Institutionalization of Geographic Information Technologies: Unifying Concept?

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ABSTRACT: This paper is about studying the role, impact, and effectiveness of geographic information technologies such as GIS. Contemporary frameworks—such as economic evaluation, organizational context, or diffusion - deal with some aspects only. Institutionalization of geographic information technologies is proposed as a paradigm for studying the impact and effectiveness more comprehensively. It refers to the ongoing process within a group or society whereby this technology itself is becoming institutionalized and gaining a strong (normative) impact on common perceptions of spatial problems and, subsequently, on collective actions to remedy these problems. Hence, it is a paradigm that encompasses value, as well as organizational and societal issues, and links these to the level of individual behavior patterns. The paradigm therefore may provide context for economic evaluation, organizational considerations, and diffusion, as well as for other interpretative perspectives. The paper outlines the concept of institutionalization of geographic information technologies and some of its salient factors and conditions. The focus is on feedback and participatory approaches in the design, and choice and implementation of geographic information technologies; whether these are institutionalized or not. However, further (empirical) research is needed to explore the practical usefulness of the concept.

KEYWORDS: GIS, geographic information technologies, effectiveness, economic evaluation, organizational context, diffusion, institutionalization, paradigm, common problem perception, society

Introduction

Geographic information technologies—such as geographic information systems (GIS)—have developed dramatically since the early pioneering work of Roger Tomlinson and others in the 1960s. (An overview of the state-of-the-art in the early 1970s can be found in, for instance, Tomlinson 1972.) Seen from a technical point of view, these developments are impressive. The effective application of geographic information technologies in practice, however, is not at all self-evident. This concern has lead to a growing body of literature addressing the impact of these technologies, specifically their effectiveness. Recently, GIS and Society has emerged as a distinct theme in the literature. (See for example: Pickles 1995; Sheppard 1995; Harris and Weiner 1998.) With this paper I hope to contribute to the literature by proposing the institutionalization of geographic information technologies. Why? There are two major arguments for doing so. First, because I am of the opinion that the effectiveness of any information technol-

ogy will ultimately depend on the behavior it will bring about; i.e., the behavior of those who will make use of the produced output of that technology. Related to this, the second argument is that the sociological notion "institutionalization," as we will see later, refers to behavior. Specifically, an institution has a normative impact on the behavior of individuals and may develop within groups or within societies at large. Institutionalization of a concrete application of an information technology such as a GIS would then refer to a process whereby this application has a strong and normative impact within a group or society on problem-solving behavior. This requires some explanation. First, how could, for instance, GIS have a normative impact on behavior? One obvious impact is through the provision of spatial information by that GIS. Under certain conditions, as we will see later, this information may dramatically influence the definition an individual makes of her or his particular situation and, hence, influence the behavior of that individual. But, what about GIS as a source of that information? Would not many people use the information without worrying about its source? This may often be the case but certainly not always. In many cases, knowing the source of the information is important for assessing the value of that information. A second point to be made is that the institutionalization of geographic information technologies is biased towards recurrent applications of these technologies. Finally the reader should not confuse the sociological meaning of "institu-

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tionalization" and "institution" as I use them here with the notion "organization." Although some organizations may be an institution as well—as, for instance, the Supreme Court in many countries is—the terms "institution" and "organization" should not be used interchangeably.

After these explanatory remarks we can return to the central theme of the paper, which is, to what extent the effectiveness of geographic information technologies can be explained by factors and conditions for their institutionalization. It should be understood from the outset, however, that this paper is not a plea for the institutionalization of geographic information technologies as such. All I aim to do by proposing this sociological viewpoint is to look at concrete applications of information technologies as if they were *becoming* institutionalized. And, in doing so, to determine whether there are any important factors and conditions that might otherwise have been overlooked. The paper is thus rather deductive and to some extent speculative. Still, empirical and operational aspects need to be addressed if institutionalization of information technology is to have any practical value.

