions of dollars are invested annually in producing and maintaining spatial data. Sound spatial decision making often requires integration of spatial datasets. An organization may need access to external spatial data, and data sharing is essential for efficient and effective decision making. Proper functioning of spatial data infrastructures requires a positive attitude towards data sharing. Therefore, understanding the mechanisms behind spatial data sharing is crucial.

Understanding spatial data sharing is much more complicated than simply determining how data created by one organization or individual can be used by other organizations or individuals. Although interactions among strangers on the Web suggest certain models for sharing, in many traditional government and business contexts the sharing

of spatial data requires existing relationships. The ability of different individuals and organizations to cooperate determines what spatial data is available.

This chapter presents a conceptual model for spatial data sharing and its social and cultural aspects. A model is always an abstraction of reality, and no one model applies equally well to all situations. Quiun (1988) indicates that overemphasizing one model will only lead to failure. Scott (1987, 1992) recommends integration of valuable insights from different theories. The proposed model is based on three theories—TPB, culture theory, and Hofstede's cultural dimensions—which provide valuable insights into SDS.

The model makes a clear distinction between individual and organizational SDS behaviors. The individual and organizational sub models are linked through 5 cultural dimensions and 6 motivational factors. In the model the relations between all the factors are presented in the form of 23 hypotheses. These hypotheses describe expected relations between socio-cultural factors and spatial data sharing. The formulation of the relations is based on evidence from the literature and our own reasoning. Some of the formulated hypotheses are clear and well supported by literature, while for others the relations are not so obvious. For instance, the positive effect of trust on spatial data sharing has been documented by many authors; the influence of cultural factors on SDS, however, might not always be as clear as stated in the hypotheses. The hypotheses may need to be reworded, qualified, and retested. Are the proposed relations really there? A questionnaire designed to test the hypotheses has been administered in Egypt and in The Netherlands.

3.6 CONCLUSIONS AND FUTURE RESEARCH

Spatial Data Sharing (SDS) is an essential issue to be tackled in order to implement successful and healthy Spatial Data Infrastructure (SDI). The purpose of this chapter has been to propose a conceptual model that might better explain individual and organizational data sharing behavior. It would be unwise to assume any aspect of reality is quantifiable by a single model. As such the proposed model relies on multiple theories to address individual and organizational behavior. This study combines insights drawn from the Theory of Planned Behavior, Culture Theory and Hofstede's cultural dimensions to enhance our understanding of the determinants of SDS across cultures by proposing a SDS model. As key in aiming to SDS across cultures, the proposed model incorporates Hofstede's cultural dimensions (individualism/collectivism, power distance, uncertainty avoidance, masculinity/femininity and long-term/short-term orientation) and motivational factors (trust, uncertainty, incentives, resource scarcity, rules and autonomy).

In regard to limitations, this chapter deals with intentions, not actual SDS behavior. Perceived behavioral control, which is highlighted in this chapter as an important element of SDS, shows a direct effect (as opposed to attitude and subjective norm) on behavior. The expectation that the relationship between control and SDS is higher in societies with long-term orientation may become evident when examining actual behavior. Therefore, studying actual SDS behavior may reveal interesting aspects of SDS. Another important challenge for the future is the validation of the proposed model and the selection of a "final" model. Hopefully this final model will lead to better insights in SDS behavior of individuals and organizations, resulting in more possibilities for influencing spatial data sharing.

ACKNOWLEDGEMENTS

Chapter 4

Spatial Data Sharing: Test and Validation of Cross-Cultural Model

Omran, El.E., Bregt, A.K., and Crompvoets, J., 2007. Spatial data sharing: Test and validation of cross-cultural model. International Journal of Spatial Data Infrastructures Research, (under review).

4.1 INTRODUCTION

In the 20th century, Geographic Information Systems (GIS) has been developed and adopted. One of the most important problems and cost component in the application of GIS is the acquisition of spatial data. Subsequently many governmental agencies have built digital spatial databases to meet their needs. The exchange of these databases among organizations is very hard and resulted in duplications and redundancies (Eichelberger 1986; Harralson et al. 1988; Warnecke et al. 1998; Wehn de Montalvo 2003; Omran 2005; Omran et al. 2006, 2007a). Since it is costly for individual users to collect spatial data, access to spatial data of other parties is efficient and effective. One way to phase out and overcoming such problems and to make full use from the possibilities of GIS is to develop Spatial Data Sharing (SDS) locally, nationally, internationally and even globally.

Numerous Spatial Data Infrastructure (SDI) initiatives are under way at the local, national, international and global level. Based on a world-wide survey (Onsrud 1999; Crompvoets et al. 2004), these initiatives typically entail the following components: core data sets, metadata, standards, and clearinghouse. Next to the necessary standards, procedures and polices dealing with the technical aspect, social and cultural aspect of SDS are important. The success of data sharing often depends more on cultural, behavior and organizational factors than on technical limitations (Montagu 2000; Sahay and Walsham 1996; Harrigan and Newman 1990; Pinto et al. 1993; Mizruchi and Galaskiewicz 1993; Grandori and Soda 1995; Omran et al. 2007a). The promoters of the SDI initiatives have yet to acknowledge that in order for their initiatives to be effective, the SDS behavior need to be explicitly considered. The important aspect that can be expected to vary most for each national initiative is the fostering of a "SDS culture". There has been unwillingness to share spatial data across boundaries. Obermeyer and Pinto (1994); Warnecke et al. (1998); and Harvey and Tulloch (2006) highlighted the difficulties of SDS between and within organizations. National cultures may facilitate or impede the data sharing. Different cultures will deal differently with spatial data sharing issue. They will also perceive 'problems' differently. Differences in national cultures will likely be more important in spatial data sharing than technical issue (Omran et al. 2007a).

To the best of our knowledge, no empirical research on how individuals and organizations in different cultures function in SDS context has yet been conducted. There is a lack of systematic studies on the effect of cultural and social aspect on personal attitude and behavior towards SDS. To fill this gap, Omran et al. (2007a) develop a SDS model. This model integrates concepts of multiple theories: Theory of planned behavior, Culture (grid-group) theory and Hofstede's cultural dimensions. The model is developed but the hypotheses are not yet tested. The objectives of this chapter are:

1- To test, validate and revise the cross-cultural SDS model proposed by Omran et al. (2007a); and
2- To assess when (and how) individuals and organizations in different cultures might respond differently to share spatial data.

This research adds to the growing body of research literature directed at the importance of cross-cultural research. In addition, the research is important for understanding spatial data sharing of individuals and organizations in different cultural contexts. The result can be used to understand the incentives and impediments to share spatial data among and within organizations. The results also provide a basis for generating guidelines to make a spatial data sharing more effective within the social and cultural domain.

The chapter is organized as follows. In section 4.2, the concepts and gaps are presented. Section 4.3 present an overview of the methodology used in this study. In section 4.4, the results are presented. Section 4.5 discusses of the results. The final section presents the conclusions and recommendations for future research.

4.2 CONCEPTS AND BACKGROUND

Interactions among and between individuals and organizations are complex socio-cultural phenomena. Individuals generally do not act in isolation but, instead, as groups or at least in relation to one another. SDS relationships are example of such socio-cultural relations. Some models and theories are developed that describe their behavior and culture.

Omran et al. (2007a) develop a SDS model (figure 4.1). In this model, SDS is influenced by individual and organizational behavior. Individual behavior is analyzed by employing the major concepts of the Theory of Planned Behavior (TPB). The intention of each individual toward data sharing is based on the attitude, Subjective Norm (SN) and Perceived Behavior Control (PBC). In order to predict the spatial data sharing intention of an individual, we need to predict these three underlying factors. By estimating these three factors, we can assess an individual's intention towards SDS.

Organizational behavior is studied by using the Culture (Grid-Group) Theory. Any organization consists of four organizational settings toward SDS. These types are (hierarchy, egalitarianism, individualism, and fatalism) always potentially present in any group or organization. By describing these four types, we can predict the organizational behavior towards SDS.

The individual and the organizational levels are linked within the model in two ways: firstly, by the cultural dimensions of Hofstede (Power distance-PD, Uncertainty avoidance-UNA, Individualism-INDV/collectivism, Masculine-MAS/feminine and Long-term-LTO/short-term orientation) and secondly, by motivational factors (trust, uncertainty, incentives, resource scarcity, rules and autonomy) that affect individual and organizational behaviors toward SDS.

The relationships within the model are formulated in 23 hypotheses (figure 4.1 and table 4.1). The model is developed but the hypotheses are not yet tested. The objective of this chapter is to test, validate and revise the cross-cultural SDS model proposed by Omran et al. (2007a).
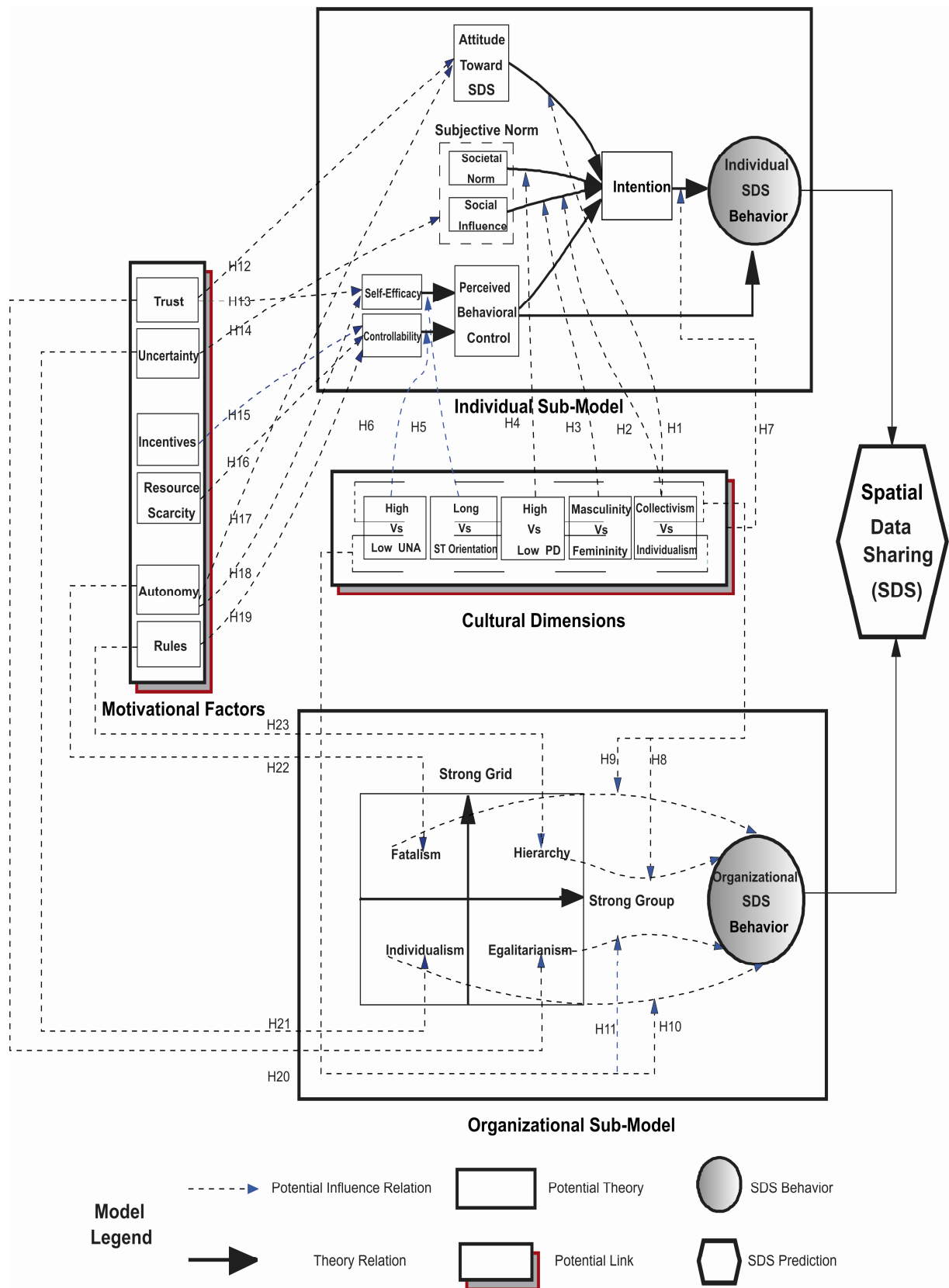
Figure 4.1 Spatial data sharing behavior model (Omran et al. 2007a).

Table 4.1 List of the Spatial Data Sharing (SDS) model hypotheses.

Hypo-thesis	Description
H1	- The positive relationship between attitude and the intention for SDS is stronger in collectivist cultures than in individualist cultures.
H2	- The positive relationship between social norms and the intention for SDS is stronger in collectivist than in individualist cultures.
H3	- The positive relationship between social norms and the intention for SDS is stronger in masculine cultures.
H4	- The negative relationship between societal influence and the intention for SDS is stronger in cultures with high power distance.
H5	- The positive relationship between Perceived Behavior Control (PBC) (self-efficacy) and the intention for SDS is stronger in Long Term Orientation (LTO).
H6	- The negative relationship between PBC (controllability) and the intention for SDS is stronger in cultures characterized by high uncertainty avoidance (UNA).
H7	- The positive relation between intention and SDS behavior is stronger in cultures high in collectivism, masculinity, low Power Distance (PD), LTO and low uncertainty avoidance.
H8	- The negative relationship between Hierarchical organizations and SDS is stronger in cultures characterized by collectivism, masculinity, higher PD, STO and high UNA.
H9	- The negative relationship between Fatalistic organizations and SDS is stronger in cultures characterized by collectivism, masculinity, higher PD, Short Term Orientation (STO) and high UNA.
H10	- The positive relationship between Individualistic organizations and SDS is stronger in cultures low in individualism, femininity, low PD, and low UNA and high in LTO.
H11	- The positive relationship between Egalitarian organizations and SDS is stronger in cultures low in individualism, femininity, low PD, and low UNA and high in LTO.
H12	- Trust positively influences favorable attitude toward SDS intention.
H13	- Trust positively influences perceived behavioral control for SDS.
H14	- Uncertainty positively influences subjective norms for the intention for SDS.
H15	- Individual's incentives have a positive influence on SDS.
H16	- Perceived individual resource scarcity has a positive influence on the intention for SDS.
H17	- Autonomy negatively influences the attitudes towards SDS.
H18	- Autonomy negatively influences perceived behavioral control for SDS.
H19	- Organizational rules positively influence perceived behavioral control for SDS.
H20	- Trust positively influences egalitarian organizations to share spatial data.
H21	- Uncertainty positively influences individualistic organization to share spatial data.
H22	- Autonomy negatively influences fatalistic organizations in sharing spatial data.
H23	- Organizational rules positively influence hierarchical organizations to share spatial data.

4.3 METHODOLOGY

The representation of individuals as indicators of organizational behavior provides the basis for the research strategy advocated here. Staw (1991) suggested that psychological theories that typically examine behavior at the micro level (individual model) can also be used to understand action at the macro level (i.e., organizational model) "...because it is possible to identify key actors in important organizational decisions, psychological research can be applied to these individuals in order to explain organizational actions". According to Staw, the most fruitful approach is not to examine in detail all individual behavior within an organization, but rather to study the key organizational decision-makers. Lammers (1998)

argued that because actors making decisions are accountable for their decision, they seek decision criteria that can be used to justify those decisions. These key decision-makers may be assumed to have an accurate understanding of their organization's position toward spatial data sharing and their perceptions may be the best indicator of their organization's behavior (Elliott et al. 1995). In this way, the situation can be expanded to a larger community (Markus and Robey 1988; Wehn de Montalvo 2003).

4.3.1 Organizations and Sample

The research focused on two organizations, Egyptian Survey Authority (ESA), Egypt and Alterra, the Netherlands. ESA organization is executing the Egyptian Cadastral Information Management (ECIM) Project, which involves the management of much spatial data. The choice fell on Egypt because the focus of the study mandated an exploration of the SDS motivation in a developing country (Egypt) context where resources for generating spatial data can be expected to be relatively limited. Therefore there may be stronger incentives to engage in SDS to reduce costs than in a country where greater resources are available. The choice fell on The Netherlands where considerable investments in GIS have been made and they are being used relatively widely in public, private and non-profit organizations. This spread of GIS has been accompanied by some bottlenecks in data sharing cooperation (Elrouby et al. 2005; Omran 2005; Omran et al. 2006, 2007a). The Netherlands and Egypt represent nearly reverse positions on three important cultural dimensions, as shown in table (4.2). Egypt is low on individualism, high on power distance, and high on masculinity. However, the Netherlands is high on individualism, low on power distance, and low on masculinity. So, ESA, and Alterra, represent almost reverse cultures.

Table 4.2 Cultural index scores for Egypt and The Netherlands.

Dimension	INDV	PD	MAS	UNA	LTO
Egypt	38	80	53	68	-
Netherlands	80	38	14	53	44

Adopted from Hofstede and Hofstede 2005

Required sample size for the survey is determined by statistical power analysis. This requires the specification of the study design and the expected effect size (Everitt 1996). It is reasonable to assume at least a moderate effect size (i.e. multiple R of around 0.3; Cohen 1988) for theory of planned behavior studies using a multiple regression approach. Generally, a sample size of 50 would be acceptable. The sample consisted of full-time individuals at the Egyptian General Survey Authority (ESA) in Egypt and Alterra, the Netherlands. All of the individuals are actively involved in spatial data applications at the time of the empirical research.

4.3.2 Questionnaire

We used a formal questionnaire for the survey among ESA and Alterra personnel. 80 questionnaires were distributed in ESA and 19 in Alterra for individual level. Only 65 participants from ESA and 16 from Alterra proved contactable. A final response rate is 81 and 84 percent respectively. However, at organizational level, we conduct 15 (out of 20) higher level administrators inside ESA and 4 (out of 5) inside Alterra. A final response rate was 75 and 80 percent respectively. Data from these persons only were reported in this chapter. All statements were adapted using standard procedures (Boudreau et al. 2001) and a refining procedure based on the pre test. A pre test of the questionnaire was conducted to further improve the statements, modify or delete some statements, and to obtain an estimate of the time required to complete the questionnaire. All scales followed Ajzen's (2002) recommendations for designing a questionnaire.

The questionnaire (appendix 2) consisted of four parts. The first part (33 statements) dealt with individual behavior model (attitude, subjective norm, PBC and intention). Attitude was measured (by 3 statements) and rated using a 7-unipolar adjective scale ranging from 1 (bad) to 7 (good) (Ajzen and Fishbein 1980). The statement that preceded the adjectives was "(e.g. overall, for me to participate in data sharing is . . ., etc.)". The answers were summed and divided by three to provide a total attitude score. The scale had an internal consistency of 0.74, as indicated by Cronbach's alpha. Subjective norm is measured and rated using a 7-unipolar adjective scale ranging from 1 (strongly disagree) to 7 (strongly agree). Scales tapped both social influence (measured by 3 statements) and societal norm (measured by 3 statements). The statement that preceded the adjectives for social influence is "(e.g. most of my colleagues whose I consult them think that I should share spatial data, etc.)", and for societal norm is "(e.g. my government approve me sharing spatial data, etc.)". Calculate the mean of the item scores to give an overall subjective norm score. The scale had an internal consistency of 0.75, as indicated by Cronbach's alpha. Perceived Behavior Control (PBC) was measured by three statements: 1) "e.g. I am confident that I can engage in data sharing if I want" (strongly disagree to strongly agree); 2) "e.g. for me to engage in spatial data sharing is" (-3 extremely easy to +3 extremely difficult); and 3) "e.g. it is mostly completely up to me whether or not to engage in data sharing" (strongly disagree to strongly agree). The PBC score was produced by calculating the mean of the three items. Cronbach's alpha for this item scale was 0.76. Respondents' intention to engage spatial data sharing was measured using the statement: From 7 of my colleagues, the following number is willing to share spatial data. Responses for this item are reported on a 7-point scale ranging from 1 -7.

In the second part, questions are asked about organizational behavior model (hierarchy, individualism, egalitarian and fatalism). General views regarding the organizational settings are assessed using 12 statements adapted from Dake (1992): ''e.g. people with more ability should earn more'' (individualism); ''e.g. I think there should be more rules for cooperation ''(hierarchy); ''e.g. if people were treated more equally, we would have fewer problems'' (egalitarian); and ''e.g. there is no incentive for cooperation with people, you only get a problem'' (fatalism). Key individuals were asked to place their answer on a 7- point scale (1 = strongly disagree; 7= strongly agree). Four organizational settings scores were calculated for each key individual. Individuals' responses to each of the

statements attributed to organizational forms were added up and divided by the number of items used for those organizational settings.

The third part of the questionnaire, 18 questions are asked about cultural dimension. The statements were developed on the bases of Hofstede's (1980) and Hofstede and Hofstede, (2005) survey items: ''e.g. to share data inequality in organization should be minimized'' (power distance); ''e.g. uncertainty in cooperation is a threat prevent me to share data ''(uncertainty avoidance); ''e.g. for me I only take care of myself when I think about data sharing/group decisions are ideal when you think about data sharing'' (individualism/collectivism); ''e.g. human relationships are the most important thing in data sharing cooperation'' (masculine/feminine); and ''e.g. If you take care of today's problems, the long run will take care of data sharing'' (long-term/short-term orientation). A 7-point scale is presented in the statements.

The fourth part consisted of 24 statements dealt with motivational behavior which are derived from the literature: ''e.g. trust creates positive data sharing relationships between individuals and organizations'' (trust); ''e.g. uncertainty creates negative data sharing relationships between individuals'' (uncertainty); ''e.g. incentives are the reason why data sharing is positive'' (incentives); ''e.g. resource scarcity makes data sharing between individuals more pessimistic'' (resource scarcity); ''e.g. bureaucracy makes sharing beyond my control'' (rules); and ''e.g. for me autonomy creates negative data sharing relationships between individuals'' (autonomy). A 7- point scale (1 = strongly disagree; 7= strongly agree) is presented in the statements.

4.3.3 Data Analysis

Descriptive statistics, ANOVA, regression and correlation coefficient for the SDS model variables are calculated using SPSS 12.0.1 (SPSS Inc. 2003). As the model consists of several possible sources of willingness to share spatial data, the appropriate statistical method for establishing the most important ones is multiple regression analysis. Multiple regressions provides a means of choosing empirically the most effective set of predictors of a variable (Howitt and Cramer 1997) and of establishing the relative importance of each independent variable in the prediction (Bryman and Cramer 1999). Measure reliability is assessed using internal consistency scores, calculated by the composite reliability scores (Werts et al. 1974). In order to test the effect of cultural differences, Baron and Kenny (1986) and Sharma et al. (1981) methods are conducted. The data analysis procedure aims to test not only the hypothesized relationships, but also other relations.

Aggregate factors (e.g. intention, PBC, and behavior) for the model can be approximated using two common procedures (Chin et al. 2003). One uses repeated indicators following Lohmoller's (1989) hierarchical component model by directly measuring the aggregate constructs using all statements of its lower-order constructs. The second approach, the paths from the lower order to the aggregate construct (Edwards 2001). The latter approach was chosen for this study because it specifies the relative weight of Self-Efficacy (SE) and controllability on Perceived Behavior Control (PBC). These weights were derived using a principal components factor analysis (Diamantopoulos and Winklhofer 2001):

PBC = γ1× SE + γ2× Controllability ………………………………………… (1)

Where: γ1 and γ2 are the parameters of the impact of SE and controllability on the PBC variable.

To examine the power of the SDS model, we compared a complete model (attitude, SN, and PBC) to three models in terms of R^2 adjusted.

1- a SDS model but PBC omitted;
2- a SDS model but SN omitted; and
3- a SDS model but attitude omitted.

Using Cohen's (1988) formula for calculating effect size (f^2) (the degree to which the SDS is present in the population) (Chin 1998):

f^2 = (R^2 included - R^2 excluded) / (1 - R^2 included) …………………………… (2)

4.4 RESULTS

Descriptive statistics and correlations for the model constructs are shown in table 4.3. Internal consistencies (Cronbach's alpha) of all variables for both Egypt and the Netherlands are considered acceptable since they exceed 0.70 (0.74-0.79), signifying acceptable reliability. Each model construct explains roughly equal variance, indicating that our data do not suffer from high variance. Descriptive statistics for the hypotheses are shown in table 4.4 for Egypt and the Netherlands.

Table 4.3 Descriptive statistics, correlations matrix of model constructs.

Model Constructs	Attitude Egypt	Attitude Netherlands	Social influence Egypt	Social influence Netherlands	Societal norm Egypt	Societal norm Netherlands	Self-efficacy Egypt	Self-efficacy Netherlands	Controllability Egypt	Controllability Netherlands	PBC Egypt	PBC Netherlands	Intention Egypt	Intention Netherlands	Behavior Egypt	Behavior Netherlands
Attitude	1.00	1.00														
Social influence	-0.01	-0.18	1.00	1.00												
Societal norm	-0.04	0.00	0.14	.591**	1.00	1.00										
Self-efficacy	.613**	-.448*	0.06	-0.18	-0.14	0.12	1.00	1.00								
Controllability	-0.10	.584**	-0.07	-0.24	0.14	-0.18	-0.19	-.436*	1.00	1.00						
PBC (aggregate)	0.14	0.22	-0.10	-0.26	0.05	-0.09	0.19	-0.24	.897**	.448*	1.00	1.00				
Intention	.557**	.848**	- .208*	-0.21	- .439**	0.07	0.13	-.474*	-0.15	.497*	0.02	.541*	1.00	1.00		
Behavior	.461**	.666**	-0.09	-0.41	-0.13	0.10	.400**	0.15	.484**	.483*	.665**	.483*	.724**	.762**	1.00	1.00
Cronbach's alpha	0.74	0.77	0.75	0.74	0.75	0.76	0.75	0.79	0.75	0.75	0.76	0.79	0.75	0.78	0.75	0.76

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.

