

In Search of Rigorous Models for Policy-oriented Research: A Behavioral Approach to Spatial Data Sharing

Uta Wehn de Montalvo

Abstract: This article introduces a theory from social psychology as an organizing framework for policy-oriented research on spatial data sharing. The article demonstrates how, using this approach, the incentives and disincentives that determine the intention of key individuals within organizations to share spatial data can be identified in a systematic fashion. With a view to methodological considerations, the article reviews research on spatial data sharing and examines the relevance of decision-making research for this field. It considers the contribution of the Theory of Planned Behavior to research on spatial data sharing and identifies the appropriate unit of analysis. Actual results that have been generated using the Theory of Planned Behavior for research on spatial data sharing are presented. These findings can form a profile of perceptions that provides a basis for addressing the issue of spatial data sharing more effectively at the policy-making level. Conclusions are drawn on the relevance of this behavioral approach to research on spatial data sharing.

Introduction¹

With the increasing use of the geographic information system (GIS) in industrialized and developing countries, the availability of spatial data has become an issue that affects many organizations. Spatial data initiatives are reliant on the willingness of different organizations to engage in spatial data sharing in order to be effective in overcoming bottlenecks in the availability of spatial data. An important role of spatial data initiatives involves more than the coordination and development of metadata, clearing-houses, and standards components. The important aspect that can be expected to vary considerably for each national initiative is the existence or the fostering of a data sharing culture (Clarke et al. 1998) that encourages participation in spatial data sharing. The purpose of this article is to demonstrate that the Theory of Planned Behavior can be applied as an organizing framework for policy-oriented research to identify the motivations and obstacles of different groups of actors to engage in spatial data sharing.

This article is organized into three parts. In search of rigorous models to better understand spatial data sharing, the first section reviews research on spatial data sharing and examines the relevance of decision-making research, and of the Theory of Planned Behavior in particular, for the issue of access to geographic information and spatial data sharing. The second section discusses the components of this theory, notes the contribution that its application can make to research on spatial data sharing, and considers the appropriate unit of analysis. The third section demonstrates the results that can be generated using the Theory of Planned Behavior as an organizing framework for research on spatial data sharing. Thus it is possible to identify—empirically—the fundamental factors underlying a disposition to engage in spatial data sharing within a specific community of actors (i.e., national or regional). For policy makers, these insights can provide a basis for the formulation of appropriate mechanisms to encourage spatial data sharing behavior.

Behavioral Models and Research on Spatial Data Sharing

The growing importance of spatial data availability and data access for the effective use of GIS has begun to generate a branch of research that focuses directly on the issue of spatial data sharing. Several contributions have been made to gain an understanding why organizations may or may not wish to engage in spatial data sharing. The factors that have been considered 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. Several models have been advanced in this field of research, and this section considers their strengths from a methodological perspective.

The conceptual framework for spatial data sharing across organizational boundaries proposed by Obermeyer and Pinto (1994) combines a number of variables as facilitators and inhibitors, and as outcomes. These variables consist of the antecedents that may improve the likelihood of creating positive, collaborative relationships between organizations and of the consequences of spatial data sharing. Although Obermeyer and Pinto claim that the variables in the model have been drawn from organization theory, intergroup dynamics, exchange theory, and political-economy, a major limitation of this framework is the lack of a justification for the inclusion of these factors in the model and for the exclusion of other factors.

Kevany (1995) proposed a structure for observing spatial data sharing by exploring the factors and conditions that may create a conducive environment for sharing. These factors consist of: a) sharing classes; b) project environment; c) the need for shared data; d) the opportunity to share data; e) the willingness to share data; f) the incentive to share data; g) the impediments to sharing; h) the technical capability to share; and i) resources for sharing. A number of measures for each of the factors are proposed in order

to determine the probability of successful sharing. Although very comprehensive, Kevany's method of analyzing the environments for spatial data sharing has several limitations. There is no explicit basis for the inclusion of the factors, nor is there a basis for conceptualizing the likely relationships between these factors. The factors are derived on the basis of the author's personal insights and experiences with GIS design, implementation, and operation projects. Hence, there is no organized framework in which to analyze the relevance of these factors. Moreover, the framework proposed by Kevany has not been verified empirically.

Azad and Wiggins (1995) proposed a research framework that focuses on inter-organizational dynamics. The central tenet of their framework is autonomy. Azad and Wiggins assume that sharing results in a loss of autonomy and increased interdependence of organizations, and they argue that these consequences are at odds with the organizational goals. These are the principle obstacles to spatial data sharing that have to be addressed. Their framework consists of a typology of inter-organizational spatial data sharing and the reasons for the development of inter-organizational relationships. In addition, Azad and Wiggins argue that the likelihood of establishing inter-organizational relations is related to the intensity of the relationship and the loss of organizational autonomy required by the relationship. Finally, they propose a process model to manage the development of inter-organizational relations for spatial data sharing.

The starting point for the Azad and Wiggins framework is open to question. The assumptions that, firstly, spatial data sharing necessarily leads to a loss of autonomy and increasing interdependence among organizations and that, secondly, these consequences are inherently negative from an organization's point of view have not been subject to empirical confirmation. Similar assumptions about the nature of the power of, and control over, spatial data are embedded in much of the literature as indicated by the following:

Because geographic information has potential value to those with effective access to it, this realization gives rise to the desire to exercise ownership rights over the information. Thus, the power that information provides is antipathetic to sharing. (Onsrud 1995:293)

If we agree that the possession of [spatial] information serves as a source of control for individuals and organizations, then we are faced with questions about the ways in which organizations can be induced to relinquish this control. (Obermeyer and Pinto 1994:107)

In contrast, in this article it is argued that it is not possible to presume the obstacles to sharing a priori. Instead, they should be the subject of empirical verification. As Pinto and Onsrud (1995: 48) suggested; "... little is known, for instance, about the reasons why governmental agencies and other GIS-using organizations will or will not share GIS-related information."