Adoption of Geographic Information Technologies

Geographic information technologies in general, and GIS in particular, have been adopted in most industrialized countries. (See for example: Campbell and Masser 1995, p. 83; Grothe and Scholten 1996, p. 238.) The extent of adoption, of course, says little about the *effectiveness* of the adopted technologies. In a study on the effectiveness of GIS in British local government, Campbell (1994, p. 321) concluded that successful implementation of GIS is extremely difficult. The situation in less developed countries is even more problematic. For example, Linden (1996, pp. 269-275) concluded on the basis of a survey in 11 countries in Sub-Sahara Africa that the majority of existing GIS is hardly used or does not meet the initial expectations of their users. Based on a survey in several Southeast Asian countries, Kammeier (1996, pp. 297-305) arrived at a similar conclusion.

Technology: Technical and Contextual Aspects

Like all technologies, information and communication technologies such as GIS encompass technical and non-technical issues; the latter relating particularly to the user and the management context. Pickles (1995) goes even further and views GIS as both a tech-

nique and *social relation*. (A similar point is made by Sheppard 1995, p. 6. For a discussion on the mutual relationship between technology and context, and on the social construction of technology: See also Bijker and Law (1992) and Bijker (1995)). The impact of geographic information technologies may well go beyond producing specific sets of spatial data and/or information. In some cases, for example, the symbolic value of owning a GIS and the social status associated with this ownership is more important than the use of the technology. Moreover, concrete applications of geographic information technologies not only provide information but link individuals as well. It may bring people together and make them think jointly about their information requirements and about their jobs and how to improve the latter. In this respect, establishing a GIS may bring about organizational and institutional development. (See also: Yeh 1991, pp. 24-25; Veregin 1995, p. 102; Campbell 1996, pp. 30-40; de Man 1996b, p. 276; Craig and Elwood 1998, pp. 100-104; Shiffer 1998.) However, it is fair to say that in some instances information technologies may pull people apart as well. (See for a discussion of these contradictory aspects Obermeyer and Pinto (1994, pp. 169-81) and Harris and Weiner (1998)).

Recognizing the significance of *context* for the effectiveness of geographic information technologies, recent publications focus on critical conditions and factors of that context. (See for example: Masser and Onsrud 1993; Campbell and Masser 1995; Pickles 1995; NCGIA 1995; Sheppard 1995; Masser et al. 1996; Harris and Weiner 1998.) These publications reflect a variety of different research directions, different levels of analysis and a multitude of diverse concepts. For example, Campbell (1996, p. 40) emphasizes the importance of organizational cultures in GIS diffusion whereas—in the same volume—Wegener and Masser (1996, p. 18) sketch a possible scenario for GIS diffusion where GIS is to be used "in an open and participatory process of social experimentation and grassroots decision making." (Of course, both perspectives are fully justified in their own right.).

Value and Acceptance of Geographic Information Technologies

Common in much of the literature on the effectiveness of geographic information technologies (or any technology for that matter) are *value* and *acceptance*. What are the conditions for a concrete application to become valued and accepted? As this has been mentioned before, in sociology a well known concept is available that might be relevant and useful in dealing with questions of this kind; *viz.* an institution as "something" recurrent that is established and valued

by a group, community, or society. One of the distinguishing characteristics of an institution is its normative impact on the behavior of individuals. (See, for example: Broom *et al.* 1981, p. 17; Robertson 1982, p. 93). Therefore, this paper addresses and explores the question whether this sociological viewpoint can be applied to concrete cases such as the establishment of a GIS. Specifically, we will explore whether what may be called "institutionalization of geographic information technologies" is *analytically* significant for studying the effectiveness of geographic information technologies.

The paper builds on previous and on-going research of the impact of so-called village surveys and village atlases. In Thailand, for instance, similar village surveys are often differently valued and accepted within different villages. This is reflected by different "roles" played by these surveys within the village (Naewpanich 1993). These observations triggered empirical—though exploratory—research into explaining factors and conditions by applying the concept of "institutionalization" to such information processes in an analytical manner (de Man 1996c).