Table 4.4 Descriptive statistics, correlations matrix of hypothesis testing in Egypt and The Netherlands.

Hypotheses	Attitude Egypt	Attitude Netherlands	Social influence Egypt	Social influence Netherlands	Societal norm Egypt	Societal norm Netherlands	Self-efficacy Egypt	Self-efficacy Netherlands	Controllability Egypt	Controllability Netherlands	Intention Egypt	Intention Netherlands	Hierarchy Egypt	Hierarchy Netherlands	Fatalism Egypt	Fatalism Netherlands	Individualism Egypt	Individualism Netherlands	Egalitarian Egypt	Egalitarian Netherlands	Cronbach's alpha Egypt	Cronbach's alpha Netherlands
H1	.652**	0.06																			0.74	0.77
H2			.656**	-0.36																	0.75	0.81
H3			0.14	-0.16																	0.75	0.69
H4					-0.09	.675**															0.75	0.78
H5							.812**	-0.11													0.74	0.74
H6									-.240*	.617**											0.75	0.74
H7											.540**	.718**									0.74	0.76
H8													-.551*	-0.23							0.74	0.75
H9															.543*	0.33					0.84	0.78
H10																	0.18	-.741*			0.68	0.75
H11																			0.22	.678*	0.73	0.77
H12	.532**	.832**																			0.74	0.74
H13							.614**	-.442*													0.74	0.82
H14			-0.11	.445*	-.243*	.657**															0.75	0.68
H15									0.09	-0.35											0.75	0.75
H16									-.272*	-0.14											0.76	0.74
H17	-.210*	-.526*																			0.75	0.86
H18							-.288*	.918**													0.76	0.69
H19									.634**	-0.32											0.75	0.73
H20																			.824**	.747*	0.75	0.74
H21																	.722**	-.745*			0.74	0.76
H22															.846**	.811*					0.74	0.75
H23											.473*	.843**									0.74	0.77

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.

4.4.1 Aggregate Factors Validation

Table 4.5 examined the regression coefficient between the lower and aggregate factors for the model. The regression coefficient between SE and controllability and the aggregate PBC factor are 0.40 and 0.22 (p = 0.000 and 0.050), respectively for The Netherlands and 0.06 and 0.42 for Egypt (p = 0.835 and 0.148). This suggests that the aggregate factor (PBC) captures the content of PBC for the Netherlands only. The regression coefficient between intention, PBC and behavior are 0.73 and 0.67 (p = 0.000 and 0.008), respectively for the Netherlands and 0.71 and 0.10 (p = 0.005 and 0.645) for Egypt. This suggests that the aggregate factor captures the content of SDS behavior in the Netherlands and to some extent in Egypt. However, the regression coefficient between attitude, social influence, societal norm, PBC and intention are 0.21, - 0.05, - 0.14 and 0.72, (p = 0.009, 0.040, 0.009 and 0.090) respectively for Egypt and 0.76, 0.05, 0.13, 0.38 (p = 0.000, 0.722, 0.359 and 0.008) for the Netherlands. This suggests that the social and societal factor captures the content of intention in Egypt but not captures the content of intention in the Netherlands.

Table 4.5 Regression coefficient for aggregate factors validation.

Model Constructs		Regression Coefficient		t- Value		Level of Confidence (P)		R-Squared		F	
		Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Behavior	Intention	0.71	0.73	3.34	7.82	0.005	0.000	0.59	0.76	9.24 **	37.89**
	PBC (aggregate)	0.10	0.67	0.47	6.68	0.645	0.008				
Intention	Attitude	0.21	0.76	2.70	6.66	0.009	0.000	0.78	0.87	52.31**	17.66**
	Social influence	-0.05	-0.05	-0.78	-0.37	0.040	0.722				
	Societal norm	-0.14	0.13	-2.22	0.96	0.009	0.359				
	PBC (aggregate)	0.72	0.38	9.38	3.22	0.090	0.008				
PBC (aggregate)	Self-efficacy	-0.06	0.40	-0.21	3.59	0.835	0.000	0.20	0.23	1.67	9.25**
	Controllability	0.42	-0.22	1.54	-1.93	0.148	0.050				

** Correlation is significant at the 0.01 level.

Correlation coefficients (Table 4.6) are used in order to test the relationship between organizational settings and social relations. In Egyptian context, the pattern of results found is more consistent for the fatalism and hierarchical setting than for the egalitarian and individualist ones. In fact, for the former the strongest correlations (- 0.742, p = 0.01) are between the predicted items, whereas for the latter this is not the case. The associations between measures of hierarchical and fatalism are stronger. These results are still in line with cultural theory that predicts that the great oppositions should be found between egalitarian and individualistic setting. However, in the Dutch context, the pattern of results found is more consistent for the egalitarian and individualistic (0.790, p = 0.01) setting than for the fatalism and hierarchical ones (0.697, p = 0.05).

It can be observed that these correlations are in the direction predicted by cultural theory. The strongest correlation is the one between the hierarchical, fatalism and the individualistic views. Beyond the theoretical consistence of the structure, its reliability was analyzed in terms of internal consistency as measured by Cronbach's alpha. The four scales showed equal degrees of internal consistency. The Cronbach's alpha coefficients are (0.74-0.77) which are respectable values.

Table 4.6 Descriptive statistics between social relations and organizational settings.

| Social Relations | Organizational Settings | | | | | | | |
| | Hierarchy | | Individualism | | Egalitarian | | Fatalism | |
	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Hierarchy	1.00	1.00						
Individualism	.559*	0.66	1.00	1.00				
Egalitarian	0.24	0.21	-0.05	.790**	1.00	1.00		
Fatalism	-.742**	.697*	0.19	0.50	0.15	0.02	1.00	1.00
Cronbach's alpha	0.75	0.76	0.74	0.75	0.74	0.77	0.74	0.75

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level

On three of the 12 statements, table (4.7), the factor loadings are strong in more than one factor, but the pattern of the associations was also coherent with the cultural theory. The item ''making money is the main reason for SDS (Individualism 2)'' loaded on the hierarchy factor (0.690) and on the individualist one (0.685). The fatalism item ''cooperating with others rarely works (Fatalism 2)'' loaded on the fatalism factor (0.632) and individualist one (0.522). Also, if we look at the association pattern as highlighted in the table 4.6 and 4.7, we find the pattern towards Fatalism, Hierarchy and Individualism. However, in the Netherlands from the pattern are Individualism, Egalitarian and Hierarchy. These associations are compatible with the theoretical model, where hierarchy and egalitarianism share a ''group'' dimension, and the egalitarian view is clearly opposed to the individualist one.

Table 4.7 Association between social relations and organizational settings.

Social Relations	Hierarchy		Individualism		Egalitarian		Fatalism	
	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Hierarchy								
1- I think there should be more rules for cooperation.	0.596**	0.496	0.523*	-0.113	-0.173	0.420	0.377	0.040
2- I am more strict than most people about what is right and wrong.	-0.067	0.717*	-0.006	0.320	0.255	0.025	-0.196	0.977**
3- I value regular routines highly.	0.563*	0.187	0.041	0.789*	0.372	0.135	0.200	0.058
Individualism								
1- People with more ability should earn more.	0.314	0.413	0.569*	0.778*	0.469*	0.321	0.077	0.183
2- Making money is the main reason for SDS.	0.690**	0.617	.685**	0.806*	-0.112	-0.307	0.247	0.636
3- I like to cooperate, but I don't always have the time to do it.	0.107	0.180	0.283	0.590*	0.266	-0.070	-0.108	0.040
Egalitarian								
1- If people were treated more equally, we would have fewer problems.	0.404	-0.064	0.171	-0.240	0.208	0.545*	-0.021	-0.510
2- The government should make sure everyone has a good cooperation with others.	0.810**	0.064	0.415	-0.320	0.105	0.842**	0.067	0.113
3- I would support the work that made people cooperate with each other.	0.214	0.496	0.474*	0.679*	0.193	0.420	-0.070	0.600
Fatalism								
1- There is no incentive for cooperation with people, you only get a problem.	0.234	0.420	0.056	0.713*	-.747**	-0.230	0.487*	0.745*
2- Cooperating with others rarely works.	0.287	0.496	0.522*	-0.113	-0.028	0.420	0.632**	0.040
3- The future is too uncertain for a person to make serious plans.	-0.310	0.717*	-0.485*	0.320	0.114	0.025	0.977**	-0.056

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.

4.4.2 Hypothesizes Test

Cultural Impact

Table (4.8) shows the results of the individual behavior model provided by the regression results. We compared the simple regression model with four independent variables versus the regression model that additionally included the interaction of these variables with culture. A significant interaction effect suggests that culture indeed affect the relationship.

H1 hypothesizes that attitude would have a stronger effect in collectivist than in individualist cultures. In fact in Egypt (b = 0.54, t = 5.13, p = 0.000), attitude has a substantially greater effect on intentions than the Netherlands (b = 0.09, t = 0.32, p = 0.753). The regression model shows that the interaction of culture with attitude is significant. This means that the hypothesis is valid.

H2 argues that social norm is more important in collectivist societies, not received support since respondents (b = 0.07, t = 0.73, p = 0.466) are not influenced by their society's norms in Egypt. The moderated regression model also shows that the interaction of norm with culture is not significant. This means that the hypothesis is not supported.

H3 argues that social influence would have a greater effect on intentions in masculine culture. The coefficient was indeed not significant (b = 0.12, t = 1.27, p = 0.208) for Egypt and (b = 0.60, t = 1.98, p = 0.075) for the Netherlands. H3 is not supported, because the interaction of influence with culture does not have a significant effect on intentions.

H4 hypothesizes that societal norm would have a stronger effect on intention in high power distance cultures. The regression model shows that the interaction of culture with societal (b = 0.27, t = 2.82, p = 0.000) for Egypt is significant and for the Netherlands (b = 0.26, t = 0.57, p = 0.581) not significant. This means that the hypothesis is valid.

H5 hypothesizes that PBC would have a stronger effect on intention in long term orientation cultures. The moderated regression model shows that the interaction of culture with PBC (b = 0.66, t = 7.07, p = 0.000) is significant. This means that the hypothesis is valid.

H6 hypothesizes that the relationship between perceived behavioral control and intentions would be higher in countries with high UNA. However, this hypothesis is not supported in Egypt. On the contrary, control has a stronger effect on intentions among respondents (b = 0.06). This unexpected finding is validated by the regression model (b = -0.06, t = 0.65, p = 0.517). However, in the Netherlands (b = 0.68, t = 3.395, p = 0.003) is significant.

H7 hypothesizes that the positive relation between intention and SDS behavior is stronger in cultures characterized by high in collectivism, masculinity, low PD, LTO and low uncertainty avoidance. The regression model (table 4.8) shows that the interaction of culture with intention in Egypt (b = 0.61, t = 6.18, p = 0.000) is significant where Egyptian culture high in PD, high in collectivism and masculinity. However, in the Netherlands (b = 0.14, t = 0.24, p = 0.816) not significant. This means that the hypothesis is valid.

Table 4.8 Cultural effect regression analyses on individual behavior model.

Model Constructs	R-Squared		Regression Coefficient (b)		t-value		Level of Confidence (P)		F	
	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Simple regression model										
Intention	0.517	0.816	0.789	0.684	6.170	4.06	0.008	0.004	16.03 **	17.7**
Attitude			0.577	0.757	6.211	6.556	0.000	0.000		
Social influence			-0.072	- 0.053	-0.791	-0.365	0.432	0.722		
Societal norm			0.267	0.133	2.865	0.957	0.006	0.359		
Perceived behavioral control			-0.134	0.375	-1.471	3.220	0.146	0.004		
Cultural regression model										
Attitude x culture (H1)	0.681	0.916	0.543	0.085	5.129	0.321	0.000	0.753	38.18 **	21.7**
Social norm x culture (H2)			0.069	0. 602	0.733	2.861	0.466	0.017		
Social influence x culture (H3)			-0.119	0.602	-1.273	1.984	0.208	0.075		
Societal influence x culture (H4)			0.265	0.256	2.823	0.570	0.006	0.581		
Perceived behavioral control x culture (H5)			0.663	0.085	7.072	0.321	0.000	0.753		
Perceived behavioral control x culture (H6)			0.062	0.684	0.652	3.395	0.517	0.003		
Intention x culture (H7)			0.614	-0.147	6.179	-0.239	0.000	0.816		

** Correlation is significant at the 0.01 level.

H8 hypothesizes that the negative relationship between Hierarchical organizations and SDS is stronger in cultures characterized by collectivism, masculinity, higher PD, LTO and high UNA. The regression model (table 4.9) shows that the interaction of culture with hierarchical setting in Egypt (b = -0.71, t = - 2.82, p = 0.015) is significant where Egyptian culture high in PD, high in collectivism and masculinity. However, in the Netherlands (b = - 0.86, t = - 1.33, p = 3.14) not significant. This means that the hypothesis is valid.

H9 hypothesizes that the negative relationship between Fatalistic organizations and SDS is stronger in cultures characterized by collectivism, masculinity, higher PD, LTO and high UNA. The regression model (table 4.9) shows that the interaction of culture with fatalistic setting in Egypt (b = 0.56, t = 2.25, p = 0.018) is significant where Egyptian culture high in PD, high in collectivism and masculinity. However, in the Netherlands (b = 0.23, t = 0.23, p = 0.843) not significant. This means that the hypothesis is valid.

Table 4.9 Regression coefficient for organizational behaviors model.

Organizational Settings	Hypotheses	Regression Coefficient (b)		t- Value		Level of Confidence (P)		R-Squared		F	
		Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Hierarchy	H8	-0.708	-0.855	-2.824	- 1.332	0.015	0.314	0.625	0.909	4.99 **	4.48 *
	H9	0.027	0.392	0.101	0.888	0.921	0.468				
	H10	0.146	- 1.056	0.712	- 3.211	0.320	0.045				
	H11	0.121	0.321	0.820	0.760	0.207	0.527				
Individua-lism	H8	0.249	- 1.703	0.844	- 2.437	0.415	0.135	0.792	0.892	4.13	9.52 **
	H9	0.273	1.150	0.925	2.390	0.373	0.139				
	H10	0.523	0.695	1.654	3.898	0.235	0.005				
	H11	0.473	-0.879	1.473	- 1.910	0.186	0.196				
Egalitarian	H8	0.091	- 1.570	0.280	- 2.175	0.784	0.162	0.797	0.885	3.84	9.82 **
	H9	0.133	1.215	0.410	2.443	0.689	0.135				
	H10	-0.187	-0.271	-0.292	-0.733	0.712	0.540				
	H11	-0.132	0.318	-0.235	2 .668	0.568	0.008				
Fatalism	H8	0.556	0.028	2.041	0.019	0.064	0.987	0.792	0.526	9.55 **	0.56
	H9	0.563	0.226	2.246	0.225	0.018	0.843				
	H10	0.072	-0.477	2.765	-0.636	0.019	0.590				
	H11	0.332	0.611	3.124	0.633	0.135	0.591				

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.

H10 hypothesizes that the positive relationship between Individualistic organizations and SDS is stronger in cultures characterized by individualism, femininity, low PD, STO and low UNA. The regression model (table 4.9) shows that the interaction of culture with individualistic setting in Egypt (b = 0.52, t = 1.66, p = 0.235) not significant where Egyptian culture high in PD, high in collectivism and masculinity. However, in the Netherlands (b = 0.69, t = 3.89, p = 0.005) significant. This means that the hypothesis is valid.

H11 hypothesize that the positive relationship between Egalitarian organizations and SDS is stronger in culture characterized by individualism, femininity, low PD, STO and low UNA. The regression model shows that the interaction of culture with egalitarian setting in Egypt (b = -0.13, t = -0.24, p = 0.570) not significant where Egyptian culture high in PD, high in collectivism and masculinity. However, in the Netherlands (b = 0.32, t = 2.67, p = 0.008) significant. This means that the hypothesis is valid.

Motivational Impact

H12 hypothesizes that Trust influences positively the favorable attitude toward SDS intention. The regression model (table 4.10) shows that trust explain (b = 0.51, t = 4.79, p = 0.000) from attitude in Egypt. However, in the Netherlands, trust explain (b = 0.81, t = 4.19, p = 0.000) from attitude. These results are significant. This means that the hypothesis is valid.

H13 hypothesizes that Trust influences positively the perceived behavioral control toward SDS. The regression model (table 4.10) shows that trust explain (b = 0.59, t = 5.88, p = 0.000) from PBC in Egypt. However, in the Netherlands, trust explain (b = 0.46, t = 4.46, p = 0.005) from PBC. These results are significant. This means that the hypothesis is valid.

As expected, both H12 and H13 receive strong support, table (4.10), because the role of trust in influencing attitude and perceived behavioral control is significant in the Egyptian and the Netherlands culture. The effect of trust on attitude and self-efficacy was also examined to test if they are influenced by culture, using a similar regression model.

H14 hypothesizes that Uncertainty influences positively subjective norm towards SDS intention. The regression model (table 4.10) shows that uncertainty explain (b = - 0.21, t = - 1.69, p = 0.095) from PBC in Egypt. However, in the Netherlands, uncertainty explain (b = 0.66, t = 3.26, p = 0.006) from PBC. These results are significant. This means that the hypothesis is valid.

H15 hypothesizes that Individual's incentives have a positive influence on SDS. The regression model shows that incentives explain (b = 0.05, t = 0.55, p = 0.580) from PBC in Egypt. However, in the Netherlands, incentives explain (b = - 0.43, t = - 1.72, p = 0.112) from PBC. These results are not significant. This means that the hypothesis is not supported.

H16 hypothesizes that Perceived individual resource scarcity has a positive influence on SDS intention. The regression model (table 4.10) shows that resource scarcity explain (b = -0.07, t = -0.69, p = 0.494) from PBC in Egypt. However, in the Netherlands, resource scarcity explain (b = - 0.25, t = - 0.99, p = 0.343) from PBC. These results are not significant. This means that the hypothesis is not supported.

H17 hypothesizes that Autonomy influences negatively the attitude towards SDS. The regression model shows that autonomy explain (b = -0.105, t = - 0.84, p = 0.405) from attitude in Egypt. However, in the Netherlands, autonomy explain (b = 0.45, t = - 0.84, p = 0.084) from attitude. These results are not significant. This means that the hypothesis is not supported.

H18 hypothesizes that Autonomy influences negatively perceived behavioral control towards SDS. The regression model (table 4.10) shows that autonomy explain (b = 0.74, t = 5.44, p = 0.000) from PBC in Egypt. However, in the Netherlands, autonomy explain (b = 0.95, t = 7.39, p = 0.000) from PBC. These results are significant. This means that the hypothesis is valid.

H19 hypothesizes that Organizational rules influence positively perceived behavioral control toward SDS. The regression model shows that rules explain (b = 0.64, t = 6.51, p = 0.000) from PBC in Egypt. However, in the Netherlands, rules explain (b = - 0.35, t = - 1.46, p = 0.171) from PBC. These results are significant. This means that the hypothesis is valid.

Table 4.10 Regression coefficient between motivational factors and individual behaviors.

Model Constructs	Hypotheses	Regression Coefficient (b) Egypt	Netherlands	t- Value Egypt	Netherlands	Level of Confidence (P) Egypt	Netherlands	R-Squared Egypt	Netherlands	F Egypt	Netherlands
Attitude	Trust (H12)	0.514	0.812	4.788	4.190	0.000	0.000	0.323	0.692	14.78**	14.63**
	Autonomy (H17)	-0.105	0.445	-0.839	1.860	0.405	0.084				
Societal-norm	Uncertainty (H14)	-0.209	0.657	-1.693	3.260	0.095	0.006	0.044	0.432	2.87	10.65**
Self-efficacy	Trust (H13)	0.590	0.458	5.876	4.455	0.000	0.005	0.405	0.845	21.08**	35.52**
	Autonomy (H18)	0.744	0.949	5.436	7.390	0.000	0.000				
Controll-ability	Incentives (H15)	0.053	-0.427	0.554	- 1.715	0.581	0.112	0.441	0.297	16.02**	1.69
	Resource Scarcity (H16)	-0.068	-0.245	-0.689	-0.986	0.494	0.343				
	Rules (H19)	0.640	- 0354	6.513	- 1.456	0.000	0.171				

** Correlation is significant at the 0.01 level.

A comparison of the groups through a series of ANOVA's (table 4.11) shows that each group scored significantly higher in the corresponding view of organizational settings than the others for Egypt and the Netherlands.

H20 hypothesizes that Trust influences positively egalitarian organizations to share spatial data. The regression model (table 4.11) shows that trust explain (b = 0.80, t = 5.18, p = 0.000) from egalitarian setting in Egypt. However, in the Netherlands, rules explain (b = 1.05, t = 4.99, p = 0.000) from egalitarian setting. These results are significant. This means that the hypothesis is valid.

H21 hypothesizes that Uncertainty influences positively individualism organization toward SDS. The regression model (table 4.11) shows that uncertainty explain (b = 0.71, t = 4.57, p = 0.001) from individualism setting in Egypt. However, in the Netherlands, rules explain (b = 0.88, t = 4.47, p = 0.000) from individualism setting. These results are significant. This means that the hypothesis is valid.

H22 hypothesizes that Autonomy influences negatively fatalistic organizations to share spatial data. The regression model shows that autonomy explain (b = 1.25, t = 5.48, p = 0.000) from fatalistic setting in Egypt. However, in the Netherlands, rules explain (b = 1.35, t = 3.22, p = 0.085) from fatalistic setting. These results are significant. This means that the hypothesis is valid.

H23 hypothesizes that Organizational rules influence positively hierarchical organizations to share spatial data. The regression model (table 4.11) shows that rules explain

(b = 0.65, t = 2.26, p = 0.007) from hierarchical setting in Egypt. However, in the Netherlands, rules explain (b = 0.54, t = 1.54, p = 0.264) from hierarchical setting. These results are significant. This means that the hypothesis is valid.

Table 4.11 Regression coefficient between motivational factors and organizational behavior.

Organizational Settings	Hypotheses	Regression Coefficient (b)		t- Value		Level of Confidence (P)		R-Squared		F	
		Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands	Egypt	Netherlands
Hierarchy	Trust (H20)	0.010	0.310	0.047	1.765	0.964	0.220				
	Uncertainty (H21)	0.685	-0.565	3.300	- 3.282	0.008	0.082				
	Autonomy (H22)	-0.391	0.485	-1.269	1.289	0.233	0.326	0.481	0.625	4.16	10.74*
	Rules and Procedures (H23)	0.648	0.536	2.262	1.537	0.007	0.264				
Individualism	Trust (H20)	0.359	0.285	2.308	0.790	0.044	0.512				
	Uncertainty (H21)	0.706	0 .875	4.568	4.473	0.001	0.000				
	Autonomy (H22)	0.362	-0.107	1.581	-0.139	0.145	0.902	0.356	0.792	9.52	2.16
	Rules and Procedures (H23)	-0.478	0.556	-2.240	0.776	0.149	0.519				
Egalitarian	Trust (H20)	0.796	1.051	5.177	4.991	0.000	0.000				
	Uncertainty (H21)	0.333	-0.344	2.180	-0.998	0.054	0.423				
	Autonomy (H22)	0.167	1.251	0.738	1.660	0.478	0.239	0.383	0.797	9.82	2.30
	Rules and Procedures (H23)	-0.364	-0.938	-1.728	- 1.342	0.115	0.312				
Fatalism	Trust (H20)	0.308	0.130	1.983	0.663	0.176	0.575				
	Uncertainty (H21)	-0.292	-0.602	-1.891	- 3.130	0.088	0.089				
	Autonomy (H22)	1.254	1.351	5.481	3.218	0.000	0.085	0.471	0.692	9.55	8.52
	Rules and Procedures (H23)	-0.446	-0396	-2.092	- 1.016	0.063	0.417				

* Correlation is significant at the 0.05 level.

4.4.3 Predictive Power of the SDS Model

A complete SDS model (attitude, SN, PBC) explains $R^2 = 0.78$ and 0.87 ($f^2 = 0.00$ and 0.00) of the variance in intentions to data sharing for Egypt and The Netherlands respectively, table (4.12). Dropping PBC reduces the variance explained in data sharing to $R^2 = 0.45$ and 0.67 ($f^2 = 1.46$ and 1.42) for Egypt and The Netherlands respectively. Dropping attitude significantly reduces the variance explained in data sharing to $R^2 = 0.21$ and 0.34 ($f^2 = 2.56$ and 3.89) for Egypt and the Netherlands respectively. However, dropping SN not significantly reduces the variance explained in data sharing, $R^2 = 0.70$ and 0.85 ($f^2 = 0.35$ and 0.09) for Egypt and The Netherlands respectively. In sum, the three competing models have significantly lower predictive validity compared to the proposed model. Most important, the proposed model explicates most accessible factors that underlie data sharing behavior, establishing its superiority over simpler models. The results presented show that the model could be used successfully to predict intentions to share data both in Egypt and The Netherlands. Attitudes

toward data sharing, as well as SN in Egypt and perceived control over the behavior in the Netherlands are implicated as important predictors. Together with attitude, PBC is a significant predictor of intention to data sharing in The Netherlands ($R^2 = 0.85$).