The point of departure for research into whether and why individuals within organizations may be willing to engage in spatial data sharing should be located one step back owing to: "... the potentially differing perceptions of the benefits from [spatial] data sharing" (Spertling 1995:391).

Perceptions may also vary with respect to the costs of, or obstacles to, sharing spatial data. The nature of these perceptions should not be generalized across organizations without recourse to an empirical investigation that permits validation of some of these assumptions and that provides a basis for generalization. Rhind (1998) provided a summary of the views of different players and stakeholders in spatial data and their agendas, which suggests that the perceptions of various actors from the public and the private sector may differ substantially in terms of finance and the dissemination of information, both in the short and in the long term.

Under "Research Initiative 9: Institutions Sharing Geographic Information" of the National Center for Geographic Information and Analysis (NCGIA) in the United States, a focus group considered the organizational aspects of sharing (Batty 1992, Onsrud and Rushton 1992, 1996). The outcome is a two-dimensional matrix of organizational issues and organizational forms to measure the degree and impact of spatial data sharing (Onsrud and Rushton 1992). Research in this case is directed to investigating the complexities of dynamic interactions at work in sharing activities. Similarly, Nedovic-Budic and Pinto (1999) proposed a conceptual framework, based on Kevany (1995) and a literature review, consisting of four general theoretical constructs, namely context, motivation, coordination mechanisms, and outcomes. In their subsequent research, they used case study and survey methods. In particular, the empirical research on the nature of interorganizational sharing arrangements (Nedovic-Budic et al. 2001) focused on sharing "clusters" of organisations. However, in both the Research Initiative 9 and the Nedovic-Budic and Pinto framework, the focus on actual incidents of sharing (albeit successful and unsuccessful sharing activities) limits the scope of the research to an investigation of the views of the "sharers." "Non-sharers" are excluded and, hence, important insights into why individuals within organizations may not be willing to share cannot be captured.

In summary, the above discussion has raised two essential concerns about research on spatial data sharing. First, the determinants of whether and why organizations may be willing to engage in spatial data sharing with other organizations should be established empirically, they should not be assumed a priori. Second, the scope of empirical research should encompass the whole community of potential sharers involved in GIS and not just the actual "sharers." If the fundamental factors underlying a disposition to engage in spatial data sharing can be identified, this can provide a basis for the formulation of appropriate mechanisms to encourage spatial data sharing behavior. In this article, it is argued that the Theory of Planned Behavior represents a robust and rigorous model from social psychology that can be employed to make the incentives for, and obstacles to, spatial data sharing the subject of empirical verification and that it will yield useful insights for policy. Furthermore, the empirical investigation based on the Theory of Planned Behavior can be designed to incorporate all potential "sharers."

Theory-Driven Models in Decision-Making Research

Research into factors that influence human judgment and decision-making provides a basis for exploring the issue of spatial data sharing from a perspective that focuses on the various positions that individuals in different organizations take toward spatial data sharing and on why they take these positions. The field of human judgment and decision making is interdisciplinary, drawing on contributions from economics, political science, organization and management studies, and social psychology. The starting point for much decision-making research is rational choice theory (Abelson and Levi 1985, Medin and Bazerman 1999), and much of the research has focused on the comparison of actual decision making with principles of rationality in decision making (Dawes 1998). Rational choice theory assumes that preferences and constraints affect behavior and that individuals optimize in some way (Opp 1999). The narrow assumptions about a fully informed, rational decision-maker have given way to the realization that cognitive as well as noncognitive factors influence the decision-making process (Keren 1996, Mellers et al. 1998) and that decision-makers are not necessarily fully informed. That perceived, subjective and not merely objective tangible constraints may be relevant. Constraints and preferences taken together, rather than individual constraints on their own, may explain behavior (Opp).

Distinguishing between the many different approaches to decision making are structural and process models (Abelson and Levi 1985)². Structural models are concerned with what decision-makers choose, while process models analyze the intervening steps in cognitive processes. A further distinction, although less clear, can be drawn between normative and descriptive models (Stevenson et al. 1990, Keren 1996). The former model considers how decision-makers should make decisions and the latter model how they actually do make decisions. In light of the overall goal to examine the nature of the conditions under which the different actors involved with spatial data are willing to engage in spatial data sharing, a structural, descriptive model is most appropriate. This enables an investigation of what decisions individuals within organizations actually do take with respect to spatial data sharing.

Fitting this requirement are prospect theory and expected value (EV) models. The prospect theory developed by Kahneman and Tversky (1979) takes into account contextual factors, but it assumes the existence of an idealized individual (Abelson and Levi 1985) and suffers from ambiguity (Yates 1990). Expectancy value models make no assumptions about rationality and instead rely on the internal consistency between the constructs included in the models (Ajzen 1996). Expectancy value models are not restricted to cognitive elements and allow for the inclusion of noncognitive factors such as emotions and desires (Ajzen).

Much behavioral decision research relies on revealed, observed preferences where probabilities and values have to be inferred from people's judgments (Medin and Bazerman 1999). The contribution of social psychology to this field is the development

of direct measurements of perceived preferences and constraints (Jones 1985, Ajzen 1996, Opp 1999) which have been developed since the 1930s (Hogg and Vaughan 1995)³. The expectancy value models of attitudes used by social psychologists are employed here in order to provide a basis for analyzing the considerations that may underlie real-life decisions to share spatial data.