The remainder of this paper begins with a brief literature review of three contemporary approaches to study the effectiveness of geographic information technologies; *viz.* economic and organizational perspectives, and the diffusion paradigm. The main purpose for doing this review is to provide some context for the central issue of the paper: the assumed institutionalization of geographic information technologies. Specifically, this review may provide some arguments to justify the emphasis put on the institutionalization paradigm. As we will see, each of the contemporary approaches addresses aspects of effectiveness, but none of them explains why (collective) actions may follow from the produced geographic information. And such explanation I consider as a major purpose of any information technology. After this brief and limited review of the literature, I will outline the notion of "institutionalizing geographic information technologies" and examine its practical value for the evaluation of concrete applications of geographic information technologies; specifically, their impact on problem-solving behavior.

Effectiveness of Geographic Information Technologies in Literature

The vast literature on technical issues of geographic information technologies tends to focus on efficiency rather than on effectiveness. Efficiency is concerned with minimizing the "cost" of producing a given output (e.g., information) whereas effectiveness is concerned with making use of the output so as to meet certain goals (Land 1975, p. 239).

At least three different approaches can be found to study the effectiveness of geographic information technologies in general, and GIS in particular. *Economic* evaluation addresses the value of geographic information and of the supporting technology in relation to actual and/or potential use. An *organizational* context acknowledges that geographic information technologies are generally applied within organizations. This context provides a framework for the identification of organizational functionality against which effectiveness can be evaluated. Finally, the *diffusion-paradigm* emphasizes the process whereby geographic information technologies are spread over time among the members of a social system (e.g., municipalities within a country). I briefly sketch these three approaches in the following subsections, highlighting some of their limitations in studying the effectiveness of geographic information technologies.

Economic Evaluation of Geographic Information Technologies

Many authors view the effectiveness of a concrete application of information technology as being concerned with the question of whether this information is to meet certain goals of the users and/or to pursue their mission. (See for instance: Land 1975, p. 239; Lewis 1994, p. 61.) *Economic* evaluation of information technologies applies to benefits from the outputs (use of the produced information) in terms of *value* against costs involved. (See also Bonnen and Nelson 1981, p. 343.)

Geographic information—like information in general—is not a free good but, instead, it is governed by scarcity. (For an economic view on "scarcity" I refer to Robbins 1952, p. 15.) Costs must be borne in order to obtain certain information by collecting, analyzing, and processing spatial data. Although the required information might exist, accessibility to it may be limited, and this will affect its scarcity. In addition, the resources required to make use of the information may be scarce as well. (See also Simon 1976, pp. 294-296). Examples of these resources are the specific skills and experience that may be required to interpret the information. Information, in short, is an *economic good*. It is generally agreed that information has decreasing marginal returns and increasing marginal costs. (See, for instance, Forster 1978, p. 907; Land 1975, pp. 239-243). In addition, information has the characteristics of both *private* and *collective* economic goods

(de Man 1989, p. 319-320). Probably this ambiguity explains to a large extent why it is so difficult to address the economic evaluation of information technologies adequately. In the literature, a number of other factors are identified as contributing to this vagueness. (See, for instance, Eisgruber 1978, p. 901; Cleveland 1982; Barr and Masser 1997, pp. 237-241.) Worth mentioning is the attempt by Barr and Masser (1997, p. 235) to broaden the discussion on geographic information by considering it from four different points of view: geographic information as a *resource*; as a *commodity*; as an *asset*; and as an *"infrastructure."* (Information viewed as an asset highlights its transformation into a product a consumer wants to buy.)

Several studies have been carried out on the economic value of geographic information and on the economic evaluation of implementing a GIS. (See for example: de Man 1989, pp. 315-320; Dickinson and Calkins 1988, pp. 307-327, and 1990, pp. 211-212; Wilcox 1990, pp. 203-210; Rhind 1992, pp. 13-30; Smith and Tomlinson 1992, pp. 247-256; Worrall 1994). To my opinion, these studies and the discussions they triggered, justify the conclusion that economic evaluation of geographic information technologies is at least a problematic process. Either the evaluation has a narrow scope in that it regards "saving costs" as benefits, and therefore does not go much beyond economic *efficiency*, or the evaluation lacks a sound economic foundation.