Table 4.12 Predictive power of the SDS model.

Model Constructs	Regression Coefficient (b) Egypt	Regression Coefficient (b) Netherlands	t-Value Egypt	t-Value Netherlands	Level of Confidence (P) Egypt	Level of Confidence (P) Netherlands	R-Squared Egypt	R-Squared Netherlands	F Egypt	F Netherlands	f² Egypt	f² Netherlands
Attitude	0.21	0.76	2.70	6.66	0.009	0.000						
Social influence	-0.05	-0.05	-0.78	-0.37	0.040	0.722	0.777	0.865	52.31**	17.66**	0.00	0.00
Societal norm	-0.14	0.13	-2.22	0.96	0.009	0.359						
PBC (aggregate)	0.72	0.38	9.38	3.22	0.090	0.008						
Attitude	0.64	0.82	6.76	5.40	0.000	0.000						
Social influence	-0.11	-0.15	-1.10	-0.82	0.074	0.428	0.451	0.673	16.67**	11.28**	1.46	1.42
Societal norm	-0.13	0.16	-1.40	0.87	0.066	0.402						
Attitude	0.58	0.77	6.19	7.04	0.000	0.000	0.700	0.853	29.92**	37.77**	0.35	0.09
PBC (aggregate)	0.28	0.38	3.00	3.45	0.074	0.004						
Social influence	-0.03	-0.23	-0.24	-0.76	0.011	0.463						
Societal norm	-0.17	0.25	-1.44	0.86	0.056	0.409	0.206	0.339	5.27	2.05	2.56	3.89
PBC (aggregate)	0.41	0.50	3.58	2.07	0.301	0.061						

(Row label spanning the table: *Intention*)

** Correlation is significant at the 0.01 level.

4.5 DISCUSSION

Recall that the first purpose of this chapter is to test, validate (table 4.13) and revise the Spatial Data Sharing (SDS) model. In order to examine how attitude, social pressure and perceived control jointly influence the likely willingness to share, a multiple regression technique was applied. The multiple regression coefficients (R^2) indicate the collective effect of all the independent variables on the dependent variables (willingness to share).

Regression coefficient serves as a measure of the extent to which willingness to share can be predicted from the three main components (attitude, social pressure and perceived control). According to the results of the regression, 79 % and 77 % of the variation in the willingness to share can be explained by the direct measures of attitude, social pressure and perceived control in both Egyptian and Dutch cultures (figure 4.2).

The relationship between attitude and intention is significant for the collectivist culture, but insignificant for the individualistic culture. These results are in line with Pavlou and Chai (2002) who found that the relationship between attitude and intention in e-commerce behavior is stronger in collectivist societies than in individualist societies. Similarly, social norm is strongly related to intention in the Egyptian collectivist culture, but insignificant in The Netherlands individualistic society. However, social influence is weakly related to intentions, suggesting that this type of subjective norm may not be a key SDS

driver that can be influenced by cultural effects, such as power distance. Pavlou and Chai (2002) found that the relationship between subjective norm and transaction intention is strong in cultures with high power distance. In addition, perceived behavioral control is a significant driver of spatial data sharing in the Netherlands. A positive relationship between behavioral control and intentions was also found by Mathieson (1991) and Taylor and Todd (1995) for information system. Pavlou (2002) found the same results for e-commerce behavior. The expected higher effect for the Egyptian culture with masculinity is not evident in this sample. Of these five dimensions of Hofstede, PD and UNA are emphasized in studying organizational culture (Hofstede 1991; Shore and Venkatachalam 1996; De Man and Den Toorn 2002). PD-UNA score best reflects the way decision making power in organizations is distributed and uncertainty accepted.

Finally, trust, autonomy, rules and uncertainty are found to be a significant predictor of intention and behavior in both countries, implying that the role of motivational factors is not depends on cultural differences in Egypt and The Netherlands. This finding suggests that trust, autonomy, rules and uncertainty are a universal driver of spatial data sharing behavior. These results are supported by Adobor (2006); Tulloch and Harvey (2006); McKnight and Chervany (2002); and Pavlou (2002) who found that trust is a driver for cooperation.

For each independent variable, the significance level of its coefficient indicates whether a variable makes a significant addition to the strength of the prediction of willingness to share above the contribution of the other two independent variables. Hence, the results indicate that perceived social pressure and attitude are significant predictors of willingness to share spatial data in Egypt. However, attitude and PBC are significant predictors of willingness to share spatial data in The Netherlands.

Table 4.13 Hypotheses validation for the SDS model.

Hypotheses	Egypt	Netherlands	Hypotheses	Egypt	Netherlands
H1	Well **	Not	H13	Well **	Well **
H2	Not	Not	H14	Well *	Well **
H3	Not	Not	H15	Not	Not
H4	Well **	Not	H16	Not	Not
H5	Well **	Not	H17	Not	Not
H6	Not	Well **	H18	Well **	Well **
H7	Well **	Not	H19	Well **	Not
H8	Well **	Not	H20	Well **	Well **
H9	Well **	Not	H21	Well **	Well **
H10	Not	Well **	H22	Well **	Well *
H11	Not	Well **	H23	Well *	Not
H12	Well **	Well **			

** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.
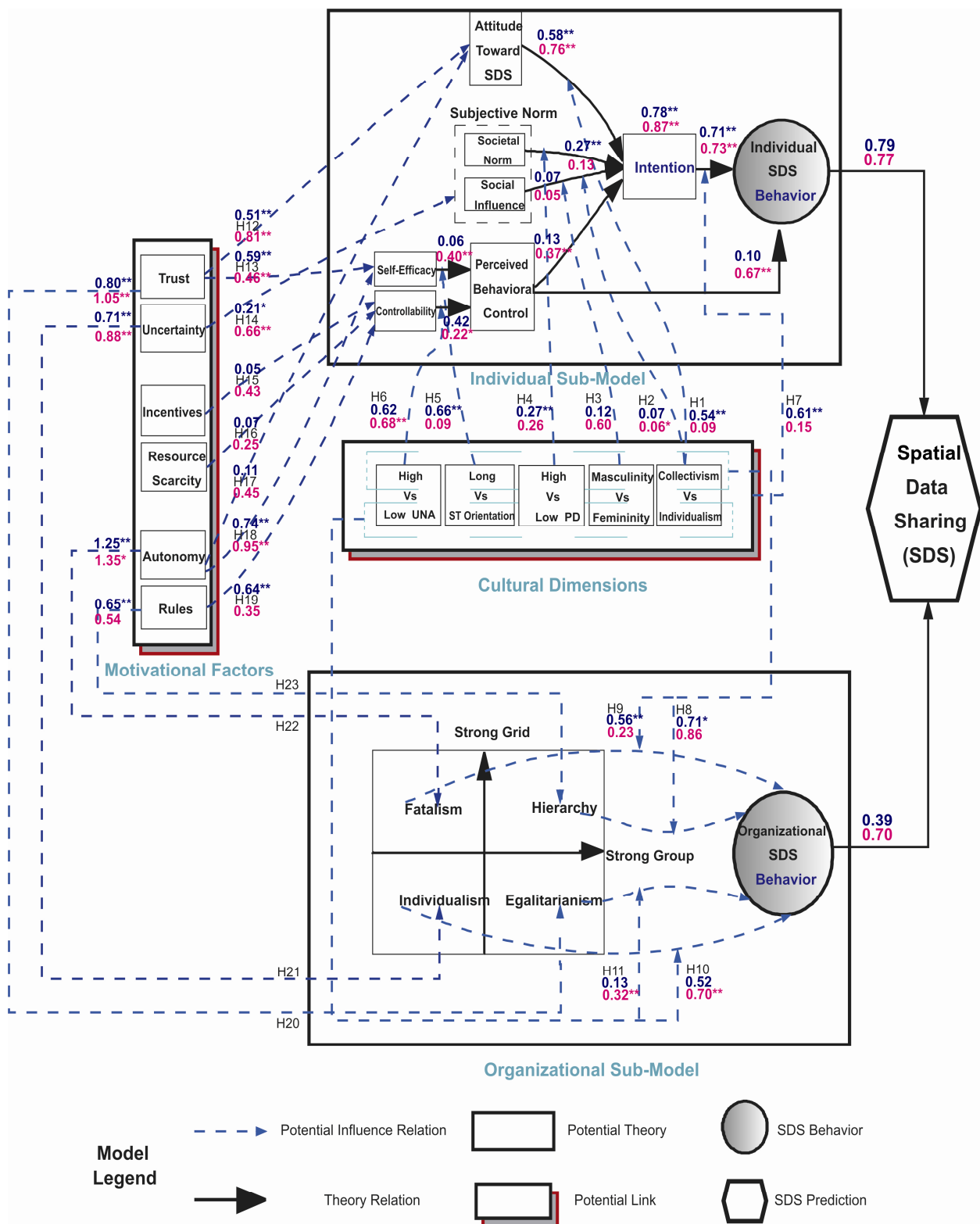
Figure 4.2 Regression coefficients of SDS model constructs.

As shown in table 4.13 and figure 4.2, the results broadly support the role of the model in explaining willing to share data. The model is valid in Egypt and The Netherlands where it explains 79 % and 77 % of the variation in SDS behavior at the individual level. However, at the organizational level, the model explains 39 % and 70 % of the variation in SDS behavior in Egypt and The Netherlands respectively.

The results in table 4.13 show that hypotheses 1, 4, 5, 8, 9, 19, and 23 are well supported in Egypt and not supported in The Netherlands. These results are in line with what are expected because Egyptian cultures are collectivism, high PD and LTO society, and hierarchy and fatalism society. However, hypotheses 6, 10, and 11 are well supported in The Netherlands and not supported in Egypt. These results are in line with what are expected because Dutch cultures are individualism, low PD and low UNA society, egalitarian and individualism society. These results reflect that the role of cultural dimensions is different from country to another. On the other hand, hypothesis 12, 13, 14, 18, 20, 21, and 22 are well supported in both cultures. This reflects the role of motivational factors (trust, uncertainty, autonomy and roles) as a driver for SDS in all societies.

Having the model of SDS validated and revised (figure 4.3), the second purpose we undertake this research is to understand how individuals and organizations in different cultures may respond differently to share data. When (and how) national cultural characteristics might facilitate or, more importantly, impede data sharing in their organizations. This model can help to explaining individual and organizational data sharing work or not work. Table 4.14 show the individual and organizational willingness to share data. In Egyptian culture, the individuals are willing to share data (79.34 %) however the organizations resist (39.20 %). On the other hand, in the Dutch culture, both individuals (76.50 %) and organization (69.70 %) are willing to share data. Also the patterns of organizational setting identified in Egypt are toward Hierarchy and Fatalism. In The Netherlands, the patterns are toward Hierarchy, Individualism and Egalitarian.

Table 4.14 Spatial data sharing willingness at individual and organizational level.

Country		Hierarchy	Individualism	Egalitarian	Fatalism	Intention	Behavior Control	Individual Behavior	Organizational Behavior
Egypt	Mean	6.0	3.0	2.5	6.1	6.0	5.1	5.6	2.7
	%	86.3	42.9	35.6	87.0	85.79	72.89	79.34	39.20
Netherlands	Mean	6.1	6.0	3.4	3.1	5.9	5.9	5.4	4.8
	%	87.7	85.8	48.4	44.2	84.4	84.4	76.50	69.70
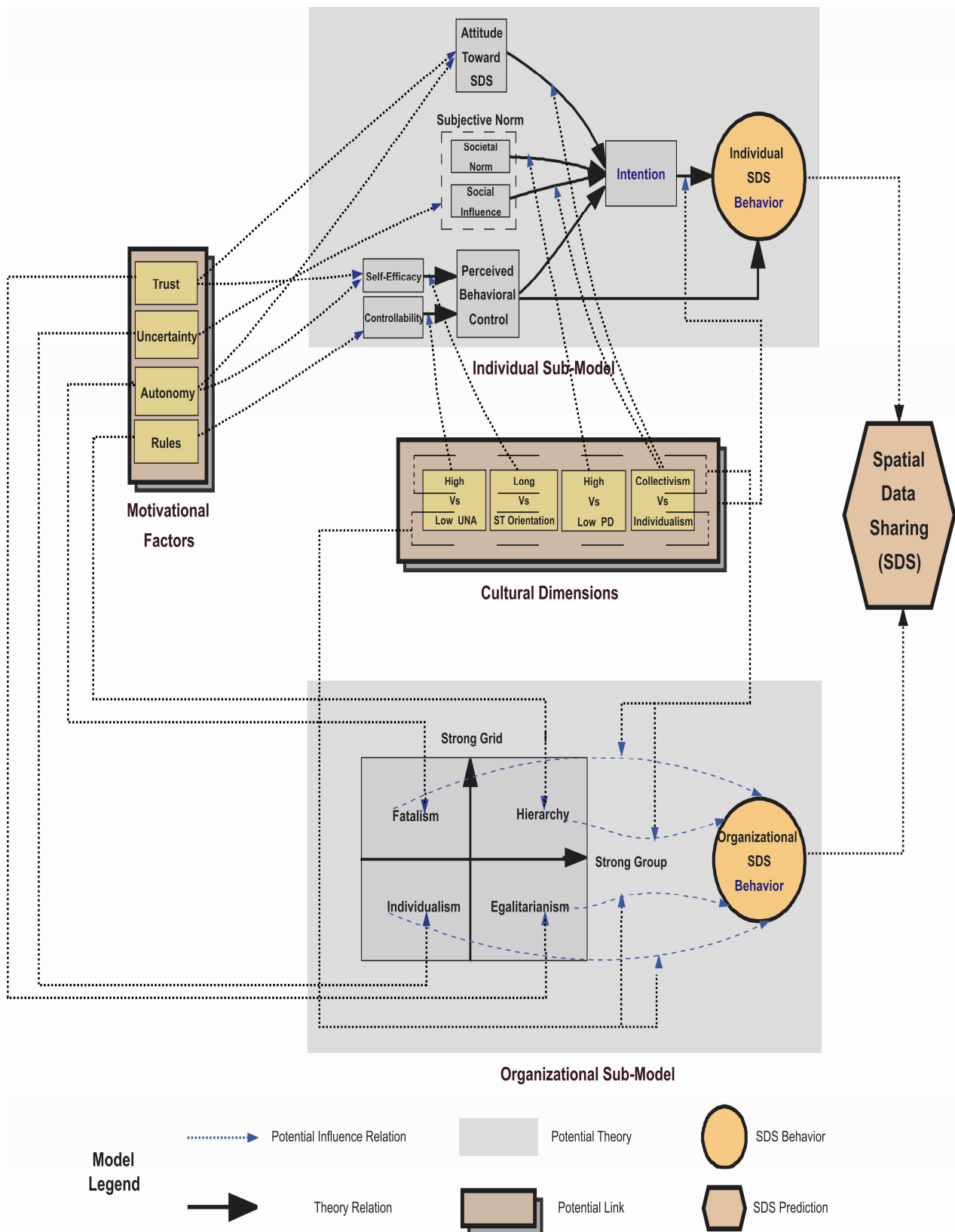
Figure 4.3 Revised spatial data sharing model.

Finally, there are some limitations for this model. The application of this theoretical approach to the issue of SDS has valid in the organizations conducted. This suggests that the model might also be applied in other cultures and organizations to understand the determinants of SDS among their organizations. This would provide useful input for the development of the SDI around the world. In addition, some cultural dimensions has valid in these organizations, however, others (e.g. masculinity/femininity) not supported and need more investigation. The role of incentives and resource scarcity is not supported and need more investigation.

4.6 CONCLUSIONS AND FUTURE RESEARCH

Spatial Data Sharing (SDS) is a crucial aspect of Spatial Data Infrastructures. This chapter test and validate the cross-cultural SDS model proposed by Omran et al. (2007a). The results present a quantitative test of the individual and organizational model as a starting point for the SDS research. The results show that the model is useful in understanding the individual and organizational behavior. The primary contribution of this research is that a set of interrelationships between important factors that tend to be associated with the individuals and organizational behaviors were specified.

The validation of the SDS model using the empirical data shows that the domains and the beliefs appear to have tapped the three concepts (attitude, social pressure and perceived control) as suggested by the SDS model. Also, many of the relationships between the variables are in the expected direction.

Culture plays an important role in shaping individual attitude and behavior. In different cultures, individuals and organizations behave differently under similar circumstance because of the differences in values and attitude. At the level of the three main components of individual model, attitude and social pressure are the most important factor in determining the current willingness to share in Egypt. The importance of perceived control could not be confirmed. However, in the Netherlands attitude and perceived behavior control play an important role in determining the current willingness to share.

The clearest effects of Hofstede dimensions on individual and organizational behavior that emerge from the study are the importance of individualism/collectivism, power distance and to some extent long term orientation and uncertainty. Adaptability of trust, autonomy, uncertainty and rules proves to be the most important motivational factors of individual and organizational behavior. This study provides substantial support for the validation of the model, but also focuses our attention the impact of culture and motivational factors on individual and organizational behavior.

The results suggest future topics for research. These include: understanding and assessing the relationships between the individual's beliefs (follow this model) and perceptions play in sharing spatial data. By mapping out the relationships between the individuals, the collective properties of SDS in organizations can be investigated. In addition, the role of masculinity/femininity, incentives and resource scarcity is not clear in the current study and need more investigation. Finally, apply the model in other cultures and organizations.

Chapter 5

Spatial Data Sharing: Applying Social Network Analysis to Individual and Collective Behavior

Omran, El.E., and Van Etten, J., 2007. Spatial data sharing: Applying social network analysis to study individual and collective behavior. International journal of Geographical Information Science, 21(6): 699-714.

5.1 INTRODUCTION

Spatial Data Infrastructures (SDIs) are now widely recognized as an important development for the organization, dissemination and use of spatial data. Such an infrastructure may be defined as a set of rules, standards, procedures, guidelines, instructions, policies and technology for creating, collecting, process, store, maintaining, exchanging, sharing, accessing and using spatial data (Crompvoets et al. 2004). Most nations recognize that developing an SDI is in their national interest and many of them make considerable investments in building SDIs (Rajabifard and Williamson 2004).

The building of SDIs has been accompanied by the appearance of bottlenecks in Spatial Data Sharing (SDS). Data sharing is a key component of SDI and is a basic condition for data access (Harvey and Tulloch 2006). We define Spatial Data Sharing as transactions in which individuals, organizations or parts of organizations obtain access from other individuals, organizations or parts of organizations to spatial data. These transactions may or may not include payment.

Most of the frameworks to analyze SDS mentioned in the literature derive from personal experiences with SDS and are not theoretically based (Calkins et al. 1991; Kevany 1995; Campbell and Masser 1995; Azad and Wiggins 1995; Craig 1995). Recently, more theoretically grounded frameworks have been proposed by Wehn de Montalvo (2001, 2003a,b), Nedovic-Budic et al. (2004) and Omran et al. (2007a). This line of work holds the promise of a more universal framework that can be applied cross-culturally (Omran et al. 2007a). While Wehn de Montalvo's work focuses mainly on factors related to individual behavior, this chapter argues that SDS can only be effectively explained if also collective or structural factors are included (see also Nevodic-Budic et al. 2004). Exchange of spatial data is an essentially social phenomenon, which always involves two or more parties. To examine the structural properties of SDS networks further conceptualization and research methods are needed. This chapter uses (Neo-Durkheimian) Cultural Theory to complement theoretical models of individual behavior. It uses Social Network Analysis as a set of methods to explore the network approach to SDS.

Thinking from a network perspective is a useful in this context to think about the collective properties that emerge from the distribution and direction of data flows between individuals or groups of individuals. Social Network Analysis focuses on how the configuration of networks enhances or constrains access to resources (Brass 1984; Ibarra 1993). The effectiveness of SDS may be influenced by the structure of the networks in which information flows. These flows may not be predictable if only individual behavior is understood. The whole is more than the sum of the parts. For instance, individual behavior of persons with a strong mediating role in the data flow may be more important than the behavior of others. Whether a person has such a role or not will depend on the overall structure of the network in which this person operates. Thus apart from information on individual behavior, insights in the structure of the network are needed to assess data flow and access in a given setting.

This chapter is methodologically innovative as to our best knowledge Social Network Analysis (SNA) has not yet been applied to SDS research. This chapter attempts to illustrate that Social Network Analysis is a powerful tool to understand the distribution of spatial data

and argues that it should play an important role in improving SDIs. The chapter introduces Social Network Analysis through an empirical study of a subdivision of one particular organization, the Egyptian Survey Authority (ESA) of Egypt. It will demonstrate the use of Social Network Analysis in this particular situation and how it complements the analysis of individual behavior. It attempts to answer the following questions. How do institutional factors and position shape individual beliefs and perceptions regarding SDS? What do the (potential) patterns of SDS tell about the institutional culture? How can Social Network Analysis be used to identify problems of SDS in an organization?

The chapter is organized as follows. In section 5.2 the theoretical framework and the research goals are introduced. In section 5.3, the methodology of this study is presented. In section 5.4, we present the results. Section 5.5 discusses the results. The concluding section 5.6 summarizes the main findings and implications for the investigated organization and outlines perspectives for future work on SDS using Social Network Analysis.

5.2 THEORETICAL BACKGROUND

Omran et al. (2007a) identified various theories that can be used in order to characterize individual and organizational behavior in relation to Spatial Data Sharing. The theories included the Theory of Planned Behavior, Cultural Theory, Hofstede's Cultural Dimensions. The selected theories are widely applied and tested with considerable proven explanatory and predictive value for the behavior of individuals and organizations. This chapter will make use of two of these theories: Theory of Planned Behavior (Ajzen 1991), and (Neo-Durkheimian) Cultural Theory (Douglas 1970; Thompson et al. 1990). The Theory of Planned Behavior has been introduced in the context of SDS before by Wehn de Montalvo (2003a,b) and Omran et al. (2007a). Cultural Theory has been used by De Vos (2007) to analyze GIS use for environmental applications in Costa Rica. Omran et al. (2007a) also used Cultural Theory to analyze SDS at the organizational level.

The Theory of Planned Behavior (TPB) asserts that specific salient beliefs about (potential) actions influence behavioral perceptions and subsequently actual behavior (Ajzen 1985, 1988, 1991). According to TPB, individual action is guided by three kinds of beliefs: behavioral, normative and control beliefs. Behavioral beliefs are beliefs about the likely consequences of a certain action. Normative beliefs are beliefs about the normative expectations of other individuals or groups about a certain action. Control beliefs are beliefs about the presence of factors that may facilitate or impede a certain action. These beliefs are specific to the behavior or action under consideration and not necessarily related to general behavioral dispositions (general attitude, personality). Therefore the theory stipulates that it is methodologically important to be as specific as possible about behavior.

The Theory of Planned Behavior represents a theoretical framework to map out the belief structures underlying intentional behavior. It is important to realize that the behavioral attention, normative, and control beliefs that people hold about a given behavior are influenced by a wide variety of cultural, personal, and situational factors. The Theory of Planned Behavior is most appropriate when "the person can decide at will to perform or not perform the behavior" (Ajzen 1991:182).

Sharing of spatial data requires the existence of relationships among individuals and organizations. Thus SDS behavior is strongly related to its particular social and cultural context. (Neo-Durkheimian) Cultural Theory sees institutional cultures not only as a combination of organizational features. Cultures involve personal beliefs which are needed to uphold these features and which are in turn shaped and sustained by the organizational context. Causality is circular in this reasoning (Douglas 1987).

Cultural Theory contends that not all combinations of beliefs and ways of organization are equally sustainable. Any organization or institutional setting has to make choices along two dimensions which are important with regards to organizational continuity; these two dimensions are social regulation and social integration (Douglas 1987; Thompson et al. 1990; 6 2005). Social regulation refers to the degree of individual freedom towards authority. In culture with strong social regulation, everyone has a well-defined place in his or her organization. Moving towards a weaker social regulation, dependence decreases whereas autonomy and competition open up. On the other hand, social integration refers to the degree to which individuals are member of groups or networks (bonding). It describes the social control exerted on the individual by the whole community. The more individuals are incorporated into bounded units, the more their choice is subject to group determination.

Cultural Theory can be used to formulate specific predictions about the patterns of SDS as they reflect the institutional culture of organizations; SDS is often not institutionalized as a separated domain in organizations. Equal access to data may be expected in situations with weak social regulation but strong integration (an egalitarian culture in the idiom of Cultural Theory). However, the theory also predicts that in such situations people will tend to be more reserved to exchange with agents outside the organization. In situations with weak regulation and weak integration (individualistic culture) spatial data will occur only on the basis of the mutual recognition of interest or on the basis of a parallel transfer of other resources. Individuals will strive to be well connected with various sources of data. In a situation in which both regulation and integration are strong (hierarchical), data exchange will be subject to rules and need to be authorized by higher-ranked individuals. Also, data exchange will follow the formal positions of individuals in the organization closely and individuals will tend to have fewer possibilities to negotiate about data exchange. Where integration is low but regulation is high, people will tend cultivate a culture of indifference, as most decisions are out of their control or even comprehension (fatalistic). This is a rational response when transactions costs are prohibitively high.