Attitude-Behavior Models

Research within the discipline of social psychology deals with decision making in the general context of predicting and explaining behavior, and research on attitudes is a central consideration within this body of work. Beliefs are understood as providing the subjective basis for individual's decisions. The source of beliefs may be logical processes as well as emotions or desires (Ajzen 1996). Attitudes are assumed to reflect the beliefs that the decision-maker holds (Eagly and Chaiken 1998), and the relationship between attitude and actual behavior is taken to be mediated by the intention to act (Fishbein and Ajzen 1975).

Several models of the attitude-behavior relationship have been developed that examine the beliefs that influence attitude formation. The framework for examining this relationship (which has received widespread attention in the literature) is that which has given use to expectancy value models that characterize the relationship between beliefs and attitudes. Expected values are said to be made up of subjective probabilities of outcomes and subjective evaluations (positive or negative) of outcomes of a behavior. The most salient, the Theory of Reasoned Action proposed by Fishbein and Ajzen (1975), is most appropriate when behavior is subject to volitional control and, apart from attitudes, it contains a social norm component to capture situational constraints that may influence decisions. Ajzen (1991) extended the Theory of Reasoned Action to account for planned, more complex behaviors to formulate the Theory of Planned Behavior. Neither, the Theory of Reasoned Action nor the Theory of Planned Behavior assume that decision-makers necessarily engage in elaborate cognitive processes prior to taking action (Ajzen and Fishbein 1980, Ajzen 1991); instead, an individual has formed an attitude by thinking about the consequences of a given behavior and those attitudes or intentions can be retrieved and acted upon at a later time. The Theory of Reasoned Action and the Theory of Planned Behavior are not restricted to explaining the determinants of behavior in a specific behavioral domain; they can be used in a wide range of practical situations.⁴ Among the contending theories, the Theory of Planned Behavior framework is the most widely applied and tested with considerable proven explanatory and predictive value for many behaviors.

The Theory of Planned Behavior as an Organising Framework for Spatial Data Sharing Research

The Theory of Planned Behavior represents a sound theoretical framework to map out the belief structures underlying intentional behavior.⁵ Owing to the predictive power of the intention

construct, understanding the antecedents of intentions implies understanding the behavior. This section introduces the principles of the Theory of Planned Behavior. As stated above, the Theory of Planned Behavior (Ajzen 1985, 1988, 1991, 1996) is an extension of the Theory of Reasoned Action (Fishbein and Ajzen 1975, Ajzen and Fishbein 1980) and is most appropriate for the investigation of behaviors that are not assumed to be under volitional control (i.e., performance of the behavior is not only reliant on the intention to carry out the behavior but also on opportunities and resources (Ajzen 1988)). Spatial data sharing among different organizations cannot be assumed a priori to be under volitional control because certain skills, resources, or opportunities may play a role in determining whether they can engage in spatial data sharing.

Basic Principles of the Theory of Planned Behavior

The basic model of the Theory of Planned Behavior consists of five distinct components: a particular behavior under consideration, the intention to act, and three determinants of intention. A distinction is made between the decision to engage in a particular behavior, conceptualized as Behavioral intention, and actual performed behavior.

It has been argued:

Intentions are assumed to capture the motivational factors that have an impact on a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior. These intentions remain behavioral dispositions until, at the appropriate time and opportunity, an attempt is made to translate the intention into action. (Ajzen 1988:113)

Because of the distinction between intention to act and actual behavior, the intention construct provides the basis for investigating the disposition of organizations toward spatial data sharing. Hence, it is possible to measure the intention, or the willingness, to engage in spatial data sharing which is, conceptually, expected to be closely linked to actual sharing behavior.

The first determinant of intention (i.e., the attitude toward the behavior) is a person's positive or negative evaluation of performing the behavior. The second (i.e., the subjective norm) captures the individual's perception of social pressure to engage or not to engage in the behavior. Finally, perceived behavioral control consists of the perceived availability of required opportunities and resources to perform the behavior.

These components have been tested empirically to predict intentions and behavior (e.g., Ajzen 1985, 1988, 1991, Ajzen and Madden 1986, Ajzen and Driver 1992). The relative weight of the attitudinal, normative, and control factors is expected to vary according to the behavior under investigation. As the Theory of Planned Behavior aims to explain, rather than merely predict, a behavior, it can be used to trace the determining antecedents of attitude, social norm, and perceived behavioral control. The underlying foundation of beliefs about the behavior is considered

to provide the basis for perception. "It is at the level of beliefs that we can learn about the unique factors that induce one person to engage in the behavior of interest and to prompt another to follow a different course of action" (Ajzen 1991:206-207).

The Theory of Planned Behavior, like the underlying Theory of Reasoned Action, focuses on subjective perceptions of individuals rather than on objective observations to explain behavior.

Basic to this approach is the view that people use the information available to them in a reasonable manner to arrive at their decisions. This is not to say that their behavior will always be reasonable or appropriate from an objective point of view. People's information is often incomplete and at times also incorrect. But we would argue that a person's behavior follows quite logically and systematically from whatever information he happens to have available. (Ajzen and Fishbein 1980:44)

Although people are assumed to hold a great number of beliefs about a particular behavior, only a small number, the so-called "salient" beliefs, are expected to be the predominant determinants of intention and action. According to the expectancy value principle, it is necessary for each belief and its strength (likelihood) to be rated and then combined.

Three types of beliefs can be distinguished: behavioral beliefs (influencing attitude), normative beliefs (determining social norm), and control beliefs (underlying perceived behavioral control). Behavioral beliefs consist of the evaluation of specific consequences and outcomes that may result from performing the behavior in question. Normative beliefs constitute beliefs about the important referents (individuals or groups) and their likely approval or disapproval with regard to engaging in the behavior. Control beliefs capture the perceived presence or absence of requisite resources and opportunities (such as skills and capabilities) and the cooperation of other people deemed necessary to perform the behavior.