Geographic Information Technology: A problem of Organization

Why adopt an organizational perspective for the analysis and evaluation of geographic information technologies? A major reason found in literature is that these technologies are generally applied within more-or-less organized groups of human beings and to a far lesser extent applied by single individuals. (See for example: Rogers 1993, p. 19; Campbell and Masser 1995, p. 9; Campbell 1996, p. 34). Concrete applications are within the whole of data and information flows, their channels, creators, collectors, users, all sorts of existing and often informal knowledge and communication systems, and so on, within the organization and oriented towards (end-) uses; the "information utilization system" (de Man 1988, p. 250). Moreover, the organizational arena must provide a *support structures* for an effective application of geographic information technologies. Support deals with conditions for acceptance of geographic information technology and its resulting geographic information, with conditions for sustained operations after implementation, and with the ability to cope with change. Support structures do not emerge and do not continue to exist automatically. They need (political) commitment. (See also de Man 1988, pp. 252-253; Yeh 1991, pp. 8 and 17; Campbell and Masser 1995, pp. 43-44; Sahay and Walsham 1996.)

Although there are apparently good reasons to adopt an organizational perspective for studying the effectiveness of geographic information technologies, to do this in practice, however, is quite problematic. This is mainly due to the inherently complex character of most organizations and, hence, of the function of information within these organizations.

First, seen from an organizational point of view, information technologies may serve different generic purposes. They may:

- Be a *tool* to achieve organizational goals (through the provision of information);
- Facilitate *communication* between organizational members (units and individuals);
- Help to *link* organizational members functionally and operationally together to a more or less common cause; and
- Be a *tool for individuals* to advance their professional position in the organization.

Not only may information technologies serve different purposes and/or functions within organizations; the same organization can be viewed differently as well. For example, the image of an organization viewed as a decision-making and information-processing system may look very different from the image of the same organization as a collection of people (Simon 1976, p. 292; Morgan 1997). Therefore, different possible images of organizations further complicate the application of an organizational perspective to studying the effectiveness of geographic information technologies.

A third problem-domain emerges because organizations may also be different in dealing with their environments (Hrebiniak and Joyce 1985, pp. 336-349). Many organizations face the need for frequent–if not continuous–adaptation to uncertain and changing environments. In other words, many organizations need to learn or may even need to learn how to learn (Morgan 1997, pp. 86-100). In the case of such innovative, flexible, learning and adaptive organizations, identification and definition of data and information needs as well as the design, adoption and effective utilization of the supporting technol-ogies become dramatically complex.

Finally, information technologies and organizations have a mutual relation. One could argue that the design and choice of information technology should "follow" the mission and decision-making processes of the organization. But information technology may have an impact on the structure and design of the organization and on its occupational structures as well. (See, for example: Simon 1976, p. 294; Barley 1986,

pp. 78-108). Referring specifically to geographic information technologies, Worrall (1994, pp. 557-558) observes some changes in occupational structures as a result of GIS implementation: some of the functionality previously undertaken in the "text based" operational system may now be undertaken within the GIS.

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Notwithstanding the merits of these economic and organizational perspectives for the study of geographic information technologies, they alone are insufficient for studying the effectiveness of such technologies comprehensively. For example, the evolution of "geomatics" activities into a spatial information "marketplace" in Maritime Canada (Post and McLaughlin 1993) cannot adequately be described and explained in terms of economic evaluation and organizational context only. The process whereby various user groups adopt technological innovations such as GIS over time is increasingly receiving attention in literature.

Diffusion of Geographic Information Technologies

Diffusion is emerging as a distinct paradigm in the literature on adoption and use of geographic information technologies since the early 90s. (See for example: Onsrud and Pinto 1991; Campbell and Masser 1992; Masser and Onsrud 1993; Masser et al. 1996.) This concept finds its roots in the diffusion-paradigm for diffusion of innovations. Rogers (1983, p. 5) defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. Many innovations are adopted by organizations rather than by individuals (Rogers 1993, p. 19). This is particularly the case in the diffusion of new information and communication technologies such as GIS.