Thompson et al. (1990) indicate that the four cultures thus delineated are simultaneously present in any social context and in fact need each other to be functional (the requisite variety condition). The analyst should not only look at the relative strength of the cultures in a given situation but also to their interactions. From the above outline on different institutional cultures it may be concluded that with regards to SDS, an equilibrated mix of all the cultures may be the ideal situation. All four described cultures have advantages as well as disadvantages for efficient and correct data management in an organization.

6 et al. (2006) introduced Social Network Analysis in combination with Cultural Theory. They argue that visualizing structural characteristics of networks and comparing it with some sort of typology of networks can enrich the analysis of organizations. They connect network typologies especially with institutional factors using Cultural Theory. Thus

analysts may be able to read back from sociograms (pictures of networks) the causal forces that shaped a particular network, e.g. integration and regulation.

In this chapter, research on the properties of networks (to be interpreted with Cultural Theory) is combined with the investigation of variables related to individual behavior (following TPB) and perceptions in order to test the hypothesis that individual behavior is associated with aspects of the structure of networks. If Cultural Theory is right and individual beliefs are strongly shaped by their social context, they can be expected to be less unique than exponents of the Theory of Planned Behavior seem to believe (cf. Ajzen 1991:206-207). Cultural Theory and Social Network Analysis complements the Theory of Planned Behavior at this point and brings into focus patterns in individual beliefs which can be explained from the point of view of institutions and networks.

5.3 METHODOLOGY

5.3.1 Organization and Sample

A survey in the Egyptian Survey Authority (ESA) was done in the last quarter of 2005. ESA is executing the Egyptian Cadastral Information Management (ECIM) Project, which involves the management of spatial data. For this study, a comprehensive survey was done of all 29 ESA employees of the ECIM project and the head of ESA.

The ECIM project started in March 2002, and is being funded by the Ministry for Foreign Affairs of Finland to support the computerization of the cadastral system in Egypt. This project aims to improve the links between the land information system for cadastral services and the systems for land registration and taxation. The project involves ESA (project owner) and two other organizations. The Real Estate Publicity Department (REPD) of the Ministry of Justice is responsible for the juridical land registry. Real estate tax collection is the responsibility of the Real Estate Taxation Department (RETD) under the Ministry of Finance. The system that is managed within the ECIM Project consists of ESA's data and workflows, and the information exchange links between ESA's cadastral system, REPD's land registration system and RETD's land taxation system (Elrouby et al. 2005).

The ECIM Project has faced an enormous challenge in changing the analogue system into a digital system. The conditions of the analogue system and its data and work flows are very unclear; they vary from office to office and are continuously changing. Also, the relationship between ESA and REPD deteriorated in the course of the project between 2002 and 2005 (Elrouby et al. 2005). Many of the challenges to the ECIM Project have been caused by this lack of cooperation between the two institutions.

5.3.2 Questionnaire

We used a formal questionnaire for the survey among ESA personnel. The questionnaire consisted of two parts. The first part dealt with spatial data sharing relationships with other persons. All individuals within the project were asked to characterize their relationship with each other with the following question: "Do you go to [name] to ask for spatial data?" This

question was asked for all individuals in the project. The informants were then asked about persons outside the project or organization from whom they could obtain spatial data.

In the second part questions were asked about beliefs and perceptions regarding SDS. To measure beliefs and perceptions, informants had to answer ten questions which were grouped in five categories. The first three categories derive from TPB: 1) Perceived Benefit of SDS (Behavioral belief); 2) Confidence to Engage in SDS (Normative belief); 3) Perceived Control over SDS (Control belief). In addition to this, two other categories of questions enquired about general perceptions regarding SDS: 4) Perceived General Role of Trust in SDS; and 5) Perceived Institutional Constraints to SDS. The questions can be found in appendix 3.

Throughout the study, individuals are indicated with their initials or a letter-number code when they indicated to prefer to remain anonymous.

5.3.3 Data Analysis

The data about relationships between the respondents was analyzed using Social Network Analysis. This set of analytical techniques is based on the principles of graph theory (Scott 1991; Wasserman and Faust 1994). Graphs are networks consisting of nodes and (directed or undirected) edges. The relational data gathered in this study can easily be expressed as graphs. Actors are seen as nodes in the graph. Spatial data sharing is conceptualized as a type of relationship between individuals. Directed vertices go from the informant to the person mentioned by the informant as a potential source of spatial data for him or her (the data flow would go in the opposite direction).

Various measures of centrality were used. Borgatti (2005) indicates that the different centrality measures used in Social Network Analysis (degree, closeness, betweenness) make assumptions about the way in which resources flow through a social network. According to Borgatti, before being able to choose among different measures we need to answer questions about the flow mechanism (transfer or replication), about the replication process (parallel or serial), about the routing (directed or undirected) and the graph-theoretic trajectories (geodesics, paths, trails or walks). Spatial data are replicable resources. However, we may consider data requested by a certain network member as unique 'packages' that travel from a known source over a short (and often shortest) path, because the specificity of data requests will often make the data combination and format only fit for certain purposes defined by the receiver and not fit for other network members. Thus within an organization spatial data are generally not copied in the course of transmission (like e-mails or gossip), but only at the source. Also, the way in which the request itself travels, is important to consider for the speed of the delivery. When a request is known and approved by the data holder, information may travel directly to the receiver. But a request may take several steps to arrive at the place of the data holder. We may expect that generally such requests travel along the shortest possible paths, because the data user and other members of the network may know from the nature of the data request in which direction to send the request. Thus unlike other information flows (e-mails, gossip) spatial data sharing in a given organization may not be very different from the mechanisms of package delivery. Following Borgatti (2005) we conclude that the centrality measures are appropriate for this situation.

The Netdraw program was used to draw a sociogram (Borgatti 2002). A sociogram shows simultaneously individual and collective aspects of SDS. On the one hand, social networks result from individual decisions about SDS. On the other hand, they may be seen as deriving from the shared norms and rules for individual behavior in an organization, as they constrain individual decision making and the configuration of the network. Thus, network structures need both behavioral and institutional interpretation.

Group identification measures were based on block-based subgroup identification algorithm as implemented in UCINET 6.126 software package (Borgatti et al. 2002), applied to informants only (excluding persons outside the organization). Network measures followed the work of Burt (1992) and Ibarra (1993) and were calculated using the UCINET 6.126 package (Borgatti et al. 2002).

Table 5.1 indicates the different measures in this study, all referring to different kinds of centrality. Centrality implies control over resources because central individuals control the access of others to spatial data. This is measured with the In Degree variable. Central individuals, because of their greater connections to others, have more relationships to draw from in order to obtain resources and so are less dependent on any single individual. This is reflected in Out Degree. These two measures take into account individuals only one step removed from the individual under study. Closeness measures take into account the whole network and measure the closeness to and from different individuals for all other individuals. Some individuals may not be central because they are connected to many others, but because they are rather unique in connecting two otherwise unconnected parts of the organization. This effect is captured in the Betweenness variable.

Table 5.1 Summary of network measures and definitions (Borgatti et al. 2002).

Variable	Definition
In Degree	Number of directional links to the individual from other individuals (incoming links).
Out Degree	Number of directional links from the individual to other individuals (outgoing links).
In Closeness	Extent to which an individual can be reached by all the other individuals in the network. Measured as the sum of the reciprocal path distances from all others. A direct link is counted as 1.
Out Closeness	Extent to which an individual can reach all the other individuals in the network. Measured as the sum of the reciprocal path distances to all others. A direct link is counted as 1.
Betweenness	Number of times in which an individual falls between any other two individuals on the shortest path between those individuals.

Descriptive statistics and correlation coefficients between network variables and individuals' beliefs and perceptions were calculated using the statistical software package SPSS 12.0.1 (SPSS Inc. 2003). Belief and perception variables were all measured using two questions. Internal consistencies (Cronbach's alpha) of all belief and perception variables ranged between 0.84 and 0.88 and were thus considered acceptable for the analysis.

5.4 RESULTS

5.4.1 Network Configuration and Subgroups

Figure 5.1 gives the network configuration for the ECIM Project workers, identifying the three subgroups. These three groups correspond neatly to three levels of management in the project. The two project leaders are in Subgroup I. A group of intermediate team leaders form Subgroup II. A Subgroup III is formed by the lowest level of workers.

Although some horizontal links between peers from all the hierarchical levels are present (8 ties or 12%), it is clear that most SDS occurs in a vertical way, between superiors and their subordinates in the organization (61 ties or 88%). Saturation for these vertical links is much less in the low-ranking Subgroup III (4 out of 306 possible links) than in the intermediate-ranking Subgroup II (3 out of 30 possible links), while the high-ranking Subgroup I has full saturation for horizontal links. It is remarkable that the horizontal links are not reciprocal – with the exception of the horizontal link in Subgroup I, while the vertical links are almost without exception reciprocal. This may indicate the relative weakness of existing horizontal linkages in the lower rungs. The dominance of vertical links in number and probably also in strength makes lower-ranking individuals more isolated than higher-ranking individuals.

Links with persons from outside the project are not plotted in Figure 5.1. Four persons outside the project were mentioned as sources of spatial data, including the director of the organization, and three persons from the collaborating institutions. Only the two persons from Subgroup I, the project leaders, mentioned persons outside the project. ES mentioned four persons, while IK mentioned two persons who were both also mentioned by ES.

5.4.2 Network Variables

The centrality measures applied in this study are presented in Table 5.2 and compared by the following.

In Degree. The variable In Degree closely follows the grouping of the project workers. In Degree is high for the leaders and lowest for the subordinates. These are sharply distinguished subgroups; no overlaps in the In Degree values exist between the subgroups.

Out Degree. Out Degree shows the same pattern with one minor change. There is a difference between the two project leaders, ES having a higher Out Degree (9) than IK (5). The former is Egyptian, while the latter is an expert worker. The latter's level of Out Degree is similar to that of the intermediate managers.
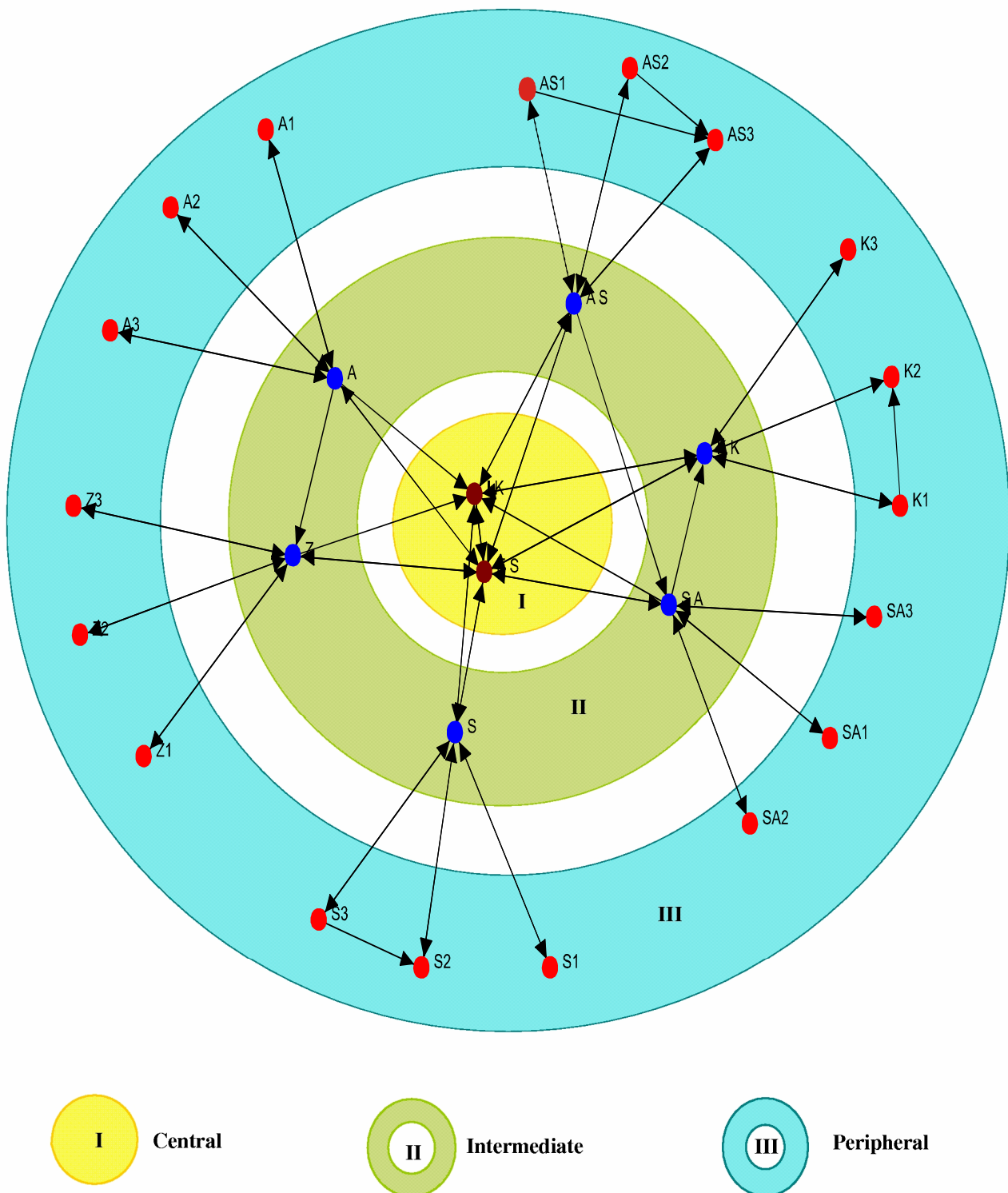
Figure 5.1 Sociogram identified three subgroups of spatial data sharing in the Egyptian cadastral information management project.

The Out Degree variable is of course highly influenced by differences in reporting by the informants (depending on individual inclinations towards self promotion), in contrast with In Degree which depends on the aggregated responses of others. Thus In Degreee may be expected to be generally more reliable as a measure of centrality than Out Degree. Even so, it is interesting to see that ES reports more connections than IK both inside the organization (Figure 5.1) and outside the organization (see section 5.4.1).

In closeness. The variable In Closeness follows a pattern similar to that of In Degree; central individuals are also closer on average to other individuals in the network. Relative differences are less marked for this variable than for the Degree and Betweenness variables.

Table 5.2 Network measures per actor and descriptive statistics for the whole network. Dotted lines refer to the three subgroups identified above (Figure 5.1) plus individuals outside the organization.

Group	Informant	In Degree	Out Degree	In Closeness	Out Closeness	Between-ness
I. Central	ES	11	9	62	28	56
	IK	9	5	59	25	16
II. Intermediate	KK	6	5	45	23	19
	Z	5	5	45	23	19
	SA	5	6	45	24	20
	S	5	5	43	23	19
	AS	5	6	43	24	19
	A	4	6	42	24	19
III. Peripheral	A1	1	1	30	20	0
	A2	1	1	30	20	0
	A3	1	1	30	20	0
	AS1	1	2	30	20	0
	AS2	1	2	30	20	0
	AS3	3	1	31	20	0
	K1	1	2	32	19	0
	K2	2	1	32	19	0
	K3	1	1	32	19	0
	S1	1	1	30	19	0
	S2	2	1	31	19	0
	S3	1	2	30	19	0
	SA1	1	1	31	22	0
	SA2	1	1	31	20	0
	SA3	1	1	31	20	0
	Z1	1	1	31	19	0
	Z2	1	1	31	19	0
	Z3	1	1	31	19	0
Head of org.	NH	2	2	39	22	0
From collaborating ministries	EH	1	1	31	20	0
	RM	0	2	3	28	0
	EE	0	1	3	28	0
Mean		3	3	34	22	6
Std Dev		3	2	12	3	12
Sum		75	75	1021	649	188
Minimum		0	1	3	19	0
Maximum		11	9	62	28	56

Out closeness. The variable Out Closeness follows a pattern similar to that of Out Degree; the difference between In closeness and Out Closeness is parallel to the difference between In Degree and Out Degree. There is not much contrast between the higher and lower values for this variable, like for In Closeness.

Betweenness. The variable Betweenness exhibits a general pattern similar to the other variables. Betweenness is high for central individuals, who have high Degree values and low Closeness values. The values clearly separate between the intermediate group with intermediate values, and the lower group; in the latter group all except one having no Betweenness at all. The only contrast with the other variables is that the Betweenness of IK, otherwise a central person in the network, is very low. He mentioned fewer sources than ES, even though he is mentioned as a source by others. This has a disproportionate effect on his Betweenness, which indicates his role as a potential broker of information. In contrast, data sharing with ES concerns mostly reciprocal ties and this makes his value as a potential controller of information and as a broker higher. This makes the network very centralized, as most data flows will need ES as a broker.

5.4.3 Individuals' Beliefs about and Perceptions of Spatial Data Sharing

Table 5.3 is a summary of the personal beliefs about and perceptions of SDS as indicated by the informants. The ratings can vary between 1 and 7, 4 being the neutral middle value. None of the values was on average lower than 4. The values for Confidence to Engage in SDS, Perceived Benefit of SDS and Perceived Institutional Constraints to SDS are all more than 0.5 higher than the neutral value 4. Only Perceived Institutional Constraints to SDS is a variable that is more than 1.0 higher than the neutral value of 4. This indicates that informants highlighted institutional constraints as one of the most important factors in their behavior regarding SDS.

Given that all variables except one show rather neutral averages, the distribution of the values over the individuals may be important to consider. The averages split out per subgroup in the organization in Table 5.3 indicate that there are gradual tendencies between the groups for all the variables. The variables were subjected to ANOVA to compare averages between subgroups (Table 5.3). Differences between subgroups were significant for all except one variable, Confidence to Engage in SDS. Table 5.3 makes clear that there is more variation among the answers in the peripheral group for all variables, except for the perceived institutional constraints, which most members of the peripheral group deemed to be severe.

In addition, variables regarding beliefs and perceptions were correlated with selected network variables (Table 5.4; compare Table 5.3). The results indicate positive relations between all variables except the relations with one variable, Perceived Institutional Constraints to SDS. Thus people higher in the organization tend to have more confidence to engage in SDS, are more aware of its benefits, are more motivated to engage in SDS and feel they have more control over SDS than persons lower in the organization. On the other hand, people lower in the organization perceive more institutional constraints to SDS.

Table 5.3 Beliefs about and perceptions of spatial data sharing (SDS).

Group	Informant	Perceived Benefit of SDS	Confidence to Engage in SDS	Perceived Control over SDS	Positive Role of trust in SDS	Perceived Institutional Constraints to SDS
I. Central	ES	6.5	6.0	7.0	6.5	2.0
	IK	7.0	6.5	6.0	7.0	3.0
II. Intermediate	KK	6.5	5.0	6.5	6.0	4.0
	Z	6.0	7.0	5.0	5.0	5.0
	SA	7.0	3.0	6.0	6.0	7.0
	S	6.5	6.0	4.0	6.5	6.0
	AS	6.0	4.0	5.0	6.0	5.0
	A	7.0	5.0	6.5	5.0	4.0
III. Peripheral	A1	7.0	4.0	1.0	1.0	6.0
	A2	3.0	5.0	1.0	3.0	7.0
	A3	5.0	6.0	3.0	5.0	6.0
	AS1	7.0	6.0	3.0	1.0	7.0
	AS2	2.0	3.0	4.0	4.0	6.0
	AS3	2.0	6.0	1.0	1.0	7.0
	K1	4.0	7.0	6.0	5.0	7.0
	K2	5.0	3.0	2.0	6.0	7.0
	K3	3.0	5.0	6.5	1.0	7.0
	S1	3.0	2.0	3.0	5.0	6.0
	S2	6.5	1.0	1.0	7.0	7.0
	S3	1.0	3.0	2.0	5.0	6.0
	SA1	4.0	4.0	3.0	2.0	7.0
	SA2	7.0	1.0	5.0	6.0	5.0
	SA3	3.0	5.0	3.0	5.0	6.0
	Z1	6.0	4.0	6.0	3.0	5.0
	Z2	3.0	5.0	5.0	5.0	7.0
	Z3	1.0	6.0	3.0	5.0	6.0
Head of org.	NH	6.0	6.0	3.0	2.0	5.0
Average	Overall	4.9	4.6	4.0	4.4	5.8
	Central	6.8	6.3	6.5	6.8	2.5
	Intermediate	6.5	5.0	5.5	5.8	5.2
	Peripheral	4.0	4.2	3.3	3.9	6.4
St. deviation	Overall	2.0	1.7	1.9	2.0	1.3
	Central	0.4	0.4	0.7	0.4	0.7
	Intermediate	0.4	1.4	1.0	0.6	1.2
	Peripheral	2.0	1.8	1.8	2.0	0.7
ANOVA*	p=	0.01	0.2	0.005	0.02	$4 \cdot 10^{-6}$

* Testing for differences in average between subgroups I, II, and III.

The strength of the correlations is interesting to consider in relation to the variable Formal Position to evaluate whether network measurements give any extra information. Correlations of belief/perception variables with the different network variables are not very different from the correlations with the variable Formal Position (ranked from 1 to 3). Closeness shows a higher correlation than Formal Position as an explanation for Motivation to Engage in SDS and as an explanation for Control over SDS. Thus Closeness may contain some extra information that is not already contained in the variable Formal Position. A better brokerage position of individuals with equally ranked formal positions is associated with a higher motivation to share spatial data and a more positive perception of control over the process.

Table 5.4 Spearman rank correlation coefficients between selected network variables, formal position and belief/perception variables.

Variables	Perceived benefit of SDS	Confidence to engage in SDS	Perceived control over SDS	Positive role of trust in SDS	Perceived institutional constraints to SDS
In Degree	0.38	0.35	0.37	0.40	-0.12
Closeness	0.25	0.32	0.68	0.46	-0.14
Flow Betweenness	0.35	0.44	0.47	0.27	-0.25
Formal Position	0.36	0.44	0.61	0.35	-0.24

5.5 DISCUSSION

From the results it has become clear that the relationships through which the workers of the ECIM Project share their data corresponds in a high degree to the formal hierarchy of work relationships in the organization. The formal position predicts the network position of individuals and their potential access to spatial data well. The informal network of data sharing in this organization is very weakly articulated. The survey results reveal that most data flows are vertical, between superiors and subordinates, with few horizontal flows between peers. As a consequence of the hierarchical nature of SDS, information flows between individuals in the organization or different teams need to be mediated by the central individuals.

From this network configuration, it could be predicted that serious constraints to SDS exist in this organization. It would also be logical that these constraints are most severe for the workers who are lower in the organization (Subgroup III), because they are in the periphery of the networks having long paths to other individuals. The answers to the questions about beliefs about and perceptions of SDS confirm this hypothesis. The most outspoken answers are given to the questions related to institutional constraints on SDS. People lower in the organization indeed attach more importance to the bureaucratic constraints on SDS than people higher in the organization. The project leaders deem the importance of institutional constraints to SDS less than any project worker. The responses about constraints had very little variation among the lower ranked individuals, in contrast to answers to other questions.

The significantly different answers of individuals from different formal positions and positions in the identified SDS network indicate that simply taking averages for different beliefs/perceptions for the whole organization would be little informative; the broader structure (or network configuration) needs to be considered to interpret these survey results. While the Theory of Planned Behavior gives an account of how people's preferences may translate into behavior, Cultural Theory offers conceptual resources to analyze people's preferences as formed by their social relations.

Interpreting the results with Cultural Theory, it is obvious that the project organization as a whole tends heavily towards a hierarchical structure. Central individuals in the network are also those with the highest ranking formal position and with most responsibility. These individuals have positive views of their organization; bureaucracy does

not seem to undermine SDS to them and they are generally confident and motivated to share spatial data. However, people lower in the project organization tend to feel more institutional constraints. Indeed, they have few horizontal links; establishing horizontal links, especially across different hierarchical levels and divisions is probably too costly to them. This is in line with the fact that they do not perceive much benefit from SDS. In summary, they tend to a fatalist orientation (also called 'atomized subordination' in the Cultural Theory literature, which indicates the aspect of social isolation). This is also in line with the finding that these individuals are less motivated or confident about SDS and do not feel they are in control. Also the high variation in the answers of lower-ranking individuals (Subgroup III) with regards to these latter questions may evince some of the indifference of fatalists.

It may be argued in the current case that the variable Formal Position of individuals would form enough background information to establish that different subgroups have different beliefs about and perceptions of SDS. However, the results suggest that in a number of cases the variable Closeness may be actually a better predictor of real power in the network (irrespective of the formal position of individuals in the project), as it showed a stronger correlation with the variable Control over SDS than Formal Position. Also, the role of Formal Position may be less important in organizations where informal networks are stronger. Their virtual absence is rather remarkable in the described case and could be established here using Social Network Analysis.