A behavior is said to be explained once the determinants of intention and behavior have been traced to the underlying beliefs. Detailed descriptions developed at the belief level of analysis provide a systematic basis for inferring why individuals embedded within organizations may be willing, or resistant, to share spatial data.

The Appropriate Unit of Analysis: Macro and Micro Considerations

Pfeffer (1985) suggested that when trying to understand organizational behavior and decisions, a focus on the individual as the unit of analysis often leads to a neglect of normative contexts and technological aspects. Yet Jones (1985:53) stressed that: "The individual must be seen as the intersection point of a variety of pressures: immediate situational demands, conflicting social expectations, and internalized beliefs and values."

Using the Theory of Planned Behavior as an organizing framework, the influence of these aspects may be explicitly addressed by the inclusion of social norm and control components within the model. Moreover, the suitability of psychological theo-

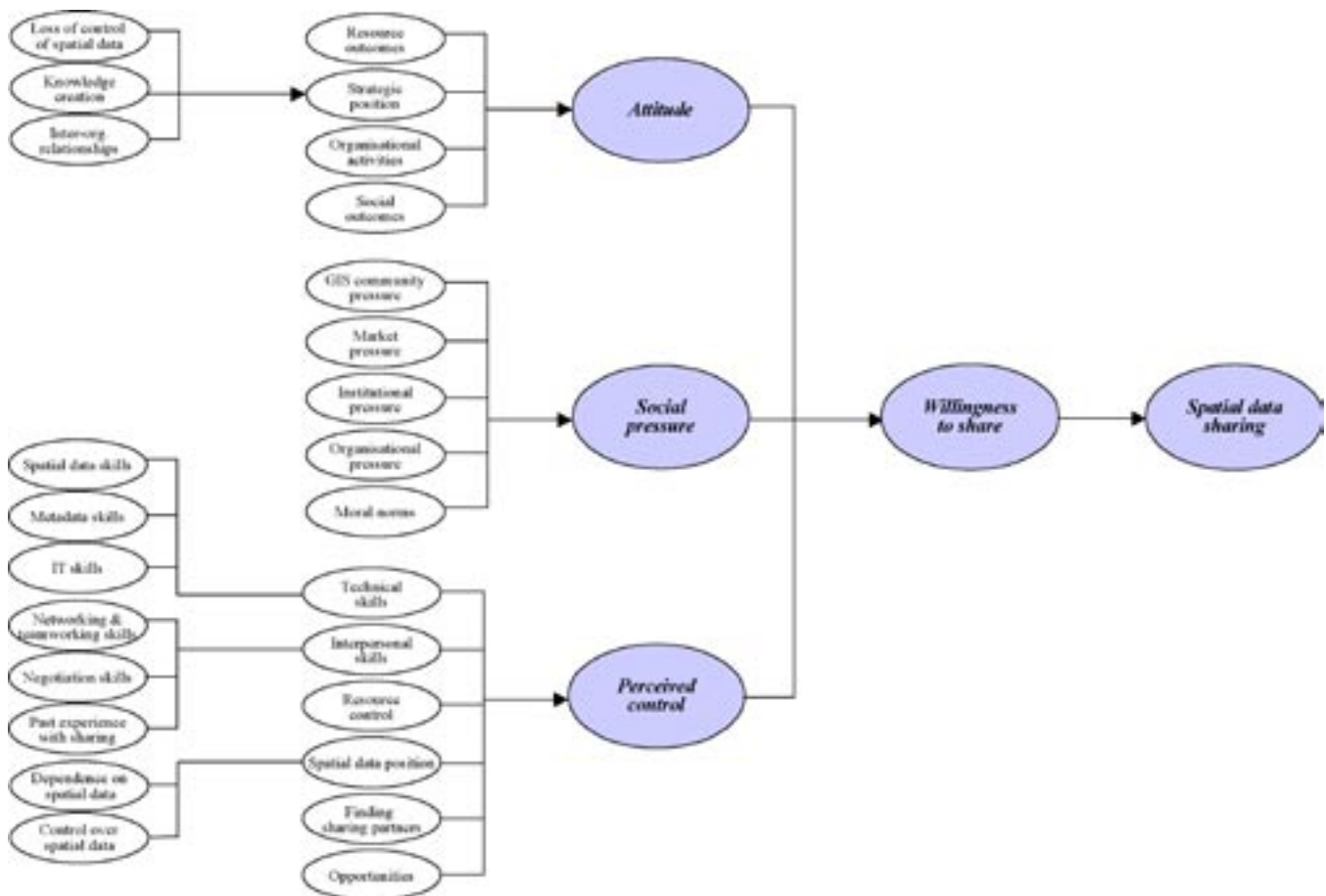


Figure 1: Model of the willingness to share spatial data across organizational boundaries (South Africa)

ries to understanding organizational behavior has been discussed by Staw (1991) and more specifically for the Theory of Planned Behavior, by Elliott et al. (1995). Staw (1991:812) suggested that psychological theories that typically examine behavior at the micro level can also be used to understand action at the macro level (i.e., organizational behavior) "...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. Bacharach et al. (1995) 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 focal situation can be expanded to a larger arena (Markus and Robey 1988).

This position with respect to the representation of individuals as indicators of likely organizational behavior provides the basis

for the research strategy advocated here. Rather than limiting the scope of the research to an in-depth study of a few organizations,⁶ a range of individuals and organizations can be included, with the goal being to examine their dispositions toward spatial data sharing.