What explains the diffusion of geographic information technologies? The "social interactionism" approach emphasizes that technology is socially constructed and views the diffusion of innovations in terms of the interaction between the technology and users within particular cultural and organizational contexts. (See also: Bijker and Law 1992, p. 13; Campbell 1996.) Accordingly, Campbell (1996, pp. 35-37) suggests organizations to be the key units of analysis and emphasizes the importance of organizational culture in relation to the diffusion of geographic information technologies.

The diffusion-paradigm certainly provides valuable insights into the processes of adoption and use of geographic information technologies. The literature convincingly shows the richness and fruitfulness of the paradigm. (See, for example: Masser and Onsrud 1993).

The paradigm broadens the scope of analysis beyond individual organizations towards societal perspectives. However, the diffusion-paradigm does not explain effectiveness. Strictly speaking, diffusion concerns the speed and saturation level with which an innovation is spread and adopted (Rogers 1993, p. 16). Effectiveness is, to some extent, implied in the diffusion model. In other words, diffusion of geographic information technologies would hardly be conceivable if these technologies were not effective. Effectiveness then is at most a condition for diffusion and certainly not being explained by it.

Effectiveness of Technology and Individual Behavior

Each of these approaches to study the effectiveness of geographic information technologies (*viz.* the economic and organizational perspectives, and the diffusion-paradigm) addresses some aspects or conditions of effectiveness only. Therefore, any approach to study comprehensively the effectiveness of such technologies should at least pull these three approaches together. Let me first outline the major aspects that, to my opinion, should not be overlooked in this respect. As we have seen before, effectiveness of geographic information technologies often deals with meeting organizational goals and mission. These may be *outside* the organization as, for instance, in the case of land-use planning and real property tax management, or *within* the organization, as with the need for internal integration. But geographic information technologies may also respond to possible demands and challenges from society and grassroots democracy. (See, for example: Pickles 1995, pp. 233-238; Sheppard 1995; Weiner *et al.* 1995; Wegener and Masser 1996, p. 18.) This can be generalized in that the effectiveness of geographic information technologies needs to be studied against a specific *social* context; be it the group, the organization, or the society at large in which a concrete application of the technology is located. However, achieving group, organizational, or societal goals and missions depends, in the final analysis, on the decisions and behavior of *individual* members of the concerned social unit. It is the culture of that unit that influences and attempts to harmonize these individual decisions and behaviors. (See for the case of organizations, for example: Simon 1976, pp. 220-228; Morgan 1997, pp. 178-181.)

Therefore, it appears to me that a viewpoint for studying the effectiveness of geographic information technologies must address the impact of such technologies on decisions and behavior of individuals within the context of a group, organization, or the society at large. In addition, the viewpoint must account for

issues of value and acceptance of these technologies at a given level.

Institutionalization of Geographic Information Technologies

This section explores and conceptualizes the notion of what I call "institutionalization of geographic information technologies." The first part will be rather deductive and, to a greater extent, speculative, while some empirical and operational concerns will be addressed at the end.

In the literature, institutionalization of technologies is often interpreted in terms of obduracy. (See, for example, Bijker and Law 1992, pp. 299 and 300.) Zwart (1993, pp. 195-200) speaks in this sense of "embodied GIS:" an everyday, ready-to-use technology. Harris and Weiner (1998, pp. 73-75) speak of a "community-integrated" GIS and pose the question of its sustainability. Here I shall view an institution from a sociological viewpoint as a rather stable cluster of norms, and normative behaviors that develops around a basic social need. Specifically, an institution has a normative impact on individual behavior and may develop within groups—such as organizations —and within societies at large. (See for this sociological view Broom *et al.* 1981, p. 17; Robertson 1982, p. 93; and Uphoff 1986, p. 9).