5.6 CONCLUSIONS AND FUTURE RESEARCH

It may be concluded that the ECIM Project may be seen as a combination of cultures in which hierarchy and fatalism dominate. Hierarchies tend to be more preoccupied with legitimacy than with how the job should be done. Fatalists are a product of hierarchies as they are excluded from control. Hierarchies may be conducive for the creation of clear rules about data exchange (Omran et al. 2006). However, the emphasis on legitimacy and authority in the ECIM Project may be unbalanced and little conducive for SDS.

From the empirical results presented in this article the authors formulate the tentative conclusion that the real challenge to improve SDS in the ECIM would only occur if the hierarchical trend would be counterbalanced by creating possibilities for horizontal data flows between units without the necessity of gaining the approval of superiors. At present, information flows with other organizations are always taking place between project leaders. This may reinforce the problems of cooperation between the various institutions around the ECIM Project.

In practical terms, it is reasonable to think that especially establishing more institutional possibilities for team leaders (the intermediate Subgroup II) to exchange information among themselves and with other outside the organization would bring much improvement. In contrast, the leaders of this project should avoid choosing 'awareness raising' about the benefits of SDS as a solution in this situation. This would not change the existing situation in which workers from the lower rungs of the organization have little control over SDS and might reinforce possible stereotypes of apathy.

Change will need to come from above, through redefining the rules about spatial data sharing and transferring more responsibility to the lower ranked individuals. However, to do

this the project leaders will have to develop reflexivity about the culture of their organization. It can be anticipated that from a hierarchical mindset, the leaders will adhere to the necessity of having rules, given the negative attitude of their subordinates.

From this particular case also methodological insights can be drawn. The chapter has outlined an approach to the individual and collective characteristics of Spatial Data Sharing (SDS) by introducing Social Network Analysis as a method and using Theory of Planned Behavior and Cultural Theory to interpret the individual and collective dynamics. The article illustrates that Social Network Analysis offers visual and numeric methods which may give a deeper understanding of SDS. The methods used offered the possibility to investigate collective behavior with an 'individualist' method, e.g. the application of a survey to individuals. Using this methodology useful hypothesis can be formulated about the organization.

The current study is a first step in a diagnostic study of SDS. The method itself offers interesting perspectives for expansion using digital technologies (web surveys, analysis of SDS networks based on actual, digitally recorded data exchange transactions). In the future, work in this direction could include topic such as the study of individual and organizational change behavior to share data. In addition, comparative work on various organizations or to investigate SDS between different organizations is important. Also, more in-depth investigation into the collective aspects of SDS would need to be done using more intensive, ethnographic methods, like focus groups or participant observation. Some more focused questions about the nature of SDS in the organization investigated could be formulated on basis of the results presented in this article. Also, a confrontation with the sociogram and the results on beliefs could spark fruitful debate. Finally, research on data flows could be complemented by an analysis of tasks and data needs (and possible sources in the organization). The analysis applied does not distinguish between different types of information which may be held by particular persons in the network. Complex interactions may exist between information type, network structure, and individual behavior, which were not explored in the present study. Future studies with a more complex research design could follow up on this important aspect.

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Chapter 6

Spatial Data Sharing: Assessment of Planned Individual and Organizational Change

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6.1 INTRODUCTION

Spatial Data Sharing (SDS) is a key component of Spatial Data Infrastructure (SDI) and is a basic condition for data access (Crompvoets et al. 2004; Harvey and Tulloch 2006). However, spatial data sharing is generally considered as problematic. Obermeyer and Pinto (1994); Warnecke et al. (1998); Nedovic-Budic et al. (2004); and Harvey and Tulloch (2006) highlighted the difficulties of SDS between and within organizations. Omran et al. (2007a) indicated that the failure rate in SDS relationships that fail to meet their founders' expectations is approximately 50 percent. Organizations continue to form SDS relationships and as a result failures are expected to continue or even increase (Miles and Snow 1992).

The questions arises are: Why so many spatial data sharing initiatives fail or cannot be sustained? Why some people fail to carry out the behavior they have formed? People say they will do one thing (share data) yet they do something else. When asked to explain why they fail to act on their behaviors, people often mention that they simply forgot or that it slipped their minds (Orbell et al. 1997; Sheeran and Orbell 1999). Individual's behavior in terms of belief and thinking are man-made (created by humans) and can be changed. One of the key aspects of change behavior towards SDS should begin with changing intention. People's intention and belief can be changed through communication (Petty 1981; Kleinke 1984). Bate (1982) offers a possible way to introduce the change. Perhaps the initial step for the change individual intention would be to attempt to change the individual mind. No effective change can be implemented without first a change in mindset. The taken-for-granted meanings that individual share and collectively maintain inhibit the SDS change behavior. Changing individual and organizational behavior could be the key to improve spatial data sharing. The present study could provide such an initial step.

An accurate measurement method of behavior change is crucial (Terborg et al. 1980). Golembiewski et al. (1976) proposed a typology labeled Alpha, Beta, and Gamma change which is designed to measure three different types of change behavior. For now, and subject to more details later, Alpha change is a simple shift in assessment from state A to state B. Beta change is a shift in the respondent's metric. Gamma change is a respondent's subjective redefinition of the construct. Measurement of the three types of changes has drawn much interest (Lindell and Drexler 1979, 1980; Bedeian et al. 1980; Golembiewski and Billingsley 1980; Terborg et al. 1980; Armenakis and Bedeian 1982; Armenakis et al. 1982a, b; Randolph 1982; Schmitt 1982; Terborg et al. 1982) but SDI researchers do not applying any of the proposed techniques to SDS projects.

This chapter is methodologically innovative as to our best knowledge change behavior has not yet been applied to SDS research. This chapter represents a first attempts to show that change behavior is a crucial aspect to have spatial data sharing in reality and argues that it should play an important role in improving SDIs. The chapter introduces SDS change behavior through an empirical study of a subdivision of one particular organization, the Egyptian Survey Authority (ESA) of Egypt. The behavior change methodology was applied through the intervention to the first line managers (supervisors) in the ESA. The aim of the intervention is to help the participants to be more aware of the SDS behaviors and to change of participants' beliefs and behaviors. If the intention of the key individuals inside the organizations towards SDS is changed, then the organizational outcome will be improved.

The purposes of this chapter are to assess the effects of the intervention on SDS change behavior and determine the types of SDS change behavior that occurred at the individual and organizational level.

This research helps to make the individuals and organizations more willing to share data. The results can be used to re-focus decision-making attention on how leadership behaviors affect individual and group access to data that are at the heart of how SDS flows. Managers have means of assessing the effects of the social fabric of the organization on spatial data flow. This study prepares a sound ground work for effective change SDS behavior which might serve the data needs for decision-makers and this aid in the development of SDIs at all levels.

The chapter is organized as follows. In the next section the concepts and background are introduced. In section 6.3, the methodology used to determine the effect of change behavior is presented. In the fourth section, the results are presented. Section 6.5 discusses the results. The concluding section 6.6 summarizes the main findings and outlines perspectives for future work.

6.2 CONCEPTS AND BACKGROUND

The first purpose of this chapter is to assess the effects of the intervention on SDS change behavior. Attitude theory suggests that individual's attitude and behavior can be changed through communication and persuasion (Petty 1981; Kleinke 1984). Goodman and Dean (1982) and Tannenbaum (1971) argue that the organization can change only when individual's behavior changes. Beliefs are the basic determinants for any behavior and, therefore, change in behavior is brought about by effecting changes in beliefs (Ajzen 1985, 1988, 1991). Omran et al. (2007a) propose and use the Theory of Planned Behavior (TPB) in order to understand and analyze spatial data sharing behavior at the individual level. Also Wehn de Montalvo (2003) used TPB as a framework to model of the willingness of organizations to engage in SDS. TPB represents a framework to map out the belief underlying intentional behavior. TPB emphasizes that specific beliefs about (potential) actions influence behavioral perceptions and subsequently actual behavior (Ajzen 1985, 1988, 1991). According to TPB, individual intention is guided by three kinds of beliefs: attitude, normative and control beliefs. Attitudinal beliefs are beliefs about the likely consequences of a certain action. Normative beliefs are beliefs about the normative expectations of other individuals or groups about a certain action. Control beliefs are beliefs about the presence of factors that may facilitate or impede a certain action. TPB is most appropriate when "the person can decide at will to perform or not perform the behavior" (Ajzen 1991:182).

A very effective mean for change beliefs is to prompt people to form an implementation intention (Gollwitzer 1999). Informing people about how the data are used in the cooperation, and how they are not used at the individual level, are vital to persuading individuals change to share data. That knowledge plays a central role in shaping behavioral change. We should be able to change behavior if we consider not only intention but also the degree to which an individual actually has control over performing the behavior. TPB stipulates that it is methodologically important to be as specific as possible about behavior (Omran and Van Etten 2007). Combine the attitudes, perceived norms and control in making the change are

expected to have better results. So, one should convince people to change their intention by giving a lot of attention to attitudes, subjective norms and perceived behavior control (Omran et al. 2007a).

Recall that the second purpose of this chapter is to determine the types of SDS change behavior that occurred. The question arise is how to measure the individual behavior change? Golembiewski et al. (1976) propose the three kinds of changes (Alpha, Beta, and Gamma) that can be used in order to measure behavior change. Alpha change is a shift in assessment from, say, "agree" at state A (before the intervention) to "strongly agree" at state B (after the intervention). Alpha change (the type normally assumed for change situations) involves no re-conceptualization or shift in standard. Changes in responses reflect accurately changes in reality. For instance, a parent taking a baby to the shoe store is interested in alpha change. His frame of reference is growth in baby's feet between this visit and the proceeding one. The crucial measurement of change occurs within a relatively fixed system of stable dimensions (length and width) of reality as defined by indicators whose intervals are more or less constant (the calibrated marks on the measuring rod against which the baby's foot is compared), Golembiewski et al. (1976). From the organizational change context, alpha change can be happened if the individual's beliefs to share data change (shift in beliefs).

Beta change is a shift in the respondent's metric. There is a change in distance between scales from state A to state B. Some intervals of the measurement scale have been recalibrated. For example, a parent could not know how much a child's feet had grown between visits to the shoe store. It would not be meaningful to compare the two measurements because the intervals on the measuring rod had somehow changed. A beta change on a rod for measuring feet is not very likely although such rods do expand and contract some even as their conceptual definition remains the same (Golembiewski et al. 1976). In SDS domain, a change in individuals' cognitions could occur, not in definitions of reality, but in standards used to assess the behavior (shift in standards). Judgments used to rate the behavior could change when one gets a better idea of the importance of behavior (awareness). So, one might feel that participation is used to a medium degree when he/she is unaware of what exactly the behavior is all about (before intervention). After awareness sets in, then assessment of the exact behavior might well switch. This would be beta change.

In Gamma change respondents subjectively redefine the construct. Gamma change is consistent with what the literature frequently terms second-order change (Levy and Merry 1986; Phillips and Duran 1992). Gamma change involves a redefinition or re-conceptualization of the behavior domain. Consider the three states of H_2O, which are a function of temperature (figure 6.1). Considering the condition of temperature only, H_2O has two major properties: 1) H_2O will remain in one of the three states of solid, liquid, or gas over a considerable temperature range induced by a substantial gain (or loss) of calories; and 2) H_2O in each of its three forms can continue over a substantial range of conditions without a change in state. At three critical temperatures (critical points), the addition or subtraction of a specific number of calories will induce a change (discontinuously jumps to different state) in the state of H_2O with little or no effect on its condition as measured by temperature. The larger distance from A to B is associated with a major condition (alpha or beta) change but no (gamma) change in state. In contrast, the smaller distance from C to D represents a minor change in condition but induces a major change in state. Gamma change occur (in the

organizational change context) when new beliefs and attitudes about spatial data sharing that did not exist previously in the individual's behavior are added to the individual mind.
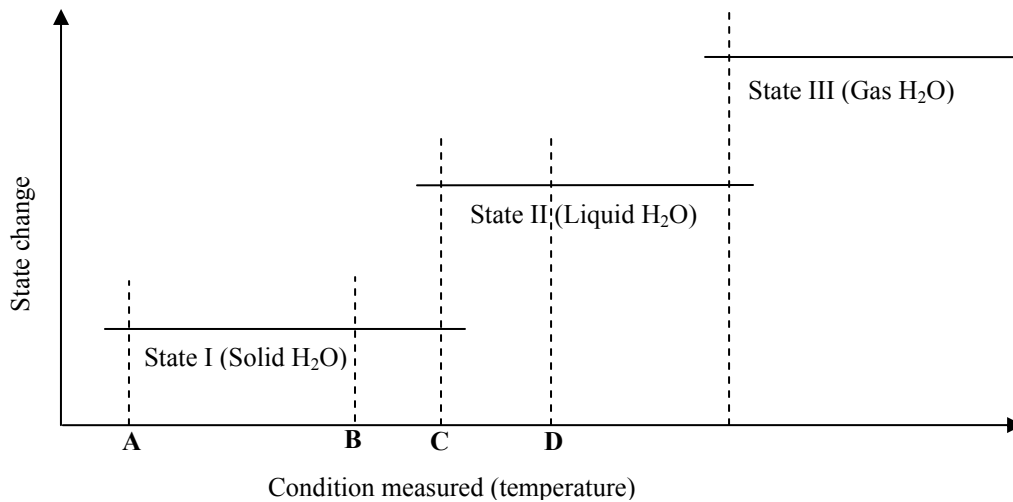
Figure 6.1 An illustration of changes in condition and state (Golembiewski et al. 1976).

Another example illustrates the distinctions between alpha, beta, and gamma (Golembiewski et al. 1976). A person having a nightmare can do many things in his dream, run, fight, cry, jump off a cliff, etc. but no change from any one of these behaviors to another would ever terminate the nightmare. These many changes within the system are alpha changes (occurs within a given system which itself remains unchanged). However, the one way out of a dream involves a change from dreaming to waking…. a change to a different state. This illustrates gamma change (changes the system itself). Via dream analysis, a person might learn that returning dream-state is more useful than scary. An individual might stay in the dream-state yet change his reaction to it. This is the sense of beta change. By definition, beta and alpha change preclude the occurrence of a redefinition of the concepts measured that is, gamma change. Thus beta and alpha change cannot be empirically measured if gamma change can be demonstrated (Bedeian et al. 1980; Armenakis and Bedeian 1982; Armenakis et al. 1982a,b; Randolph 1982; Schmitt 1982; Terborg et al. 1982). The absence of gamma change is a necessary for measuring the other kinds of change.

Finally, in this chapter, research on SDS change behavior, alpha, beta, and gamma, (to be interpreted with motivation control theory) is combined with the investigation of variables related to individual behavior (following theory of planned behavior), and perceptions in order to test the hypothesis that change of SDS behavior is associated with aspects of the individual's beliefs.

6.3 METHODOLOGY

The research strategy adopted in this chapter is based on the representation of individuals as indicators of organizational behavior. Staw (1991) recommended that psychological theories that examine behavior at the individual level can be used to understand action at the organizational level "...because it is possible to identify key actors in organizational decisions, psychological research can be applied to these individuals in order to explain organizational actions". According to Staw, the approach is to examine the key organizational decision-makers. These key decision-makers may be assumed to have an accurate understanding of their organization's position (Elliott et al. 1995) toward spatial data sharing and their change behaviors may be the best indicator of their organizational behavior change. In this way, the situation can be expanded to a larger community (Markus and Robey 1988). In addition, the research based on the concepts developed within actor-network theory (see e.g. Latour 1987; Callon 1991; Law and Hassard 1999) focusing on the negotiations and interactions among, and the motivations of, a small set of actors (Wehn de Montalvo 2003a,b). Using this argument it is reasonable to suggest that the research findings can be generalized to other organizations.

6.3.1 Organization and Sample

A survey in the Egyptian Survey Authority (ESA) was done in 2006. ESA is executing the Egyptian Cadastral Information Management (ECIM) Project, which involves the management of spatial data. The project aims to improve the links between the land information system for cadastral services and land registration and taxation systems (Omran et al. 2007a). The system that is managed within the ECIM Project consists of ESA's data and workflows. The spatial data exchange links between ESA's cadastral system, REPD's (the Real Estate Publicity Department) land registration system and RETD's (the Real Estate Taxation Department) land taxation system (Elrouby et al. 2005).

The relationship between ESA and REPD deteriorated in the course of the project between 2002 and 2005 (Elrouby et al. 2005). Many of the challenges to the ECIM Project have been caused by this lack of cooperation between the two institutions. Omran and Van Etten (2007) argue that ECIM Project share their data corresponds in a high degree to the formal hierarchy of work relationships in the organization. Most data flows are vertical, between superiors and subordinates. As a consequence of the hierarchical mindset of the project leaders, SDS flows between individuals in the project are problematic.

Sixteen supervisors from ESA participated in the SDS change behavior and formed the intervention group in this study. Seven other supervisors from other similar project in the same organization were used as controls. These control groups are used for comparison only and not attend the intervention.

6.3.2 Intervention Process

Figure 6.2 depicts the framework setting of the planned individual change process. Its assumption is that an individual behavior change toward SDS comprises six major factors: attitude, social influence, societal norm, individuals own capabilities (self-efficacy), individual's confidence to perform data sharing (controllability) and intention (Omran et al. 2007a,b). The six behaviors are connected to the main key factors (attitude, intention, subjective norm and perceived behavior control) of the TPB. These factor influences SDS behavior by their effects on behavioral, normative, and control beliefs. These factors shape and guide the individual behavior toward SDS. If changed, these factors can induce change in individual behavior. Intervention activities are designed and implemented to change the individual behavior through these factors. From a methodological perspective, individual change behavior toward SDS must be the primary focus of the intervention activities.
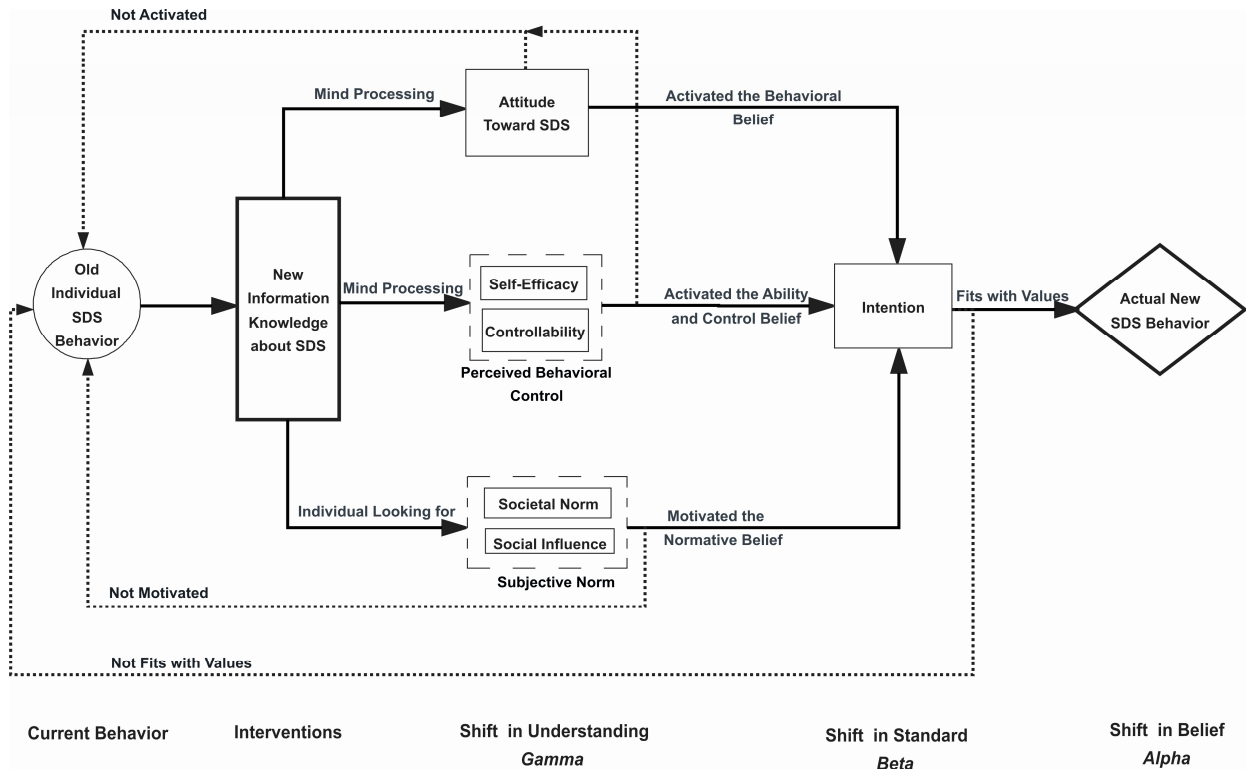
Figure 6.2 Framework setting of the planned individual change process.

The six behaviors targeted for change are implemented in 3 weeks intervention. The intervention consists of workshops, oral presentations, discussion groups, and poster presentations. The intervention is applied to the first line managers (supervisors) in the Egyptian Survey Authority (ESA). The intervention objectives are: to enhance respondents' understanding of SDS concepts, to help the participants to be more aware of the SDS behaviors, and to change of participants' beliefs and behaviors. SDS behavior change of each first line supervisor is assessed by his immediate subordinates (Porras et al. 1982).

The question now is the individual motivated to engage in spatial data sharing? The answer depends on whether individuals' attitudes are activated or not. For instance, a motivated individual may think about what the attitude toward SDS fits with beliefs and values in his or her mind. If the individual is not motivated, the individual's intention will shift to the old behavior. Individual motivation is determined by knowledge. Individual who have limited information regarding SDS will not be able to make as many comparisons between the new information and the content of their knowledge.

The motivational aspects of change may be explained by motivation control theory (Hyland 1988; Klein 1989). In brief, motivation control theory suggests that people first compare their present performance with that of some standard and then initiate behaviors to correct deficiencies between the current and intended performance. For the attitude to be effective, it needs to be based on new correct information (beliefs and values). In the absence of correct information, people will look to others in their environment (subjective norm) to determine if their beliefs and values are appropriate. Beliefs and values provide the background knowledge used by individual to form an overall evaluation of attitude (Thomson and Hunt 1996). Once people have an attitude (behavioral belief) and ability (control belief) that has substantial support (in the form of beliefs), they may begin to use this attitude and ability (perceived control) to change his or her behavior. According to motivation control theory, if the individual has the motivation and the ability to process the information, he or she change their behavior and engages in activity.

Once formed, attitudes toward a behavior can work backwards to influence the formation of new behavioral beliefs. That is, existing attitudes can bias perception and interpretation of new spatial data sharing and thus, influence the formation of new behavioral beliefs (see McGuire and McGuire 1991). The same may be true for subjective norms feeding back on normative beliefs, and for existing perceptions of control influencing formation of new control beliefs.

6.3.3 Questionnaire

Questionnaires for the survey among ESA personnel were used. Questionnaires focuses on the six specific behaviors (attitude, social influence, societal norm, self-efficacy, controllability and intention) targeted for change (Omran et al. 2007a,b). To measure individuals' beliefs and behaviors, participants had to answer 18 questions (every behavior measured by 3 statements) which describe the six behaviors. Key individuals are asked to place their answer on a 7- point Likert scale (1= strongly disagree; 7= strongly agree). The questions can be found in Appendix 4.

Questionnaires were administered three times to all participants: 1) Pre intervention; 2) Immediately after the intervention, asking for a response based on how the supervisor perceived himself now (POST response); and 3) One week after the intervention was over, asking how the supervisor perceived he was before intervention began (THEN response). It is important to note that this measure is not asking the respondents to recall their earlier rating but rather to recall the conditions that existed before the intervention began and to rate them again a second time.

PRE data are the measures before the intervention, POST data are the measures after the intervention, and THEN data are the third measures. Comparisons of THEN with PRE and POST measures yield more reasonable indications of alpha, beta and gamma change.

6.3.4 Data Analysis

Although there are a variety of techniques (e.g. Terborg et al. 1980; Porras and Singh 1986; Bedeian et al. 1980; Armenakis and Bedeian 1982) to assess behavior change, a key one rests in the interpretation of the data gathered to assess change (Roberts and Porras 1982). Since most approaches to evaluation of change use subjective self-reported ratings, any evaluation procedure needs to be examined for its ability to identify specific types of change that might have occurred (Golembiewski et al. 1976). There is an agreement on the importance of first testing for gamma change (Golembiewski and Billingsley 1980). Failure to test first for gamma change can produce invalid assessment of beta and alpha change (Golembiewski and Billingsley 1980). The limited ability of the Bedeian et al. (1980) approach to detect gamma change is a shortcoming that seems to sufficiently preclude use of the procedure. However, Terborg et al. (1980) and Porras and Singh (1986) approaches detect gamma change first. No other methods have even considered these three types of change at the individual level of analysis. The three types of change (Alpha, Beta, and Gamma) can be measured by the following steps:

1- Using the response of a supervisor on each question for PRE, POST, and THEN measures as raw data.
2- Obtaining dispersions in behavior scores by calculating standard deviations using all data. Calculate separately these overall standard deviations for PRE, POST and THEN measures.
3- Using the raw-data (1 above), calculate a t-statistic for every supervisor for the following comparisons: PRE versus THEN (yields $t_{PRE, THEN}$), POST versus PRE (yields $t_{POST, PRE}$), POST versus THEN (yields $t_{POST, THEN}$).
4- Also using the raw data (1 above), calculate correlations for every supervisor, making the same comparisons described in 3 above ($r_{PRE, THEN}$, $r_{POST, PRE}$ and $r_{POST, THEN}$).