Application of The Theory of Planned Behavior to Spatial Data Sharing

As argued above, the Theory of Planned Behavior provides a systematic way of combining qualitative and quantitative empirical research methods to arrive at a model of the propensity to engage in spatial data sharing across organizational boundaries. This framework was employed to integrate qualitative empirical evidence, with insights drawn from several bodies of literature in a systematic fashion to arrive at a model of the willingness of organizations to engage in spatial data sharing (Wehn de Montalvo 2001). This entailed two stages of empirical research. The qualitative stage involved semi-structured interviews, the results of which were analyzed and complemented by insights drawn from the appropriate theoretical and empirical literatures to build a

conceptual model of the willingness of individuals within organizations to share spatial data (see Figure 1). The resultant model was operationalised using a questionnaire, and the second, quantitative stage of research entailed the application of the questionnaire instrument using a face-to-face interview method. The survey included local, provincial, and national government, para-statal organizations, the private sector, academia, and nongovernmental organizations in South Africa.⁷

Owing to the complexity of the behavior–spatial data sharing–interviews alone would not have been sufficient to provide the necessary information about the full range of beliefs or a basis for translating them into questionnaire items. Therefore, based on the analysis of the qualitative interviews in stage one, the development of the model of spatial data sharing also employed theoretical insights drawn from several related fields of enquiry such as resource dependence theory and knowledge creation. The construction of the model and its components, as well as detailed aspects of the research methodology of the empirical research and of the analysis, are beyond the scope of this article and are considered elsewhere (Wehn de Montalvo 2001).

In this model, the intention construct refers to the willingness to engage in spatial data sharing activities across organizational boundaries; “attitude” refers to the attitude toward spatial data sharing; “subjective norm” is referred to as the social pressure to engage, or not to engage, in spatial data sharing; and “perceived behavioral control” is referred to as the perceived control over spatial data sharing activities that key individuals within organizations perceive.

The verification of the model of the willingness to share spatial data against empirical data demonstrated that, in terms of the reliability of the measures, the items in the questionnaire had highly satisfactory levels of internal reliability. With respect to conceptual validity, the analysis of the empirical data confirmed that the items in the questionnaire instrument tapped the concepts suggested by the model. Finally, concerning construct validity, the relationships between the variables derived from the Theory of Planned Behavior were all in the expected direction and confirmed the explanatory power of the model.

These results offer strong statistical support for the model. The attainment of the validity of the model constitutes a crucial step in the approach which proposes to systematize the determinants of organizations’ spatial data sharing behavior. Only after a model has been demonstrated to be valid, can it be relied upon to further the understanding of the incentives and disincentives for key individuals within organizations to engage in spatial data sharing.

Research Results–Determinants of Spatial Data Sharing

Empirical data were used to assess the factors likely to influence the willingness of key individuals embedded in organizations to engage in spatial data sharing across organizational boundaries. The specific findings are summarized below.

Regarding the intention of key individuals within organizations to share spatial data, the results suggest that willingness in South Africa cannot be taken for granted; this is contrary to the underlying assumption in the design of, and in many discussions on, spatial data infrastructures. It was found that the actual motivation of organizations in the sample was not in favor of participating in spatial data sharing. Overall, the willingness of the representatives of organizations in the sample to share spatial data across organizational boundaries was low, with only a slight increase expected in the near future. The majority of the respondents reported that their organization was undecided about whether to engage in spatial data sharing, and a small share indicated that their organizations were unwilling to share spatial data across organizational boundaries.

The results of the analysis further indicate that the intention of organizations, as expressed by the respondents in the sample, to engage in spatial data sharing did not vary significantly for the different sectors in the GIS community.⁸ There were also no significant differences in the willingness to share according to the perceived extent of self-sufficiency or dependence of organizations on spatial data. Contrary to what was expected, the willingness to share did not differ with respect to the organizations’ spatial data position (i.e., whether organizations were predominantly giving spatial data to, or receiving spatial data from, other organizations).

The results of the statistical analysis show that the intention of key individuals within organizations to engage in spatial data sharing can be predicted from corresponding measures of “attitude” toward spatial data sharing and “social norm” from important referents to engage in spatial data sharing. Somewhat greater emphasis was placed on the “social norm” component. It was found that the technical aspects of sharing in terms of the skills and resources considered under the “perceived control” component could not be confirmed as an important factor in influencing the willingness of individuals in organizations to engage in spatial data sharing. This finding suggests that, while the technical aspects that are currently the focus of attention in the context of spatial data sharing initiatives (such as the interoperability of different GIS applications and spatial data sets, the establishment of standards, and the implementation of clearinghouses) are necessary, it cannot be expected that their resolution will be sufficient to overcome the obstacles to spatial data sharing.

An additional finding was that the National Spatial Information Framework (NSIF) directorate did not emerge as an important referent for organizations with respect to their engagement in spatial data sharing. The aim of the NSIF is to build a spatial data infrastructure in South Africa in pursuit of social and economic goals by promoting spatial data sharing among different organizations. In the context of diffusion of innovations research, the intended role of the NSIF can be conceptualized as that of a change agent.⁹ Change agents are seen as opinion leaders who can influence the attitudes and behavior of individuals with respect to a particular innovation (Rogers 1995). Since the analysis could not directly confirm the NSIF as an important

referent for organizations regarding their engagement in spatial data sharing, this finding suggests that the capacity of the NSIF to influence the decisions of key individuals within organizations to engage in spatial data sharing is still limited and that it could be strengthened. The additional results of the analysis revealed ways in which the effectiveness of the NSIF to encourage greater spatial data sharing could be improved.