Once these calculations were made, the next steps were to use them in testing for the three types of behavior change. Gamma change was tested first. If it occurred, then interpretations of alpha and beta change were problems. If gamma change did not occur, the next step was to test for beta change. Testing for alpha change was the last step. The next three steps in the testing sequence were as follows:

5- Perform tests for gamma change in three ways:

First, using correlations coefficients computed in step 4 above calculate the correlations differences (CD) for each supervisor. The first correlation differences (CD1) calculates using the subtraction of correlations "POST versus THEN" from correlations "POST versus PRE". The second and third correlation differences are calculated in the same manner as follow:

(a) CD1 = r $_{POST, THEN}$ - r $_{POST, PRE}$

(b) CD2 = r $_{POST, THEN}$ - r $_{PRE, THEN}$

(c) CD3 = r $_{POST, PRE}$ - r $_{PRE, THEN}$

- Comparing intervention differences with control differences by using a Mann-Whitney U test as implemented in SPSS 12.0.1 (SPSS Inc. 2003). For gamma change to have occurred, the following relationships must obtain:

  (a) CD1 for intervention group NOT = CD1 for control group

  (b) CD2 for intervention group NOT = CD2 for control group

  (c) CD3 for intervention group = CD3 for control group

Second, using the standard deviations (SD) computed in 2 above; calculate the following differences for each supervisor:

(a) SD1 = SD $_{THEN}$ - SD $_{PRE}$

(b) SD2 = SD $_{POST}$ - SD $_{PRE}$

(c) SD3 = SD $_{POST}$ - SD $_{THEN}$

- Compare intervention differences with control differences using a Mann- Whitney U test. For gamma change to have occurred, the following relationship must obtain:

  (a) SD1 for intervention group NOT = SD1 for control group

  (b) SD2 for intervention group NOT = SD2 for control group

  (c) SD3 for intervention group = SD3 for control group

Third, using correlations computed in step 4 above for every supervisor, gamma change occurs if:

(a) r $_{PRE-POST}$ for intervention group < r $_{PRE-POST}$ for control group

(b) r $_{PRE-THEN}$ for intervention group < r $_{PRE-THEN}$ for control group

(c) r $_{POST-THEN}$ for intervention group = r $_{POST-THEN}$ for control group

The strongest evidence for occurrence of gamma change exists when predicted relationships between intervention and control groups are found for both correlations coefficients and standard deviations. All three predicted relationships must hold for each test. If predicted significant differences between intervention and control groups were found either for correlations coefficients and standard deviations, this constitutes weaker evidence for occurrence of gamma change. If gamma change had occurred, interpretations of test results for beta and alpha change become somewhat difficult, and should be done with caution (Terborg et al. 1980). If gamma change does not occur, not such interpretation problems do exist.

The final steps were to check for beta and alpha change.

6- Using the t-statistic calculated for each subject in 3 above, test for beta change using a Mann-Whitney U test to demonstrate the following relationship.

t $_{PRE, THEN}$ for intervention group > t $_{PRE, THEN}$ for control group

7- Two tests for alpha change are possible. If no beta change is found either test is appropriate. But if beta change does occur, only the second test is appropriate.

$t_{POST, PRE}$ for intervention group $> t_{POST, PRE}$ for control group

$t_{POST, THEN}$ for intervention group $> t_{POST, THEN}$ for control group

Descriptive statistics and spearman correlation coefficients are calculated using the statistical software package SPSS 12.0.1 (SPSS Inc. 2003). A Mann-Whitney U test corrected for relation was used to assess significance of each comparison. Z value is used to assess the significance differences between the groups. If Z value is greater than 1.96, there are significant differences between the groups. The estimated effect size (R) was performed based on the equation: $R = Z /\sqrt{N}$ (where N = total observation). The effect size defines as a standardized measure of the size of the effect you observed, which they can compare to other studies. The threshold value is from 0.3 (medium effect) to 0.5 (high effect). A Mann-Whitney U test, Z value and the estimated effect size were calculated based on Field (2005). Cronbach Alphas calculated for all the eighteen questions ranged from 0.83 to 0.85 (internally consistent). These coefficients were sufficiently high to permit use of the Terborg et al. (1980) and Porras and Singh (1986) approach.

The results obtained are discussed in the next section.

6.4 RESULTS

Table 6.1 shows the results summarizing the impact of the intervention. Columns indicating tested related to type of change being considered and dependent variables being compared across groups. A Mann- Whitney U test corrected for relation is used to assess significance of each comparison. The complete results can be found in appendix 5. In the following sections, the results obtained for the three types of change are presented.

6.4.1 Re-Conceptualization of SDS Domain (Gamma Change)

Table 6.1 and appendix 4 show that, as predicted for gamma change, correlation differences CD1 and CD2 are equal in intervention and control groups (P = 0.000 and 0.015 respectively). Mean rank is almost equal (18.5 – 20). Correlation difference CD3 is significantly (P = 0.000) not equal for the two groups. Mean rank is different (15 – 4). These comparisons for intervention and control groups using correlation differences revealed support for non existence of gamma change.

In addition, a comparison of correlations coefficients for intervention and control groups revealed support (P = 0.000 and 0.078 respectively, Table 6.1) for not existence of gamma change. Mean ranks for intervention (15.5) are greater than for control groups (4). However, this expected pattern of results is found for differences in dispersions (P = 0.008 and 0.000 respectively, Table 6.1). Mean ranks for intervention (13.5) are almost equal to control groups (14.29). Dispersion differences indicated no gamma change. When new attitudes (beliefs or values) about SDS are added to individual mind, the behavior has not simply changed. There exists for the individual a new attitude.

Table 6.1 Type of Spatial Data Sharing (SDS) individuals change behavior.

Concept	Test Used	Dependent Variable	Prediction	Mean Rank		Mean		Mann-Whitney U	Z	R	P. level	SDS Behavior Change Occurred	
				Intervention (I)	Control (C)	Intervention (I)	Control (C)					Degree	Types
Gamma	Correlation differences	CD1	$I \neq C$	18.50	20.00	0.04	0.05	0.00	2.43	0.61	0.000	Does not occur	Re-conceptualization
		CD2	$I \neq C$	15.75	13.14	0.06	0.06	20.00	-2.42	0.61	0.015		
		CD3	$I = C$	15.50	4.00	0.02	0.01	0.00	-3.76	0.94	0.000		
	Standard deviations	SD1	$I \neq C$	13.50	14.29	0.06	0.31	40.00	-1.07	0.26	0.008		
		SD2	$I \neq C$	10.50	8.57	0.59	0.56	32.00	-1.61	0.40	0.118		
		SD3	$I = C$	15.50	4.00	0.65	0.25	0.00	-3.83	0.95	0.000		
	Correlation coefficients	r PRE, THEN	$I < C$	9.81	17.00	0.27	0.50	21.00	-2.34	0.59	0.175		
		r PRE, POST	$I < C$	15.50	4.00	0.29	0.49	0.00	-3.57	0.89	0.000		
		r POST, THEN	$I = C$	10.97	14.36	0.23	0.44	39.50	-1.13	0.28	0.078		
Beta	t- statistic	PRE, THEN	$I > C$	15.50	4.00	1.98	0.77	0.00	-3.76	0.94	0.000	Occurred	Awareness
Alpha		POST, THEN	$I > C$	14.00	6.00	9.63	1.78	0.00	-5.98	1.49	0.009	Occurred	Actual

CD1 = r $_{POST, THEN}$ - r $_{POST, PRE}$; CD2 = r $_{POST, THEN}$ - r $_{PRE, THEN}$; CD3 = r $_{POST, PRE}$ - r $_{PRE, THEN}$; SD1 = SD $_{THEN}$ - SD $_{PRE}$; SD2 = SD $_{POST}$ - SD $_{PRE}$; SD3 = SD $_{POST}$ - SD $_{THEN}$

The new attitude does not mean that the individual is directed toward a new behavior change. These new attitudes are ones that did not exist previously in the individual's behavior. Therefore our interpretation of these findings would indicate that gamma change did not occur as a result of the intervention.

6.4.2 Awareness (Beta) Change

The significantly differences in the levels of PRE and THEN measures are indicated for Beta change. This result reflects a shift in standards used to judge behavior. Before intervention, supervisors used a particular standard to evaluate their own behavior (PRE measure). After intervention, supervisors looked back and once again judged their behavior prior to beginning the change activity (THEN measure). If beta change had occurred, standards with which supervisors judged their own behaviors would have been affected by the intervention (increase awareness). Consequently the level of the PRE measures should have been different from that of the THEN measures.

The data show that beta change did occur, since levels of PRE and THEN measures were significantly different (P = 0.000, Table 6.1). Mean for intervention is greater (1.98) than for control groups (0.77). Mean rank for intervention (15.5) is greater than for control (4) groups. Supervisors recalibrated their conceptual domains (after awareness) as they related to the six behavior targeted for change and assessed their behavior with a different standard after the intervention. This pattern of results, not support for gamma change and significant support for beta change, sheds new light on the impact of an intervention on SDS behavior change. The intervention was of a type to effect of altering the standards applied to judging targeted behaviors.

The results indicate that the metric by which SDS is measured has somehow changed between measurements (shift in standard). Activating the belief regarding SDS held responsible for the performance of SDS. Individual may engage in comparisons of the current information regarding the attitude toward SDS against other information to make a decision as suggested by motivation control theory.

6.4.3 Actual SDS Behavior (Alpha) Change

It is appropriate (since beta change occurred) to assess alpha change by comparing levels of POST and THEN measures. Terborg et al. (1980) recommend using this comparison in all cases regardless of presence or absence of beta change, but if beta change is indicated, this is the only appropriate comparison to use.

The data show that alpha change occurred (P = 0.009, Table 6.1). Mean and mean ranks for intervention (9.63 and 14.0 respectively) are greater than for control (1.78 and 6 respectively) groups. POST and THEN comparisons yielded mean substantially higher in the intervention group as compared to control.

When there is a change (shift) in the overall behavior (shift in beliefs), an alpha change has occurred. Alpha changes occur when individual comes to believe in the truth of some information more strongly (shift in strength of belief). It appears therefore, that the intervention was sufficiently strong to produce significant alpha change.

6.5 DISCUSSION

Recall that the objectives of this chapter are to examine the effects of the intervention on SDS change behavior and determine the types of SDS change behavior that occurred at the individual and organizational level. Analyses of three different types of change provide insights into the change behavior process. Investigation of gamma, beta, and alpha change led to a more complete understanding of the effects of the intervention on SDS behavior change. The results confirm the hypothesis that change of SDS behavior is associated with aspects of the individual's beliefs. In the following sections, the results related to the different SDS change are discussed. Followed by implications of the results to the organizational change.

6.5.1 Redefinition of Spatial Data Sharing Domain

Gamma change refers to the re-conceptualization or redefinition of a SDS domain Golembiewski et al. (1976). It occurs when respondents change their basic understanding, from one testing period to another, of the criterion being measured. Testing for gamma change has been done by comparing correlations and standard deviations. Comparisons using correlation differences indicated that gamma change may have occurred as a result of the intervention. But when only correlations were compared, no support exists for a conclusion that gamma change, based on correlations coefficients differences, occurred. A comparison of correlations coefficients did not indicate that gamma change had taken place. Thus, the intervention did not produce significant alterations in how supervisors interpret the reality of their behaviors.

  The results of different analysis did not follow predicted patterns for gamma change. Differences occur, given similar correlations coefficients, when those skills perceived as high at one point in time are perceived as even higher at another point, or when those perceived as low at an earlier time, are later seen as even lower. In order for gamma change to have occurred, differences in standard deviations of THEN and PRE (SD1) and POST and PRE (SD2) would have been unequal for intervention and control groups while the difference for POST and THEN scores (SD3) would have been equal. The results indicate that the second differences in dispersions were not significant (P = 0.118), but the first and third were highly (P = 0.008 and 0.000, Table 6.1) significant. Thus, tests of differences on dispersions did not lend support to existence of gamma change.

  The strongest support for gamma change would consist of changes in both correlations and standard deviations (Terborg et al. 1980). Since neither the correlations nor standard deviations changed in ways that indicated gamma change, we concluded that no gamma change had occurred due to the intervention. This was, however, not surprising. Given the highly focused nature of the intervention (SDS behavior), the level of correlations and standard deviations needed for gamma change would have been not significantly changed.

6.5.2 Spatial Data Sharing Recalibration

Beta change occurs when the standard of measurement used by a respondent to assess an item changes from one testing period to another (Lindell and Drexler 1980). Such change indicates a recalibration of a respondent's internalized scale of measurement. Beta change could be expected to be one consequence of the intervention. Prior to this intervention, most supervisors perceived themselves as relatively skilled to share spatial data. The intervention could have affected the supervisor's perceptions of just how well he performed each behavior in question and, as a consequence, caused a shift in measuring scale. The results show that, overall, there is a difference in the PRE and THEN scores.

It appears, therefore, that this group of supervisors significantly shifted the points with which they fixed their perceptions of behavioral items. Frequency distributions of PRE and THEN scores show that control group responses tended to be a lower than intervention group responses with the shift indicated by those data being statistically significant. Therefore, an alteration in scales occurred and was large enough to be greater than one which could have occurred by chance.

This finding with the previous one, absence of gamma change, gives a clearer insight into the dynamics of behavior change processes. On the other hand, it appears that the intervention did result in a shift of standards used for judging the extent to which behavior occurs. Certainly, the intervention made participants more aware of the behaviors (SDS) as well as more knowledgeable of levels of competence possible in use of SDS. These processes may have contributed to a shift in standards applied by participants.

6.5.3 Actual Individual and Organizational Change

Alpha change is defined as a rating change for which both gamma and beta change have been ruled out. That is to say, neither the respondents' understanding of the criterion being measured nor the measurement scale has changed. When assessed using POST and THEN scores, differences in levels of the two scores are quite large. An analysis of POST and THEN data shows substantial changes in most of the 18 items as well as in overall scores. Thus, the intervention not only changed supervisors' standards for judging their own behaviors, but also behaviors themselves. Indeed, change of these behaviors was the objective of the intervention.

Another interesting finding, underscoring the importance of using this methodology, relates to the use of POST and THEN scores to evaluate alpha change given beta change. Z-score improve from 3.99 (if PRE and POST are used, appendix 4) to 5.98 occurs (Table 6.1). In this case, the level of significance does not change. SDS behavior change of each first line supervisor was assessed by his immediate subordinates. First level employees were asked to rate their supervisors' behavior before and immediately after the intervention. Subordinates perceived their bosses' behavior as different immediately after the intervention was over.

6.5.4 Implication for Spatial Data Sharing within the Organization

The results have several direct implications for the individual and organizational change.

First, based on our understanding of the organization intervention toward SDS, we should be able to predict the type of change we expect. Many organizational change programs are designed to induce behavior change. However, organizations do not specify what type of behaviors change they are trying to obtain. Predicting type of change is an improvement over simply predicting increases in attitudinal strength.

Second, by better understanding the type of change, we will be better able to predict important behaviors of individual and grouped them together. Socio-cultural aspects play an important role in shaping individual attitude and behavior (Omran et al. 2007a,b). In different cultures, individuals and organizations behave differently under similar circumstance because of the differences in values and attitude. Fleishman (1986) suggested that although attitudes seem to differ from individual to individual, a person can develop groups whose attitudes are similar. Similarly, Bar-Tal (1990) suggested that for group members to perceive themselves as a group it is necessary for them to share one or more beliefs.

Third, a planned intervention is used to enhance respondents' understanding of SDS concepts. This intervention creates common awareness of SDS problems, helps to define solutions, and helps individual change toward spatial data sharing. There is a value of distinguishing changes in condition-within-a-state from changes in state which is here called alpha change as contrasted with gamma change (Golembiewski et al. 1976; Armenakis and Bedeian 1982). This distinction has implication for spatial data sharing behavior change. A change of the individual's behavior can sometimes be at a development point that even minor changes in condition induce a deep change in state. Hence, increase awareness is needed to get SDS to the reality. Considerable time and effort may be needed in individual change development before "anything happens," and then quickly an individual will "take off" and "go into orbit." Thus the results show considerable promise for helping organizations to improve data sharing cooperation, knowledge creation and knowledge transfer between organizational members. The intervention made participants more aware of the SDS change behaviors as well as more knowledgeable of levels of competence possible in use of SDS.

6.6 CONCLUSIONS AND RECOMMENDATIONS

The results reported here highlighted three important aspects of assessing planned individual and organizational change. First, a SDS intervention can be a highly effective means for change behavior of first line supervisors. Second, it is important to analyze three different types of changes that occur, using alpha, beta, and gamma change, when attempting to assess change of SDS behavior in organizations. The methodology used proved quite useful in evaluating these three types of changes. Third, this methodology can be usefully elaborated by testing the techniques used for measuring the intervention's impact on SDS change.

Change behavior is an important means of ensuring that expertise resident in a given organization is being effectively utilized. The results would have important implications for how to increase individual and organizational change to share data and thus increase organizational achievement.

Given that this is the first attempt to explore SDS change behavior; this study focuses on change key individuals in the organization toward SDS in one country over short time. The methodology used offers interesting directions for the future work. First, although the existing chapter identifies the three types of individual SDS change, it has not conceptualized these types to provide a process model in order to help individual and organizational change. Comprehensive organizational change process model could be the first future research topic. A second one, in order to obtain strong evidence on how to influence change behavior toward SDS, a more long term experiments and monitoring the effect a cross-culture of several countries could be further research study. Does the greater willingness to share displayed dwindle over time? Identifying the critical factors which might have effective individual and organizational change is crucial. These critical factors (readiness to change) can help organizations to have long term SDS success. Finally, understanding and identifying who is not willing (negative reaction to changes) to share data and crafting ways to change these people behavior might be the third future research topic. Some individuals could intentionally attempt to refuse (negative) to give or share data. It is highly important to find ways to change people attitude to share data more quickly.

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Chapter 7

Conclusions and Eye to the Future

7.1 CONCLUSIONS

The main research objective of this thesis is *to examine the theoretical and practical aspects of spatial data sharing behavior from a socio-cultural perspective.* To structure this main objective, five specific objectives were formulated in the first chapter of this thesis. The current chapter summarizes the conclusions relating these five objectives and gives overall conclusions related to the main objective. Finally, some suggestions for further spatial data sharing research are given. The results contribute to the enhancement of spatial data infrastructure development.

Objective 1. *To identify the main socio-cultural theories relevant for spatial data sharing behavior.* If the overall trend in (43 papers appeared from 1990 through 2006) spatial data sharing literature is considered, there is clearly a gap in the use of socio-cultural theories in SDS behavior. The emphasis on technical aspects makes spatial data sharing far from optimal and presents a challenge for new socio-cultural theory development. This objective reviews the main (31) socio-cultural theories to provide potential insight into spatial data sharing behavior. The results show that theory of planned behavior, cultural theory, Hofstede's culture dimensions and social network theory appear to be the most relevant, robust and rigorous theories to describe and understand (*objective 2*) SDS behavior.

Objective 2. *To develop a cross-cultural conceptual model for understanding spatial data sharing behavior.* In order to understand spatial data sharing behavior, the purpose of this objective has been to propose a cross-cultural conceptual model. The proposed model is influenced by individual and organizational behavior. The individual behavior is analyzed by employing the concepts of the theory of planned behaviors. The organizational behavior is examined by using the cultural theory. The individual and organizational behaviors are linked within the model in two ways: 1) by Hofstede's cultural dimensions (individualism/collectivism; power distance; uncertainty avoidance; masculinity/femininity; and long-term/short-term orientation); and 2) by motivational factors (trust; uncertainty; incentives; resource scarcity; rules; and autonomy). The relationships are formulated in the emerging model by 23 hypotheses to enhance our understanding of the drivers of individuals and organizations toward SDS.

Objective 3. *To validate the cross-cultural model developed.* The proposed conceptual model is tested and validated within two organizations, one in Egypt and the other in The Netherlands. The results show that the model appears to be valid for these two organizations since it supports most of the hypotheses. At individual level, attitude and social pressure are the most important factors in determining the individual' willingness to share spatial data in Egypt. On the other hand, attitude and perceived behavior control play an important role in determining the individual' willingness to share in The Netherlands. At the organizational level, culture plays an important role in shaping organizational behavior towards SDS. In different cultures (Egypt and The Netherlands) organizations behave differently because of the differences in values and attitude. The patterns of SDS identified in Egyptian organization

are toward Hierarchy and Fatalism. In The Netherlands, the SDS patterns are toward Hierarchy, Individualism and Egalitarian.

The results emphasize the role of cultural differences and motivational factors on the individual and organizational SDS behavior. The clearest effects of Hofstede's dimensions on individual and organizational behavior that emerge from the study are the importance of individualism/collectivism and power distance. In the context of this thesis, the masculinity and femininity dimensions appear to be not important for SDS. Trust, autonomy, uncertainty and rules prove to be the universal drivers of SDS behavior. Finally, the findings indicate that the willingness of individuals in Egypt and The Netherlands are high to share data. The willingness of the organization to share data in the Netherlands is high. However, in Egypt the willingness is low. Because the willingness of the organization in Egypt is low, the *fourth and fifth objectives* are proposed.

Objective 4. *To determine the actual spatial data sharing behavior in an Egyptian project.* By mapping out relationships among social actors using social network analysis, actual SDS behavior can be determined. The empirical results show that the Egyptian project may be seen as a combination of cultures in which hierarchy and fatalism dominates. Hierarchies tend to be more preoccupied with legitimacy than with how SDS should be achieved. Fatalists are a product of hierarchies as they are excluded from control. Hierarchies may be conducive for the creation of clear rules about data sharing. However, the emphasis on legitimacy and authority in the project may be unbalanced and little conducive for SDS. At present, information flows inside and outside the organization are always taking place between project leaders. The real challenge to improve SDS in the project would only occur if the hierarchical trend would be counterbalanced by creating possibilities for exchange spatial data between units without the necessity of gaining the approval of superiors. Thus, change the hierarchical mindset (*objective 5*) of the team leaders about spatial data sharing is crucial.

Objective 5. *To change and assess the actual spatial data sharing behavior.* Systemically SDS change behavior is analyzed by using the "alpha, beta and gamma" method. The results highlight two important aspects of actual SDS change. First, a SDS intervention can be a highly effective means for change intention and behavior of first line supervisors. A planned intervention is used to enhance respondents' understanding of SDS concepts. The intervention made participants more aware of the SDS change behaviors as well as more knowledgeable of levels of competence possible in SDS. Second, the assessment of the SDS change occur has been operationalized in terms of alpha, beta and gamma change. This methodology can be used for measuring the intervention's impact on SDS change. The results indicate that supervisors' behaviors toward SDS are changed (actual sharing) as assessed by their subordinates. SDS change behavior is important to ensure that expertise, resident in a given organization, is effectively utilized. This is resulting in more possibilities for influencing spatial data sharing at all levels.

The overall objective of this thesis is to *examine the theoretical and practical aspects of spatial data sharing behavior from a socio-cultural perspective.*

From a theoretical view, this thesis determines that the most promising theories to explain SDS behavior are: theory of planned behavior; cultural theory; Hofstede's cultural dimensions; and social network theory. These theories are used in three different ways: 1) as a framework to build a cross-cultural spatial data sharing model. This is achieved by combining insights drawn from the theory of planned behavior, cultural theory and Hofstede's cultural dimensions. This model provides a rich and systematic means of assessing SDS behavior by understanding and analyzing relationships among individuals and organizations; 2) as a tool to study the individual and organizational characteristics of spatial data sharing. This is achieved by introducing social network analysis as a tool using theory of planned behavior and cultural theory as a basis to interpret the SDS behavior. The method offered the possibility to examine "organizational" behavior based on "individualist" behavior. The results show that social network analysis is a useful tool to study SDS behavior; and 3) as a method to change and assess the organizational SDS behavior. This is realized by implementing six behaviors targeted for change drawn from theory of planned behavior through interventions. The "alpha, beta, and gamma" method is used to assess the type of spatial data sharing changes. The methodology proved to be useful in evaluating spatial data sharing change intervention.

From a practical view, this thesis enhances the understanding of the SDS behavior across-cultures in two ways: 1) the results identify the particular motives and behaviors that make spatial data sharing more effectively within the social domain. Although the literature suggest many factors which motivate the individuals and organizations to establish sharing relationships, this thesis suggests four critical factors of SDS behavior: rules, trust, autonomy, and uncertainty. These motivational factors, which can be changed, play a crucial role in determining the willingness to share spatial data. These factors might allow managers of organizations (which have been loath to make their data available) to understand the reasons why and when organizations facilitate or impede data sharing. These behaviors and motives should be taken into account by policy makers at all levels. 2) The cultural aspect of SDS patterns that shape individual attitude and organizational behavior regarding SDS is a combination of cultures. The effects of Hofstede dimensions on individual and organizational behavior that emerge from this study are the importance of individualism/collectivism and power distance. These cultural dimensions should be respected which are not easy to change.