A more detailed and substantive explanation of spatial data sharing across organizational boundaries was obtained by distinguishing between three distinct groups of respondents—those who perceived their organizations to be willing to engage in spatial data sharing, those undecided, and those unwilling. This revealed areas important to take into account for the current spatial data sharing initiative in South Africa in order to foster a spatial data sharing “culture.” The six points are:

1. As a key referent inside the organization for spatial data sharing activities, the management of GIS-using organizations (rather than mainly the technical GIS personnel, as is currently the case) could be targeted by the spatial data infrastructure initiative in order to increase their awareness and understanding of spatial data sharing activities for the effectiveness of their organizations’ GIS and so that they may provide support and encouragement for such activities.
2. Although they are key referents outside the organization for spatial data sharing activities, the different sectors of the GIS community do not yet seem to be providing clear and encouraging stimuli for spatial data sharing. The results of the analysis also suggest that, according to the perception of the respondents, the NSIF is conceptually linked to the GIS national government departments, thereby indirectly including the NSIF in the referents from the GIS community. Yet the role of the NSIF as an important referent for organizations regarding their engagement in spatial data sharing could not be directly confirmed. In combination with the assessment of actual sharing behavior, which found that the extent of sharing was still very limited, these results suggest that a spatial data sharing “culture” has not yet developed. This adds further weight to the remaining findings of the research that can be used to guide the fostering of such a sharing culture.
3. While it is important to specify particular benefits of engaging in spatial data sharing, the results show that the disincentives for spatial data sharing also need to be addressed. In particular, the importance of reducing the fears associated with losing control over spatial data has been highlighted. While much of the promotion of the NSIF stresses the benefits of spatial data sharing across organizational boundaries, it would be helpful to reduce the fears associated with the negative consequences of such activities rather than solely emphasizing positive outcomes. The threats to an organization’s strategic position would need to be addressed by specifying how unregulated access to an organization’s spatial data by other organizations can be limited and how the use of an organization’s spatial data can be restricted to the particular organizations that are considered sharing partners. It would also be important to clarify the mechanisms that might be put in place to ensure that rules regarding the ownership of, access to, and the use of the organization’s spatial data can be enforced. With respect to the benefits of spatial data sharing, reference should be made to the potential benefits of spatial data sharing for an organization’s particular activities.
4. Generally, promotion of the National Spatial Information Framework in South Africa makes reference to the benefits of establishing the NSIF and of spatial data sharing. However, the results of this study indicate that it would be beneficial to articulate explicitly how organizations that engage in spatial data sharing are able to benefit, by focusing on their core activity, to increase the usefulness of their GIS and to improve the quality of their decision making. Furthermore, it would be important to mention the specific benefits of spatial data sharing in terms of the savings in administrative efforts that would otherwise be needed for data capture.
5. Furthermore, aside from the cost-benefit approach usually adopted in the promotion of spatial data sharing initiatives, the results showed that more intangible consequences of spatial data sharing, such as the opportunity to gain new insight, can act as incentives for spatial data sharing. They should be referred to in detail by providing information about how organizations can benefit from spatial data sharing in terms of these intangible outcomes with salient examples. Specific reference could be made to these by detailing how organizations can benefit from spatial data sharing because it may: 1) trigger dialogue and collective reflection across organizational boundaries (such as joint problem solving) and involve articulating and comparing spatial data-related concepts; 2) allow access to ideas that are codified in spatial data, enabling their translation, combination, and application in different organizations; 3) provide the means to observe spatial data skills through personal interaction and to create shared mental models and experiences across organizational boundaries; and 4) enable the combination of new and existing spatial data sets from different organizations to create new knowledge.
6. Finally, the results revealed that the South African government initiative ‘Integrated Development Planning’ has emerged as another incentive for spatial data sharing. Since this has not previously been linked to the promotion of spatial data sharing, specific reference to the benefits of spatial data sharing in terms of integrated development planning should be made in the context of the spatial data infrastructure initiative in South Africa.

Conclusions

The theory-based, behavioral approach to spatial data sharing presented in this article takes advantage of a robust model developed in another field of enquiry within the social sciences (i.e., in the existing body of knowledge about human behavior and

decision making). Based on the validation and the analysis of resultant model of the willingness to engage in spatial data sharing, it can be argued that: 1) the Theory of Planned Behavior has been applied successfully as an organizing framework for research on spatial data sharing; and 2) this model, as implemented using the questionnaire instrument, could also be used in other national contexts to elicit the dispositions of actors in a specific GIS community.

From a policy perspective, the findings of the analysis reported here show that by using the Theory of Planned Behavior, it is possible to generate specific insight for policy formulation by revealing—in a systematic fashion—the incentives and disincentives for decision-makers within organizations to share spatial data. The results can provide a basis for specific guidance as to how policy makers may influence the actual behavior of spatial data sharing more effectively. The strength of this approach is not to produce generalisable truths but to identify context-specific incentives and disincentives to spatial data sharing.

About the Author

Uta Wehn de Montalvo is researcher and advisor at the Institute for Strategy, Technology and Policy at the Netherlands Organisation for Applied Scientific Research. She previously worked as a programmer for IBM UK Ltd. and as a research officer in SPRU—Science and Technology Policy Research. She holds a B.Sc. in Computer Science, and a M.Sc. and a Ph.D. in Science and Technology Policy. Her research focuses on access to geographic information and spatial data sharing, the social aspects of implementing spatial data infrastructures, and the role of information and communication technologies for development. She currently chairs the Data Policy Working Group of the Association of Geographic Information Laboratories for Europe (AGILE).

Corresponding Address:

Dr. Uta Wehn de Montalvo

TNO - The Netherlands Organisation for Applied Scientific Research

Institute for Strategy, Technology and Policy

Schoemakerstraat 97

P.O. Box 6030

2600JA Delft, NL

email: wehndemontalvo@stb.tno.nl

References

- Abelson, R.P. and A. Levi, 1985, Decision Making and Decision Theory. In Lindzey, G. and E. Aronson (Eds.) *The Handbook of Social Psychology*, 3rd ed (New York: Random House), 1, 231-309.
- Ajzen, I., 1985, From Intentions to Actions: A Theory of Planned Behavior. In Kuhl, J. and J. Beckmann (Eds.) *Action Control—From Cognition to Behavior* (Berlin: Springer-Verlag) 11-39.
- Ajzen, I., 1988, *Attitudes, Personality, and Behavior* (Milton Keynes, UK: Open University Press), 110.
- Ajzen, I., 1991, The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Ajzen, I., 1996, The Social Psychology of Decision Making. In Higgins, E.T. and A.W. Kruglanski (Eds.) *Social Psychology—Handbook of Basic Principles* (New York and London: The Guildford Press), 297-325.
- Ajzen, I. and B.L. Driver, 1992, Application of the Theory of Planned Behavior to Leisure Choice. *Journal of Leisure Research*, 24(3), 207-224.
- Ajzen, I. and M. Fishbein, 1980, *Understanding Attitudes and Predicting Social Behavior* (Englewood Cliffs, N.J.: Prentice-Hall).
- Ajzen, I. and T.J. Madden, 1986, Prediction of Goal-Directed Behavior: Attitudes, Intentions, and Perceived Behavioral Control. *Journal of Experimental Social Psychology*, 22, 453-474.
- Alfelor, R.M., 1995, GIS and the Integrated Highway Information System. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 397-412.
- Azad, B. and L.L. Wiggins, 1995, A Proposed Structure for Observing Data Sharing. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 22-43.
- Bacharach, S., P. Bamberger, and B. Mundell, 1995, Strategic and Tactical Logics of Decision Justification: Power and Decision Criteria in Organizations. *Human Relations*, 48(5), 467-488.
- Batty, M. (1992), *Sharing Information in Third World Planning Agencies*, National Center for Geographic Information and Analysis, Buffalo, Technical Report No.92-8, February.
- Callon, M., 1991, Techno-Economic Networks and Irreversibility. In Law, J. (Ed.) *A Sociology of Monsters: Essays on Power, Technology and Domination* (London and New York: Routledge), 132-164.
- Clarke, D., E. Gavin, W. Honu, T. Krieg, M. Muller, H.J. Smith, T. Smith, and S. Vorster, 1998, *Proceedings of the National Spatial Information Framework Workshop*, Sinodale Sentrum, Pretoria, February 11, 1998.

- Dangermond, J., 1995, Public Data Access: Another Side of GIS Data Sharing. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 331-339.
- Dawes, R.M., 1998, Behavioral Decision Making and Judgement. In Gilbert, D.T., S.T. Fiske, and G. Lindzey (Eds.) *The Handbook of Social Psychology*, 4th ed (New York: McGraw-Hill), 1, 497-548.
- Dueker, K.J. and R. Vrana, 1995, Systems Integration: A Means and a Means for Data Sharing. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 149-171.
- Eagly, A. and S. Chaiken, 1993, *The Psychology of Attitudes* (Fort Worth: Harcourt Brace College Publishers).
- Eagly, A.H. and S. Chaiken, 1998, Attitude Structure and Function. In Gilbert, D.T., S.T. Fiske, and G. Lindzey (Eds.) *The Handbook of Social Psychology*, 4th ed (New York: McGraw-Hill), 1, 269-322.
- Elliott, R., D. Jobber, and J. Sharp, 1995, Using the Theory of Reasoned Action to Understand Organisational Behaviour: The Role of Belief Salience. *British Journal of Social Psychology*, 34, 161-172.
- Fishbein, M. and I. Ajzen, 1975, *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research* (Reading, MA: Addison-Wesley).
- Hogg, M. and G. Vaughan, 1995, *Social Psychology—An Introduction* (London: Prentice Hall).
- Jones, E.E., 1985, Major Developments in Social Psychology During the Past Five Decades. In G. Lindzey and E. Aronson (Eds.) *The Handbook of Social Psychology*, 3rd ed (New York: Random House), 1, 47-107.
- Kahneman, D. and A. Tversky, 1979, Prospect Theory: An Analysis of Decision Making under Risk. *Econometrica*, 47, 263-291.
- Keren, G., 1996, Perspectives of Behavioral Decision Making: Some Critical Notes. *Organizational Behavior and Human Decision Processes*, 65(3), 169-178.
- Kevany, M.J., 1995, A Proposed Structure for Observing Data Sharing. In H. J. Onsrud and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 76-100.
- Latour, B., 1987, *Science in Action* (Cambridge, MA: Harvard University Press).
- Law, J. and J. Hassard (Eds.), 1999, *Actor Network Theory and After* (Oxford: Blackwell Publishers)
- Masser, I. and H.J. Onsrud (Eds.), 1993, *Diffusion and Use of Geographic Information Technologies* (London: Kluwer Academic Publishers).
- Markus, M.L. and D. Robey, 1988, Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science*, 34(5), 583-598.
- Medin, D.L. and M.H. Bazerman, 1999, Broadening Behavioral Decision Research: Multiple Levels of Cognitive Processing. *Psychonomic Bulletin and Review*, 6(4), 533-546.
- Mellers, B.A., A. Schwartz, and D.J. Cooke, 1998, Judgement and Decision Making. *Annual Review of Psychology*, 49, 447-477.
- Mohr, L.B., 1982, *Explaining Organizational Behavior* (San Francisco: Jossey-Bass Publishers).
- Nedovic-Budic, Z. and J. Pinto, 1999, Understanding Interorganizational GIS Activities: A Conceptual Framework, *Journal of the Urban and Regional Information System Association (URISA)*, 11(1), 53-64.
- Nedovic-Budic, Z., L. Warnecke, and J. Pinto, GIS Database Development and Exchange: Interaction Mechanisms and Motivations. Submitted to *Journal of the Urban and Regional Information System Association (URISA)*, Version 09/24/01, www.urisa.org/journal/
- Obermeyer, N. and J. Pinto, 1994, *Managing Geographic Information Systems* (New York and London: The Guildford Press).
- Onsrud, H.J., 1995, The Role of Law in Impeding and Facilitating the Sharing of Geographic Information. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 292-306.
- Onsrud, H.J. and J.K. Pinto, 1991, Diffusion of Geographic Information Innovations. *International Journal of Geographical Information Systems*, 5(4), 447-467.
- Onsrud, H.J. and G. Rushton, 1992, NCGIA Research Initiative 9: Institutions Sharing Geographic Information, National Center for Geographic Information and Analysis, Report of the Specialist Meeting, Technical Report 92-5, June 1992.
- Onsrud, H.J. and G. Rushton (Eds.), 1995, *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research).
- Onsrud, H.J. and G. Rushton, 1996, *Institutions Sharing Geographic Information*, National Center for Geographic Information and Analysis, Closing Report, Research Initiative 9, March 1996.
- Opp, K.-D., 1999, Contending Conceptions of the Theory of Rational Action. *Journal of Theoretical Politics*, 11(2), 171-202.
- Pfeffer, J., 1985, Organizations and Organization Theory. In Lindzey, G. and E. Aronson (Eds.) *The Handbook of Social Psychology*, 3rd ed (New York: Random House), 1, 379-440.
- Pinto, J.K. and H.J. Onsrud, 1995, Sharing Geographic Information Across Organizational Boundaries: A Research Framework. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 44-64.
- Rhind, D. (1998) 'Public/private sector relationships in the creation, management and exploitation of geospatial data' in Conference Proceedings, XXI International Congress Developing the Profession in a Developing World - Commission 3: Land Information Systems, vol.3, Brighton: The International Federation of Surveyors, pp.201-215.