7.2 EYE TO THE FUTURE

This thesis is a systematically attempt *to examine the theoretical and practical aspects of spatial data sharing behavior from a socio-cultural perspective*. The author believes that Spatial Data Sharing (SDS) behavior is an essential and fertile area to be tackled in order to implement successful and healthy Spatial Data Infrastructures (SDIs). On the basis of the work reported in this thesis, theoretical, methodological, empirical and practical insights can be drawn for further research**.** Four potential directions are suggested.

1- *From a theoretical perspective*, the SDS behavior model developed and proposed in this thesis is based on socio-cultural theories. There is a need to integrate other theories (e.g. exchange theory, game theory, etc...) in which interactions among individuals and organizations are complex socio-cultural phenomena. Combining insights drawn from other theories and integrate more motivational factors could be an interesting area for future research.

2- *From a methodological perspective*, the questionnaire used to test and validate the SDS model appeared to be useful in the context of this thesis. However, for future validation, an extension of the questionnaire is recommended. The additional questions should be more focused and in-depth about the nature of SDS behavior in organizations.

3- *From an empirical perspective*, the SDS model is validated in two specific organizations in two countries (Egypt and The Netherlands). A long term monitoring and validating of the model in other organizations and cultures at all levels (local, national, international) is needed.

4- *From a practical perspective*, this thesis is directed on a spatial data sharing in general. The analysis applied does not distinguish different types of spatial data which may be held by a particular organization. It is recommended to examine if differences exist between specific data sharing communities (e.g. soil, geological, topographic, etc…).

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SUMMARY

The development and maintenance of spatial data have become large cost components in the use of technology to address today's problems. Solving these problems requires the integration of many spatial datasets in order to have a sound spatial decision making. Therefore, billions of euros are invested annually in producing and maintaining spatial data. Not many organizations are in the position to have all the data they need for solving the current problems, and so they need access to external spatial data produced and maintained by other organizations. In other words, Spatial Data Sharing (SDS) among organizations is essential for having an efficient and effective spatial decision making process. This requires positive attitudes towards SDS. However, various authors indicate that the attitudes both of individuals and of organizations toward SDS are often problematic. So, major questions should be answered regarding the willingness of individuals and organizations to engage in SDS.

It appears to be common that stakeholders ask questions about the relevance of SDS-theory as exemplified in saying "Theory is one thing, practice is something else". SDS is much more than accessing spatial data only. It involves individual and organizational behavior that is shaped by socio-cultural conditions. Re-conceptualization the relation between SDS-theory and practice is proposed. Through theory new possibilities for SDS resistance can be constructed. Through practice the SDS resistance can be changed in reality.

While technical aspects in SDS receive much attention, it cannot be expected that all SDS problems can be solved by technical solutions. This thesis focuses on these socio-cultural aspects. To the best of author's knowledge, not many systematic studies have been undertaken with regard to the socio-cultural aspects of SDS-behavior. To this end, the main objective of this thesis is *to examine the theoretical and practical aspects of spatial data sharing behavior from a socio-cultural perspective.* To structure this main objective, five sub-objectives are formulated in this thesis as below.

1- To identify the main socio-cultural theories relevant for spatial data sharing behavior;
2- To develop a cross-cultural conceptual model for understanding spatial data sharing behavior;
3- To validate the cross-cultural model developed;
4- To determine the actual spatial data sharing behavior in an Egyptian project; and
5- To change and assess the actual spatial data sharing behavior.

Each of the chapters 2-6 of this thesis focuses on the methodology and results of a sub-objective as just presented.

Chapter 2 has two goals. First, it describes, analyzes and justifies the study of the SDS- literature in order to outline the theoretical, methodological and organizational SDS gaps in the existing literature. The main gap identified is that the studies on individual and organizational behavior of SDS are still in its infancy. Second, it reviews the main social and

cultural theories to provide insight into SDS behavior. Theories of Planned Behavior, Culture Theory, Hofstede's Cultural Dimensions and Social Network Theory are identified as possible theories for explaining SDS-behavior.

Chapter 3 argues that SDS is far from optimal and presents a challenge for new theory development. The objective of this chapter is to shed light on the interaction between individual and organizational SDS behaviors and their social and cultural aspects. A new cross-cultural theoretical model is proposed. This SDS model integrates concepts from multiple theories: Theory of Planned Behavior, Culture (grid-group) Theory, and Hofstede's Cultural Dimensions. The relationships within the model are formulated in 23 hypotheses. Knowledge about relationships among individuals and organizations derived from the emerging model may provide insights into the attitudes of individuals and organizations towards SDS.

Chapter 4 presents the validation of the formulated hypotheses within the cross-cultural SDS model as proposed in Chapter 3. In order to achieve this, an empirical study was conducted to test the hypotheses in two different cultures; Egypt and The Netherlands. A formal questionnaire survey at Egyptian Survey Authority (Egypt), and Alterra (The Netherlands) personnel was conducted. The results provide support for most of the proposed hypotheses, emphasizing the role of cultural differences and motivational factors on the individual and organizational SDS. The chapter concludes that the revised SDS model can be applied in other countries, both developed and developing. In order to improve the model, it is strongly recommended to validate this model in many other cultures and organizations.

In contrast with the previous chapters, the main focus of *chapter 5* is on the actual SDS-behavior whereas Chapters 3 and 4 focus on the modeling of SDS-behavior. Chapter 5 introduces Social Network Analysis to research on SDS. By mapping out relationships among social actors using social network analysis, the collective properties of SDS in organizations can be investigated. Previous theoretical approaches have focused exclusively on individual behavior. This chapter attempts to expand this focus and applies Social Network Analysis in a study of SDS in a project of the Egyptian Survey Authority. It concentrates on the emerging pattern of SDS between social actors in the organization and their perceptions and attitudes. The Social Network Analysis results show that SDS in this organization corresponds strongly to the existing hierarchy in the organization. Individual perceptions and attitudes regarding SDS show patterns that correspond strongly to the network structure. Project leaders are central in the SDS network and optimistic about SDS. Employees lower in the organization feel they have less control and express more concern about constraints regarding SDS than the ones higher up in the organization. The chapter shows that Social Network Analysis can be a useful approach to study SDS and complements approaches to individual behavior.

Chapter 6 focuses on the possibilities to change the SDS behavior of individuals and organizations. One of the key aspects of change behavior towards SDS should begin with changing intention. If the intention of the key individuals inside the organizations towards SDS is changed, then the organizational outcome will improve. This intention change has been "operationalised" in terms of Alpha, Beta and Gamma change typologies. At Gamma change, a conceptual shift occurs on the leader's mindset (e.g. a shift in thinking and understanding from no access of spatial data to free access). At Beta change this shift to the

group, meanwhile at Alpha change this shift to actual sharing. Real changes only happen when a Alpha change occurs. The focus of this chapter is to analyze the impact of a planned SDS change on the behavior of a group of supervisors within a project of the Egyptian Survey Authority. The main results show that Beta and Alpha change appear to occur after the planned intervention. This means that the supervisor's mindset is really changed as assessed by his immediate employees. Employees perceived their supervisor's behavior as different after the intervention was over. The methodology itself proves to be useful in evaluating the different types of changes.

The main focus of this thesis is on the socio-cultural aspects of SDS. A cross-cultural conceptual model for understanding spatial data sharing behavior is developed, organizational networks are mapped out to determine the actual SDS-behavior, and a method is proposed to change and assess the actual SDS-behavior. A growing body of literature confirms that these social-cultural aspects are critical to successful SDS-activities and implementations of Spatial Data Infrastructures. In this way, the results of this thesis are a step further to understand the role of socio-cultural aspects on SDS. Lets many steps follow.

SAMENVATTING

Voor het ondersteunen van ruimtelijke vraagstukken wordt intensief gebruikt gemaakt van ruimtelijke gegevens. Het verzamelen en onderhouden van deze gegevens is een kostbare aangelegenheid. Wereldwijd worden er miljarden uitgegeven aan het verzamelen en beheren hiervan. Bij het gebruik van ruimtelijke gegevens voor het ondersteunen van ruimtelijke vraagstukken dienen vaak gegevens uit meerdere bronnen te worden gecombineerd. Bijvoorbeeld bij de aanleg van een nieuwe weg is informatie nodig over de bodemgesteldheid, de eigendomsituatie, ecologie, landgebruik, etc. Het beheer en onderhoud van deze gegevens is vaak bij verschillende organisaties belegd. Om ruimtelijke vraagstukken goed te kunnen ondersteunen is het delen (Spatial Data Sharing (SDS)) van ruimtelijke gegevens dan ook essentieel. Met de term delen wordt in deze samenvatting het gebruik van gegevens door andere organisaties bedoeld. Dit kan zowel gratis als tegen betaling te geschieden. In praktijk verloopt het delen van gegevens vaak niet optimaal en zijn er grote verschillen tussen landen. In sommige landen zijn de gegevens zeer moeilijk beschikbaar, terwijl anderen een veel ruimer beschikbaarheidbeleid kennen. Bij het delen van gegevens wordt onderscheid gemaakt in technisch- en sociaal-culturele aspecten. In dit proefschrift staan de sociaal-culturele aspecten centraal. Aan dit onderwerp is nog maar beperkt onderzoek verricht. Het vormt volgens sommige auteurs echter de sleutel tot een veel beter gebruik van ruimtelijke gegevens voor de ruimtelijke vraagstukken waar we als samenleving voor staan. Het onderzoek richt zich op het gedrag van zowel individuen als organisaties. Samenvattend is het hoofddoel van deze thesis als volgt te formuleren: *het zowel praktisch als theoretisch onderzoeken van het gedrag van het delen van ruimtelijk gegevens vanuit een sociaal-cultureel perspectief*. Vanuit dit hoofddoel zijn de volgende vijf subdoelen geformuleerd:

1- Het identificeren van de belangrijkste sociaal-culturele theorieën die het gedrag van het delen van ruimtelijke gegevens mogelijk kunnen verklaren;
2- Het ontwikkelen van conceptueel model voor het beschrijven van het gedrag van het delen van ruimtelijke gegevens;
3- Het valideren van het ontwikkelde conceptuele model;
4- Het bepalen van het huidige gedrag van het delen van ruimtelijke gegevens in project in Egypte; en
5- Het veranderen en vervolgens meten van verandering in het gedrag van het delen van ruimtelijke gegevens in Egypte.

De hoofdstukken 2 t/m 6 in het proefschrift beschrijven de aanpak en de resultaten van de vijf hiervoor geformuleerde subdoelen.

Hoofdstuk 2 beschrijft en analyseert de literatuur op gebied van het delen van ruimtelijke gegevens. Hierbij wordt naar zowel de theoretische, methodologische en praktische aspecten gekeken. Uit de analyse blijkt dat er nog weinig bekend is over gedrag

van individuen en organisaties. In het tweede deel van het hoofdstuk worden de sociale en culturele theorieën verkend die mogelijk gebruikt kunnen worden bij het verkrijgen van inzicht in het gedrag van individuen en organisaties. De *Theory of Planned Behavior, Culture Theory, Hofstede's Cultural Dimensions and Social Network Theory* zijn geïdentificeerd als potentieel bruikbare theorieën voor het beschrijven van het gedrag.

In *hoofdstuk 3* wordt een conceptueel model voor het beschrijven van het gedrag van het delen van ruimtelijke gegevens gepresenteerd. Dit model is gebaseerd op de volgende theorieën: *Theory of Planned Behavior, Culture (grid-group) Theory, and Hofstede's Cultural Dimensions*. De relaties in het model zijn geformaliseerd in de vorm van 23 hypotheses. Op basis van deze hypotheses kan een voorspelling worden gemaakt van het gedrag van individuen en organisaties ten aanzien van het delen van ruimtelijke gegevens. Het centrale uitgangspunt van het model is dat cultuur en motiverende factoren het gedrag van zowel individuen als organisaties op het gebied van het delen van gegevens beschrijven.

Hoofdstuk 4 beschrijft de validatie van de geformuleerde hypotheses in het model. De validatie is uitgevoerd in Egypte en Nederland. Hiervoor is een uitgebreide vragenlijst opgesteld, waarbij de vragen toetsen of de geformuleerde hypothese ook overeenkomt met de antwoorden van individuen en organisaties. In Egypte is deze toets uitgevoerd bij Egyptian Survey Authority (ESA) en in Nederland bij Alterra. Medewerkers zijn gevraagd om de vragen vanuit persoonlijk perspectief te beantwoorden. Een aantal hogere functionarissen hebben de vragen vanuit het organisatiebeleid beantwoord. Op deze wijze kon zowel de houding van het individu als dat van de organisatie worden geëvalueerd. De resultaten laten zien dat veel van de geformuleerde hypotheses niet worden verworpen. Wel dient hier te worden opgemerkt dat het een zeer beperkte validatie is, die maar bij twee organisaties is uitgevoerd. Op basis van deze eerste validatie is het model aangepast. De resultaten van de case studie (toepassing van het model) laten zien dat de bereidheid van individuen om ruimtelijke gegevens te delen zowel in Egypte (ESA) als in Nederland (Alterra) hoog is. De bereidheid van organisaties is echter sterk verschillend. In Nederland is bereidheid van organisaties ook hoog, maar is in Egypte laag. Deze modelvoorspellingen komen ook goed overeen met de praktijk waarbij de bereidheid om ruimtelijke gegevens te delen in Nederland over het algemeen groter is dan in Egypte. Het is interessant om te zien dat in Egypte vooral de houding van de organisatie belemmerend is. We moeten ons wel realiseren dat het peiling betreft van maar twee organisaties in twee landen. Voor een brede toepassing van het model is het nodig dat het model ook in andere landen wordt gevalideerd en geëvalueerd.

Stond in de vorige hoofdstukken het modelleren van het gedrag centraal, in *Hoofdstuk 5* wordt het actuele gedrag van het delen van ruimtelijke gegevens onderzocht. Hierbij is gebruik gemaakt van de Social Network Analysis methode. Met deze methode kan het collectieve gedrag goed worden onderzocht en geeft het ook inzicht in houdingen en percepties van de verschillende actoren. De methode is toegepast op een project van de Egyptian Survey Authority. De resultaten laten zien dat het delen van ruimtelijke gegevens sterk overeenkomt met de hiërarchie in de organisatie. Projectleiders nemen een sterke positie in en zijn over het algemeen positief over de mogelijkheden om gegevens te delen, terwijl project medewerkers veel meer belemmeringen ervaren en veel minder controle hebben. Deze methode blijkt zeer goed bruikbaar te zijn om het groepsgedrag in kaart te brengen en vormt een goede aanvulling op de methoden die individueel gedrag beschrijven.

Hoofdstuk 6 behandelt de mogelijkheid om het gedrag van personen op het vlak van het delen van ruimtelijke gegevens te veranderen. Het onderzoek richt zich op het meten van de intenties van individuen. Hierbij is gebruik gemaakt van een uit de literatuur geselecteerde methode van alfa, bèta en gamma verandering. Bij een gamma verandering treedt een conceptuele verandering op in iemands denken. Bijvoorbeeld een verandering van geen vrije beschikbaarheid van ruimtelijke gegevens naar een vrije beschikbaarheid. Bij een bèta verandering wordt dit ook op de groep overgedragen en bij een alfa verandering wordt daadwerkelijk tot verstrekken overgegaan. Echte ingrijpende veranderingen kunnen alleen optreden als er een alfa verandering is opgetreden. In Egypte is deze methode toegepast en het blijkt dat na een interventie, waarbij een poging is ondernomen om een groep medewerkers te overtuigen van een ruimere beschikbaarheid van ruimtelijke gegevens, bij de respondenten alfa en bèta aanpassingen te meten zijn. Een gamma verandering kon niet worden vastgesteld. Dit betekent dat uiteindelijk een verandering zal optreden, omdat er nu meer overtuiging (alfa) is om iets te veranderen.

In deze thesis staan de sociaal-culturele aspecten van het delen van ruimtelijke gegevens centraal. Er is een model ontwikkeld dat het delen van ruimtelijke gegevens beschrijft, netwerken zijn in kaart gebracht en er is een methode voorgesteld om veranderingen in houding van mensen te meten. In de literatuur wordt zeer breed onderkend dat sociaal-culturele aspecten een cruciale rol spelen bij het delen van ruimtelijke gegevens en dat ze in hoge mate het succes van de wereldwijd in ontwikkeling zijnde ruimtelijke data infrastructuren bepalen. In deze thesis is een stap gezet om beter grip te krijgen op de sociaal-culturele aspecten die een rol spelen bij het delen van gegevens. Laten er meer stappen volgen.

APPENDICES

Appendix 1: Coding sheet that used to classify the information extracted from the articles (belongs to chapter 2)

Authors: ……………………………………………… Journal Title: …………………………………
Year: ……………………………………………….. Article Title: ………………………………….

1- Research Methods:
❑ Descriptive (D)
❑ Theoretically Grounded (TG)
❑ Interpretive (I)
❑ Other
2- Research Approach:
❑ Case study
❑ Survey
❑ Field study
❑ Conceptual
❑ Review
❑ Other
3- Data Collection Types:
❑ Single
❑ Longitudinal
❑ Multiple
❑ Other
4- Casual Organization:
❑ Technological
❑ Organizational
❑ Emergent
❑ Other
5- Inter-organizational Relationships (IOR) Motives:
❑ Necessity
❑ Asymmetry
❑ Reciprocity
❑ Efficiency
❑ Stability
❑ Legitimacy
❑ Other
6- Inter-organizational Relationships (IOR) Typology:
❑ Dyads
❑ Sets
❑ Networks
❑ Other
7- Theory and Perspective Used: ………………………………………………………………..……
8- Article discipline: ………………………………………………………………………………….

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Appendix 2: Opinion Survey (belongs to chapter 4)

Dear Sir/ Madam

This questionnaire is designed to gather relevant information regarding whether and why individuals and organizations are willing to share spatial data.

Spatial Data Sharing is extremely useful as it enables organizations to save resources, time and effort when trying to acquire new datasets by avoiding duplication of expenses associated with generation and maintenance of data. Despite the potentiality important role of data sharing, the actual data sharing behavior remains a "black box". Probably some of the mystery surrounding data sharing arises from its particular social and culture context. Individuals and organizational behavior remains the key to improve data sharing. The problems here are not of a technical nature, but there is a variety of "human" reasons why individuals and institutions resist in spatial data sharing. There has been a general inability and unwillingness to share data across and within organizational boundaries.

So, GI organizations and individuals are encouraged to be more active participants in this study. The results of this questionnaire will not only contribute to this research but will provide useful information to encourage data sharing in Egypt and The Netherlands.

Note that this questionnaire has four parts. Part 1 measures your intention toward spatial data sharing. Part 2 measures the organizational setting behavior toward data sharing. Part 3 measures the cultural dimensions. Part 4 determines the motivational factors that affect spatial data sharing.

Please read each question carefully and answer it to the best of your ability. *There are no correct or incorrect responses; I am merely interested in your personal point of view.*

In making your ratings, please remember the following points:
Be sure to answer all items – do not omit any.
Never circle more than one number on a single scale.

I would like to thank you in advance for your valuable contribution to this study.

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Example

Many questions in this survey make use of rating scales with 7 places; you are to circle the number that best describes your opinion. For example, if you were asked to rate "The Weather in The Netherlands" on such a scale, the 7 places should be interpreted as follows:

If you think the weather in The Netherlands is extremely good, then you would circle the number 1, as follows:

Extremely good	1	2	3	4	5	6	7	Extremely bad
	extremely	quite	slightly	neither	slightly	quite	extremely	
	☑	☐	☐	☐	☐	☐	☐	

If you think the weather in The Netherlands is quite bad, then you would circle the number 6, as follows:

Extremely good	1	2	3	4	5	6	7	Extremely bad
	extremely	quite	slightly	neither	slightly	quite	extremely	
	☐	☐	☐	☐	☐	☑	☐	

If you think the weather in The Netherlands is slightly bad, then you would circle the number -1, as follows:

Extremely bad	-3	-2	-1	0	1	2	3	Extremely good
	extremely	quite	slightly	neither	slightly	quite	extremely	
	☐	☐	☑	☐	☐	☐	☐	

Part 1: *Questionnaire to measures your intention toward spatial data sharing*

Number	Statement		Scale							
1- A	For me to share (giving) spatial data is	Harmful	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Beneficial
2- PBCs	I am confident that I can share spatial data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
3- SNal	Most of my colleagues whose I consult them think that I should share spatial data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
4- A	For me to engage in spatial data sharing is	Extremely difficult	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Extremely easy
5- I	I intend to share spatial data	No	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Yes
6- PBCs	I can decide to share spatial data or not	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
7- SNal	My close friends approve me sharing spatial data	Not at all	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Very much
8- PBCc	The decision to share spatial data is completely up to me	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
9- I	I plan to share spatial data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
10*- SNet	My institution prevent me to share data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
11- A	For me to participate in spatial data sharing is	Bad	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Good
12*- PBCc	The decision to share spatial data is beyond my control	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree

A= Attitude, SN= Subjective Norm, SNal= Social Influence, SNet= Societal Norm, I= Intention, PBC= Perceived Behavior Control, PBCs= Self-efficacy, PBCc= Controllability

*For these questions, the scale was inverted for the analysis to make the answers compatible.

Number	Statement	Scale									
13- SNet	My government approve me sharing spatial data	Not at all	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Very much	
14- I	From 7 of my colleagues, the following number is willing to share spatial data		1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐		
15- A	Data sharing helped me to build trust relationships	Extremely disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Extremely agree	
16- A	Data sharing helped me to have effective resources outcome	Extremely disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Extremely agree	
17- A	Data sharing helped me to join other individuals and organizations	Extremely disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Extremely agree	
A	**How important were each of the following outcomes for you for data sharing?**										
18-	Loss of control over spatial data is	Bad	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Good	
19-	Loss of security over spatial data is	Bad	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Good	
20-	Sharing data makes a lot of trouble to me	Bad	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Good	
SNal	**How strongly would each of the following individuals have approved or disapproved of you data sharing?**										
21-	My colleagues	Disapprove	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Approve	
22-	Close friends	Disapprove	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Approve	
23-	My boss	Disapprove	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Approve	

A= Attitude, SN= Subjective Norm, SNal= Social Influence, SNet= Societal Norm, I= Intention, PBC= Perceived Behavior Control, PBCs= Self-efficacy, PBCc= Controllability

Number	Statement		Scale								
SNet	**How important was it for you to do what each of these groups think about data sharing?**										
24-	GIS community	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
25-	Moral norms	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
26-	Organizational pressure	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
PBC	**How strongly would have each item influenced your level of data sharing?**										
27-	Government regulations (legitimacy)	Not at all	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Very much
28-	Resource scarcity	Not at all	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Very much
29-	Lack of trust	Not at all	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Very much
30-	Incentives	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
31-	Past experiences with data sharing	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
32-	Uncertainty	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much
33-	Autonomy	Not at all	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Very much

A= Attitude, SN= Subjective Norm, SNal= Social Influence, SNet= Societal Norm, I= Intention, PBC= Perceived Behavior Control, PBCs= Self-efficacy, PBCc= Controllability

Part 2: *Questionnaire to measures the organizational setting behavior toward data sharing*

Number	Statement		Scale								
1- H8HI	I think there should be more rules for cooperation	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
2- H10IND	People with more ability should earn more	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
3- H11E	If people were treated more equally, we would have fewer problems	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
4*- H9F	There is no incentive for cooperation with people, you only get a problem	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
5- H8HI	I am more strict than most people about what is right and wrong	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
6*- H9F	Cooperating with others rarely works	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
7- H8HI	I value regular routines highly	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
8*- H10IND	I like to cooperate, but I don't always have the time to do it	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
9- H11E	The government should make sure everyone has a good cooperation with others	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
10*- H9F	The future is too uncertain for a person to make serious plans	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
11- H10IND	Making money is the main reason for spatial data sharing	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
12- H11E	I would support the work that made people cooperate with each other	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree

HI= Hierarchy, E= Egalitarianism, IND= Individualism, F= Fatalism
*For these questions, the scale was inverted for the analysis to make the answers compatible.

Part 3: *Questionnaire to measures your data sharing culture*

Number	Statement		Scale								
1- H6	Uncertainty in cooperation is a threat prevent me to share data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
2- H4	Men need to be assertive	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
3- H2	For me to share data, I should follow the opinion of my group	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
4- H1	Individuals are expected to look after themselves	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
5- H5	I am confident that personal thrift (saving) is important to share data	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
6- H3	Data sharing decision are made for me by others	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
7- H6	There is a need for written rules and regulations toward data sharing	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
8- H4	Work is the focus of life	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
9- H2	One belongs and opinions toward data sharing are predetermined by the organization	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
10- H1	For me I only take care of myself when I think about data sharing	Strongly disagree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly agree
11- H3	Everyone should have equal rights to share data	Strongly agree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly disagree
12- H5	If you take care of today's problems, the long run will take care of data sharing	Strongly agree	-3 ☐	-2 ☐	-1 ☐	0 ☐	1 ☐	2 ☐	3 ☐	Strongly disagree

Number	Statement		Scale								
13- H3	To share data inequality in organization should be minimized	Strongly agree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly disagree
14- H6	A willingness to take risk is important to share data	Strongly agree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly disagree
15- H4	Human relationships are the most important thing in data sharing cooperation	Strongly agree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly disagree
16- H2	Group decisions are ideal when you think about data sharing	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
17- H1	Everyone has a right to a private opinion towards data sharing	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
18- H5	Saving resources is important to have control on data sharing	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree

H= Hypothesis

Part 4: *Questionnaire to measures Motivational factors affects data sharing behavior*

Number	Statement	Scale									
1- H12	For me, cooperation with others is based on honesty	Strongly disagree	1	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
2- H14	Uncertainty creates negative data sharing relationships between individuals	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
3- H15	Incentives are the reason why data sharing is positive	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
4- H16	Resource scarcity influenced my data sharing level with other individuals	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
5- H17	For me autonomy between individuals or organizations creates negative data sharing relationships	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
6- H19	Bureaucracy makes sharing beyond my control	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
7- H12	For me trust creates positive data sharing relationships between individuals	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
8- H14	Uncertainty create pessimistic data sharing relationships between individuals	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
9- H15	Incentives make data sharing positive	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
10- H16	Resource scarcity makes data sharing between individuals more pessimistic	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
11- H17	Autonomy create negative data sharing relationships between individuals	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree
12- H19	Daily routine make data sharing boring	Strongly disagree	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	Strongly agree

Number	Statement		Scale								
				1	2	3	4	5	6	7	
13- H13	I am confident that trust affects the data sharing between individuals	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
14- H21	Uncertain creates negative data sharing relationships between organizations	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
15- H18	I am confident that autonomy affects data sharing between individuals	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
16- H23	Bureaucratic make data sharing level between organizations low	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
17- H13	I am certain that trust affects the level of data sharing between individuals	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
18- H21	Uncertain creates pessimistic data sharing relationships between organizations	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
19- H18	I am self-assured that autonomy affects data sharing between individuals	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
20- H23	Bureaucratic organizations influence my data sharing level	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
21- H20	Trust creates positive data sharing relationships between individuals and organizations	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
22- H22	Autonomy makes data sharing relationships between individuals and organizations more negative	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
23- H20	Cooperation with others organizations is generally based on trust	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree
24- H22	Autonomy creates pessimistic data sharing relationships between organizations	Strongly disagree		☐	☐	☐	☐	☐	☐	☐	Strongly agree

H= Hypothesis

Appendix 3: Questionnaire questions to determine the individual and collective behavior toward spatial data sharing (belongs to chapter 5)

Domain	Theoretical variables		Questions	Scale								
Perceived Benefit of Spatial Data Sharing (SDS)	Behavioral beliefs	1	For me to share (giving) spatial data is…	Harmful	1 2	3 4	5 6	7	Beneficial
		2	Spatial data sharing helped me to join other individuals and organizations.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
Confidence to Engage in SDS	Normative beliefs	3	I am confident that I can share spatial data.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
		4	My institution encourages me to share spatial data.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
Perceived Control over SDS	Control beliefs	5*	The decision to share spatial data is beyond my control.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
		6	The decision to share spatial data is completely up to me.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
Perceived general role of trust in SDS	General perception of actual behavioral control	7	For me trust creates positive spatial data sharing relationships between individuals.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
		8	I am certain that trust affects the level of spatial data sharing between organizations.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
Perceived Institutional Constraints to SDS	General perception of actual behavioral control	9	Bureaucracy makes the spatial data sharing level between our organizations low.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree
		10	Daily routine makes spatial data sharing boring for me.	Strongly disagree	1 2	3 4	5 6	7	Strongly agree

*For this question, the scale was inverted for the analysis to make the answers compatible.

Appendix 4: Questionnaire questions to assess the organizational change behavior toward spatial data sharing (belongs to chapter 6)

Behavior		Questions		Scale									
Attitudinal Belief		1	For me to share (giving) spatial data is…	Harmful	1	2	3	4	5	6	7	Beneficial
		2	For me getting spatial data is…	Bad	1	2	3	4	5	6	7	Good
		3	For me spatial data sharing is…	Not interesting	1	2	3	4	5	6	7	Interesting
Normative Belief	Social influence	4	Most of my colleagues whose I consult them think that I should share spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		5	For me to share spatial data, I should follow the opinion of my group	Not at all	1	2	3	4	5	6	7	Very much
		6	My boss approve me sharing spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		7	My institution encourage me to share spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
	Societal norm	8	My government approve me sharing spatial data	Not at all	1	2	3	4	5	6	7	Very much
		9*	GIS community prevent me to share spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Control Belief	Self-efficacy	10	I am confident that I can share spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		11*	There are no incentives for cooperation with people, you only get a problem	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		12	Spatial data sharing helped me to join other individuals and organizations	Not at all	1	2	3	4	5	6	7	Very much
	Controll-ability	13	The decision to share spatial data is completely up to me	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		14	I can decide to share spatial data or not	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		15*	Spatial data sharing decision are made for me by others	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Intentional Belief		16	I intend to share spatial data	No	1	2	3	4	5	6	7	Yes
		17	I plan to share spatial data	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
		18*	I like to cooperate, but I don't always have the time to it	Strongly disagree	1	2	3	4	5	6	7	Strongly agree

*For these questions, the scale was inverted for the analysis to make the answers compatible.

Appendix 5: Intervention supervisors versus control supervisors (belongs to chapter 6)

Supervisors	t- statistic			r- Correlation coefficient			Correlation differences			Standard deviations		
	PRE, THEN	POST, PRE	POST, THEN	POST, PRE	PRE, THEN	POST, THEN	CD1	CD2	CD3	SD1	SD2	SD3
Intervention group												
1	2.35	-11.43	11.20	0.12	0.44	0.22	-0.21	0.10	0.32	-0.10	0.60	0.70
2	1.30	-12.55	9.88	0.47	0.06	0.12	0.07	-0.34	-0.41	-0.09	0.40	0.49
3	2.80	-12.12	12.68	0.25	0.27	0.32	0.05	0.07	0.02	-0.24	0.80	1.04
4	2.20	-13.34	10.55	0.13	0.35	0.22	-0.12	0.09	0.22	0.09	0.49	0.40
5	2.59	-10.52	5.62	0.28	0.43	0.33	-0.10	0.05	0.15	0.11	1.00	0.89
6	1.40	-12.55	9.88	0.27	0.04	0.32	0.29	0.05	-0.24	-0.14	0.55	0.69
7	1.59	-13.55	9.88	0.27	0.01	0.32	0.32	0.05	-0.27	0.09	0.60	0.51
8	2.70	-12.55	10.90	0.18	0.61	0.34	-0.27	0.16	0.43	-0.13	0.82	0.95
9	2.59	-9.14	8.88	0.21	0.39	0.22	-0.17	0.01	0.18	0.09	0.96	0.86
10	2.30	-12.55	6.32	0.16	0.69	0.21	-0.48	0.05	0.53	-0.12	0.08	0.20
11	1.10	-9.65	9.88	0.45	0.02	0.12	0.10	-0.33	-0.43	-0.31	0.12	0.43
12	1.59	-11.55	9.88	0.67	0.05	0.12	0.08	-0.55	-0.63	0.01	0.62	0.61
13	2.20	-10.00	10.00	0.09	0.50	0.14	-0.36	0.05	0.41	-0.02	0.68	0.70
14	1.30	-12.55	9.88	0.57	0.01	0.22	0.22	-0.35	-0.57	-0.04	0.65	0.69
15	1.10	-12.55	8.00	0.37	0.02	0.32	0.31	-0.05	-0.36	-0.10	0.63	0.74
16	2.60	-13.55	10.70	0.15	0.46	0.17	-0.30	0.02	0.31	-0.06	0.40	0.46
Control group												
1	0.84	-1.37	1.54	0.67	0.59	0.74	0.06	0.15	0.08	-0.13	-0.28	-0.15
2	0.64	-1.37	2.54	0.44	0.29	0.24	-0.20	-0.05	0.15	-0.38	-0.55	-0.17
3	0.84	-2.37	1.54	0.49	0.62	0.49	-0.01	-0.13	-0.13	-0.62	-0.78	-0.16
4	0.74	-1.37	2.00	0.27	0.49	0.54	0.27	0.04	-0.23	-0.32	-0.71	-0.39
5	0.64	-1.37	1.32	0.49	0.39	0.45	-0.04	0.06	0.10	-0.32	-0.50	-0.18
6	0.84	-2.37	2.00	0.59	0.59	0.14	-0.45	-0.45	0.00	0.19	-0.09	-0.28
7	0.84	-1.37	1.54	0.49	0.51	0.48	-0.02	-0.04	-0.02	-0.60	-1.00	-0.40
Mean Intervention	1.98	11.88	9.63	0.29	0.27	0.23	0.04	0.06	0.02	0.06	0.59	0.65
Mean Control	0.77	1.66	1.78	0.49	0.50	0.44	0.05	0.06	0.01	0.31	0.56	0.25
Mean Rank Intervention	15.50	8.50	14.00	15.50	9.81	10.97	18.50	15.75	15.50	13.50	10.50	15.50
Mean Rank Control	4.00	20.00	6.00	4.00	17.00	14.36	20.00	13.14	4.00	14.29	8.57	4.00
Mann-Whitney U	0.00	0.00	0.00	0.00	21.00	39.50	0.00	20.00	0.00	40.00	32.00	0.00
Z	-3.76	-3.99	-5.98	-3.57	-2.34	-1.13	2.43	-2.42	-3.76	-1.07	-1.61	-3.83
R	0.94	0.99	1.49	0.89	0.59	0.28	0.61	0.61	0.94	0.26	0.40	0.95
P. Sig.	0.000	0.000	0.009	0.000	0.175	0.078	0.000	0.015	0.000	0.008	0.118	0.000

CD1 = $r_{POST, THEN}$ - $r_{POST, PRE;}$ CD2 = $r_{POST, THEN}$ - $r_{PRE, THEN;}$ CD3 = $r_{POST, PRE}$ - $r_{PRE, THEN;}$ SD1 = SD_{THEN} - $SD_{PRE;}$ SD2 = SD_{POST} - $SD_{PRE;}$ SD3 = SD_{POST} - SD_{THEN}

ABOUT THE AUTHOR

El-Sayed Ewis Omran was born on June 17, 1969 in El-Behira, Egypt. In June 1990, he received his BSc degree in Agriculture Science at Suez Canal University and graduated with the grade Excellent with Honor degree. From then, he has been appointed as a researcher at the same University. In June 1996 he obtained a MSc in soil science at Suez Canal University. From 1995 to 2003 he was an assistant professor of soil science (pedology) at the same University. From June 2003 he was studying at Wageningen University, The Netherlands. Meanwhile, he graduated also as MSc in geo-information science at Wageningen University in May 2005. From June 2005 to June 2007, he is doing his PhD research at the Center for Geo-Information (CGI) of Wageningen University, The Netherlands. His thesis, which you have hopefully just read after arriving at this section, addresses spatial data sharing from theory to practice. His current research interests are diverse but his main focus includes spatial data sharing, network analysis, and individual and organizational change. El-Sayed Ewis Omran is married and has two children, Hoda and Eman.

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PHD TRAINING AND SUPERVISION PLAN (PE&RC)

With the educational activities listed below the PhD candidate has complied with the educational requirements set by the C.T. de Wit graduate School for Production Ecology and Resource Conservation (PE&RC) which comprises of a minimum total of 22 credits (= 32 ECTS = 22 weeks of activities).
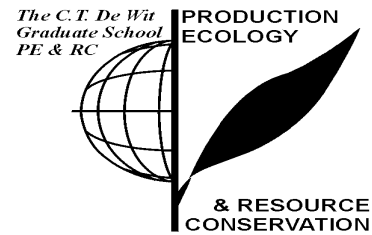
Review of Literature (4 credits)
- Potential theories promising to explain spatial data sharing behavior (2005)

Writing of Project Proposal (5 credits)
- Spatial data sharing: modelling individual and institutional behavior (2005)

Post-Graduate Courses (4 credits)
- Advanced statistics; SCU (2006)
- Socio-cultural field research methods; MGS (2006)

Deficiency, Refresh, Brush-up and General Courses (10.3 credits)
- Spatial data infrastructure; GIRS (2004)
- Geo-information tools; GIRS (2004)
- Techniques for writing and presenting a scientific paper; WIAS (2005)
- Project and time management; WGS (2005)
- Scientific publishing; WGS (2007)

PhD Discussion Groups (4 credits)
- Application of GIS in environmental studies (2003)
- Statistics, maths and modelling in production ecology and resource conservation (2004-2006)

PE&RC Annual Meetings, Seminars and Introduction Days (1.4 credits)
- PE&RC day (2003)
- PE&RC annual meeting (2004/2005)
- The PE&RC introduction weekend (2005)
- PE&RC 10 years anniversary (2005)

International Symposia, Workshops and Conferences (6 credits)
- Global spatial data infrastructure from pharaohs to geo-informatics; GSDI-8, Egypt (2005)
- Workshop on exploring spatial data infrastructures; CGI, Wageningen (2006)
- Promoting value- added GI services; TU, Delft (2006)
- Master class realistic explanation; Utrecht and Wageningen (2006)
- 9th International conference of the global spatial data infrastructure; Santiago de Chile (2006)

الفصل السادس من هذه الرسالة يعتبر خطوة أولى لتغيير سلوك الأفراد والهيئات تجاه تبادل البيانات. وإحدى الجوانب الرئيسية التي يجب أن نبدأ بها لتغيير سلوك الفرد تجاه تبادل البيانات هي أن نبدأ بتغيير النية والقصد. فإذا تغير القصد الرئيسي للفرد داخل الهيئة تجاه تبادل البيانات فإن نتائج الهيئة سوف تتقدم. هذا التغيير يتم على ثلاث مراحل (ألفا – بيتا – جاما). يركز هذا الفصل على دراسة تأثير تغيير سلوك مجموعة من رؤساء الهيئة على تبادل البيانات. وتبين النتائج أن ألفا وبيتا قد تغيرت وهذا يدل على أن سلوك الأفراد تجاه تبادل البيانات قد تغير فعلاً.

وعليه فالفصل الأخير من الرسالة يعتبر بمثابة خلاصة عامة. تبين نتائج الهدف الأول (الفصل الثاني) أن الدراسات المتعلقة بتبادل البيانات تأخذ مكانة مهمة لإيجاد نظرية جديدة لدراسة سلوك الفرد والهيئة تجاه تبادل البيانات الجغرافية. إن السلوك الفردي يجعل الحصول على البيانات الجغرافية أكثر صعوبة. تشير النتائج إلى أن نظرية Theory of Planned Behavior, Cultural Theory, Hofstede's Culture Dimensions and Social Network Theory من بين النظريات الهامة لتفسير سلوك الفرد والهيئة تجاه تبادل البيانات. هذه النظريات تم استخدامها لبناء النموذج الشامل المقترح (الهدف الثاني – الفصل الثالث) لدراسة العوامل التي تؤثر على تبادل البيانات الجغرافية. الهدف الثالث (الفصل الرابع) هو اختبار هذا النموذج لتشجيع تبادل البيانات بين الأفراد والهيئات والمجتمعات. أشارت النتائج إلى أن رغبة الأفراد في مصر وهولندا لتبادل البيانات الجغرافية كان عالياً. أما استعداد الهيئات لتبادل البيانات في هولندا فكان عالياً بينما في مصر كان منخفضاً. لأن الرغبة في مصر لتبادل البيانات منخفض فإن الهدف الرابع والخامس قد تم اقتراحه. الغرض من الهدف الرابع (الفصل الخامس) هو تحديد ـ والتعرف على ـ الأنماط التي تشكل الموقف الفردي تجاه تبادل البيانات. أبرزت النتائج أن المشروع يمكن أن يعتبر مزيجاً من الثقافات السائد فيها هو النظام الهرمي والمعزول hierarchy and fatalism. لذا فإن التحدي الحقيقي لتحسين تبادل البيانات في هذا المشروع لا يحدث إلا إذا كانت الهيئة توفر الفرص لتدفق البيانات و تبادلها بين الوحدات دون ضرورة الحصول على موافقة رؤسائهم. وهذا لا يحدث إلا إذا استطعنا تغيير السلوك الفردي تجاه تبادل البيانات (الهدف الخامس). تشير نتائج الهدف الخامس (الفصل السادس) إلى أن رؤساء الهيئة قد تغير سلوكهم تجاه تبادل البيانات (تبادل فعلى) تغير فعلي الذي تم تقييمه بثلاثة أنواع مختلفة من التغيرات (ألفا – بيتا – جاما). إن تغيير السلوك تجاه تبادل البيانات هو وسيلة هامة لضمان أن الخبرات في الهيئة قد استخدمت بصورة فعاله لزيادة تطور الهيئة .

للفصل الثاني من الرسالة هدفان. أولاً هذا الفصل يصف ويحلل أهم ما كتب عن تبادل البيانات الجغرافية بغرض معرفة أهم الثغرات النظرية والعملية لتبادل البيانات. والثغرة الأساسية التي تم تحديدها هي أن الدراسات التي تمت على سلوك الأفراد تجاه تبادل البيانات الجغرافية لا تزال في بداياتها. ثانياً هذا الفصل يستعرض أهم النظريات الاجتماعية والثقافية لفهم سلوك الأفراد تجاه تبادل البيانات. نظرية Theory of Planned Behavior, Cultural Theory, Hofstede's Culture Dimensions and Social Network Theory تم تحديدها كأهم النظريات لشرح وفهم سلوك الأفراد تجاه تبادل البيانات. إن المساهمة الرئيسية لهذا الفصل هو اقتراح إطار جديد لفهم ودراسة سلوك الأفراد والهيئات تجاه تبادل البيانات من منظور اجتماعي وثقافي.

يوضح الفصل الثالث من الرسالة أن تبادل البيانات الجغرافية بعيد عن الحالة المثلى وهذا يعتبر تحديا لإيجاد نظرية جديدة لفهم سلوك الأفراد والهيئات تجاه تبادل البيانات. وتعتبر مواقف الأفراد والهيئات تجاه تبادل البيانات مشكلة كبيرة. لذا فإن الهدف من هذا الفصل هو اقتراح نموذج جديد. هذا النموذج مبني على أساس عدد من النظريات والمفاهيم منها : Theory of Planned Behavior, Cultural Theory, Hofstede's Culture Dimensions and Social Network Theory. حيث تم صياغة العلاقات داخل النموذج في ٢٣ فرضية. ان معرفة العلاقات بين الأفراد والهيئات المستمدة من النموذج قد توفر رؤية جديدة لفهم مواقف الأفراد والهيئات تجاه تبادل البيانات.

أما الفصل الرابع فيتناول نتائج البحث التجريبي لاختبار صحة ال ٢٣ فرضية في النموذج المقترح في الفصل الثالث. هذا النموذج يضم Hofstede's culture dimensions والعوامل المساعدة Motivational factors لتبادل البيانات. من السمات الرئيسية لهذا النموذج هو تمييز الفرق بين سلوك الفرد والهيئة تجاه تبادل البيانات الجغرافية. ولقد أجريت دراسة تجريبية لاختبار ال ٢٣ فرضية المقترحة في دولتين مختلفتين (مصر – هولندا). حيث أجريت استبانه رسميا بين أفراد(عينه) من هيئة المساحه المصريه (مصر) و Alterra (هولندا). توفر النتائج التي تم الحصول عليها دعماً للكثير من الفرضيات المقترحة مشدداً على دور الفروق الثقافية والعوامل المساعدة تجاه تبادل البيانات. يوصي هذا الفصل بأن النموذج المعدل يمكن تطبيقه في الدول الأخرى سواء المتقدمة أو النامية. ويعتبر هذا النموذج هام لواضعي السياسات تجاه تبادل البيانات. إن المقارنة بين مختلف الثقافات تجاه تبادل البيانات من شأنها أن تقدم مساهمة مفيدة لمواصلة تطوير البنية الأساسية للبيانات الجغرافية .

يقدم الفصل الخامس من هذه الرسالة Social Network Theory (SNA) لرسم العلاقات بين الأفراد تجاه تبادل البيانات. فباستخدام SNA يمكن دراسة سمات وصفات تبادل البيانات بين الأفراد. يحاول هذا الفصل تطبيق SNA في دراسة تبادل البيانات بين الأفراد والهيئات مركزا على نمط تبادل البيانات. تشير النتائج التي تم الحصول عليها أن تبادل البيانات في هيئة المساحة المصرية يتبع النظام الهرمي والمعزول hierarchy and fatalism. إن المعتقدات والتصورات الفردية تجاه تبادل البيانات تظهر أنماط تتطابق بشدة مع هيكل الشبكة في الهيئة. وتلعب قيادات ورؤساء الهيئة الدور المركزي في تبادل البيانات أما المرؤوسون فيشعرون أنهم أقل تحكم في عملية تبادل البيانات داخل الهيئة . يبين هذا الفصل أن SNA تعتبر وسيلة وأداة مفيدة لدراسة تبادل البيانات. هذه الدراسة يمكن توسيعها لتشمل دراسة تبادل البيانات مع استخدام التكنولوجيا الرقمية.

الملخص العربي

أصبحت تنمية وتطوير وصيانة البيانات الجغرافية من أكثر المكونات تكلفة في استخدام التكنولوجيا لمعالجة المشاكل اليومية المرتبطة بالتطبيقات المختلفه للبيانات الجغرافية ، وهي تستثمر البلايين من الدولارات سنويا في إنتاج وصيانة البيانات الجغرافية. يتطلب اتخاذ القرارات السليمة أيضا تكامل البيانات الجغرافية. وتحتاج أي هيئة أو معهد إلى الحصول على البيانات الجغرافية، ولذا أصبح تبادل البيانات الجغرافية نقطه أساسية يتعين معالجتها والتغلب على مشاكلها من أجل تنفيذ برامج ناجحة للبنية الأساسية للبيانات الجغرافية. إن تبادل البيانات الجغرافية ضروري جداً لكفاءة وفاعلية صنع القرار، ويتطلب الأداء السليم لبنية البيانات الأساسية موقفا إيجابيا تجاه تبادل البيانات الجغرافية. وعلى الرغم من ذلك فإن هناك تساؤلاً رئيسياً حول مدى استعداد الأفراد والهيئات للمشاركة في تبادل البيانات الجغرافية. يبدو أن هناك اختلافات بين النظرية والتطبيق المتمثلة في المقولة المعروفة " النظرية شيء لكن التطبيق شيء آخر".

إن تبادل البيانات الجغرافية هو أكثر بكثير من مجرد نظام للوصول إلى البيانات الجغرافية. إنه يشمل سلوك ومواقف الأفراد تجاه تبادل البيانات التي تشكلها الظروف (الاجتماعية والثقافية) المحيطة. لذا فإن التحدي الحقيقي لتحسين تبادل البيانات يقع أولاً على مدى فهمنا لسلوك ومواقف الأفراد والهيئات وأثر الجوانب الاجتماعية والثقافية . لذا فالسؤال الذي يطرح نفسه الآن هو "كيف يمكن سد هذه الفجوة بين النظرية والتطبيق؟"

تقترح هذه الرسالة إعادة التفكير لهيكلة العلاقة بين النظرية والتطبيق. وتقترح هذه الرسالة فكرة أن النظرية هي ما يعتقده الفرد تجاه تبادل البيانات ومن الممكن أن يتم تغيره (بالمشاركة الفعلية). فمن خلال النظرية يمكن إيجاد احتمالات جديدة للتغلب على عدم المشاركه في تبادل البيانات يتم تبنيها ، ومن خلال تطبيق هذه الاحتمالات تصبح حقيقة للتغلب علي عدم المشاركه بالتغيير في المواقف والسلوك الفردي تجاه تبادل البيانات.

إن الدراسات المنهجية للجوانب الاجتماعية والثقافية التي من شأنها أن تؤثر على مدى استعداد الأفراد لتبادل البيانات نادرة جداً. وتحقيقاً لهذه الغاية فإن الهدف الرئيسى لهذه الرسالة هو دراسة الجوانب النظرية والعملية لتبادل البيانات الجغرافية من منظور اجتماعي وثقافي ، ولصياغة الهدف الرئيسى خمسة أهداف محددة صيغت في هذه الرسالة:-

● التعرف على أهم النظريات الاجتماعية والثقافية التي يمكن من خلالها فهم سلوك الأفراد والهيئات تجاه تبادل البيانات الجغرافية.

● اقتراح نموذج نظري لفهم سلوك تبادل البيانات الجغرافية.

● اختبار النموذج المقترح والتحقق منه.

● تحديد السلوك الفعلي تجاه تبادل البيانات الجغرافية في إحدى الهيئات المصرية.

● تغيير وتقييم سلوك الأفراد والهيئات تجاه تبادل البيانات الجغرافية الفعلي.

يستعرض الجزء التالي ملخصاً لهذه الأهداف الخمسة. يتناول كل فصل من الفصول ٢ ـ ٦ إحدى هذه الأهداف.

تبادل البيانات الجغرافيه من النظرية إلى التطبيق

رسالة دكتوراه مقدمة من

السيد عويس عمران عبيد

لاستكمال الدراسات المقررة للحصول على درجة الدكتوراه في
علوم الاستشعار عن بعد و نظم المعلومات الجغرافيه

جامعة فاخننجن

قسم العلوم البيئيه

معمل الاستشعار عن بعد و نظم المعلومات الجغرافيه

فاخننجن – هولندا

٢٠٠٧م