- Rogers, E.M. (1995) *Diffusion of Innovations*, 4th ed, New York: The Free Press.
- Sabini, J., 1995, *Social Psychology*, 2nd ed (New York: W.W. Norton and Company).
- Sperling, J., 1995, Development and Maintenance of the TIGER Database: Experiences in Spatial Data Sharing at the U.S. Bureau of the Census. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 377-396.
- Stage, D., 1995, A Multi-Agency Management Structure to Facilitate the Sharing of Geographic Data. In Florida. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 426-447.
- Staw, B.M., 1991, Dressing Up Like an Organization: When Psychological Theories Can Explain Organizational Action. *Journal of Management*, 17(4), 805-819.
- Stevenson, M.K., J.R. Busemeyer, and J.C. Naylor, 1990, Judgement and Decision-Making Theory. In Dunette, M.D. and L.M. Hough (Eds.) *Handbook of Industrial and Organizational Psychology*, 2nd ed (Palo Alto, CA: Consulting Psychologists Press), 1, 283-367.
- Tosta, N., 1995, The Evolution of Geographic Information Systems and Spatial Data-Sharing Activities in California State Government. In Onsrud, H.J. and G. Rushton (Eds.) *Sharing Geographic Information* (New Brunswick, NJ: Center for Urban Policy Research), 193-206.
- Wehn de Montalvo, U., 2001. *Crossing Organisational Boundaries: Prerequisites for Spatial Data Sharing in South Africa*. D.Phil. Thesis, SPRU—Science and Technology Policy Research, University of Sussex, Brighton.
- Yates, J.F., 1990, *Judgement and Decision Making* (Englewood Cliffs, NJ: Prentice Hall).

Notes

- 1 The author is grateful for comments from the participants of the ESF-NSF Workshop on Access to Geographic Information and Participatory Approaches Using Geographic Information, Spoleto, Italy, 6-8 December 2001, where an earlier version of this article was presented.
- 2 This parallels the distinction between variance and process models in more general literature on organisational behavior (for example, Mohr 1982).
- 3 For a discussion of different measurement techniques, see Hogg and Vaughan (1995).
- 4 The current list of empirical research papers applying the Theory of Planned Behavior exceeds 240 articles (<http://www-unix.oit.umass.edu/~aizen/>).
- 5 Modifications to the Theory of Planned Behavior have been discussed, such as the inclusion of personal norm and perceived moral obligation, self-identity, and past behavior variables, to improve the predictions of intention and behavior (Sabini 1995, Eagly and Chaiken 1993). It is argued that these additions may be drawn upon and included in the TPB model depending on the specific behavior under investigation (Eagly and Chaiken 1998).
- 6 This would be the case, for example, for research based on the concepts developed within actor-network theory (see, for example, Latour (1987), Callon (1991) and Law and Hassard (1999)) focusing on the negotiations and interactions among, and the motivations of, a small set of actors.
- 7 The sample includes just over 110 key individuals from some 70 different organisations.
- 8 The South African GIS community is made up of the following groups: local authorities, provincial government, national government, para-statal organisations, academic research institutions, GIS industry, private sector, and non-governmental organisations.
- 9 For a conceptualisation of the diffusion of geographic information technologies, see Onsrud and Pinto (1991) and Masser and Onsrud (1993).