How then would this sociological view of "institution" and "institutionalization" apply to geographic information technologies and what might be a relevant social need in this respect? An important social need for any society or group is the solution of social problems. That is to say; when there is a sizeable discrepancy between what is and what people think ought to be (Merton 1976, p. 7). These problems could be in their external environment (as in the case of resources management) as well as in their internal integration. The question regarding the assumed institutionalization of geographic information technologies therefore is how these technologies can contribute to the solution of such common problems. Institutionalization of geographic information technologies as we will see means that the technology (somehow) would have a strong and almost normative impact within a group or society on common definition of problems; specifically on the definition of spatial problems. As I have mentioned this before, one obvious way for geographic information technologies of having such normative impact is through the resulting spatial information. Sufficient commonness in the definition of shared (or social) problems, in turn, is conditional for collective actions to remedy such problems and are often a motivation for doing so.

In the GIS literature, however, the term "institutional" is generally used in a more restricted sense; referring to conditions for effective implementation and utilization of geographic information technology. (See for example: Fox 1991, p. 60; and Yeh 1991, p. 25). Thus the paper takes a fundamentally broader view, in that institutions not only provide possible conditions for enabling effective functioning of the technology; *geographic information technologies themselves may become institutionalized*.

At this stage, a few points need to be made. First, the question is justified whether it is simply not going too far to view geographic information technologies in terms of institutionalization. To my opinion, however, the institutionalization viewpoint may help in focusing the analysis and evaluation of effectiveness of these technologies. Specifically, the focus will be on influencing the behaviors of actors through the output of a concrete application of a geographic information technology. This target-group is, of course, the arena of shared (common) problems. Second, the reader should notice that I do not deal here with the question of whether GIS is really becoming an institution. I will return to this point later. A third point to be made is that institutionalization does not obviate socially differentiated understanding and other conflicts. How to deal with these conflicts can very well be institutionalized. The point is that at least some commonness among the members of a group is provided and/or reinforced by the institutionalization process.

Finally, the impact of information on society and within organizations should not be exaggerated and/or idealized. Campbell (1996, p.37) points to an abundance of literature emphasizing the extent to which information produced by computer based systems reinforces both existing practices and power structures. Communication and information technologies may lead to standardization, uniformity, the manipulation of consensus, and even propaganda. However, the potential of technologies like GIS also challenge us to think further about their democratizing possibilities beyond being an instrument of power and control (Pickles 1995, pp 233-238). Aitken and Michel (1995, p. 26), for instance, ask how GIS might empower voices at the margins. The proposed viewpoint of institutionalization (as a process, not as an "end state") may help in identifying conditions and factors for geographic information technologies to meet these challenges.

Although this paper is not a plea for institutionalization *per se*, I will briefly touch on the benefits that might accrue to society if geographic information technologies were to become institutionalized. All societies are somehow in transition, though some more obviously so than others. Traditional and established ways of conducting affairs are eroding. Existing institutions

are becoming obsolete; new ones must replace the old order. In the literature, these transitional processes have been described eloquently, e.g., by Fred W. Riggs (1962, 1964) in his theory of "prismatic society." Some see lack of institutions as a major problem in many low-income countries (e.g., Caiden and Wildavsky 1974, pp. 46, 52-53). Geographic information technology as an institution might contribute to achieving some degree of social coherence and commonness (group identity) within society. Some village atlases and village sketch-maps—as "grassroots" applications of such technologies—provide good illustrations of this point. This does not mean that the technology acts as a *deus-ex-machina* (from outside) in such cases. To the contrary; the very meaning of an institution is that it has been socially developed *within* the group. Major factors and conditions to this end will be discussed below.

Geographic Information Technologies as Social Processes

From the outset, and following others, I view geographic information technologies as *social* processes (see, for instance, Sheppard 1995, p 6). First, like other technologies their shaping does not depend on technical aspects only but on social attitudes and cultural developments as well. Added to this social constructivist approach to technology is the view that information itself implies an interpretative process of giving meaning to observable facts (e.g., Bonnen 1975, p. 759). This view is also supported by so-called "symbolic interactionism" viewing the process of giving meaning as a fundamentally *social process* (Blumer 1969).

Geographic Information, Common Definitions of Social Problems, and Collective Actions

Central to this paper is the potential and/or actual impact of geographic information technologies on the definition of problems and, with that, on the problem-solving behavior of individuals. In many cases this impact will be through the produced geographic information. But, as we have seen before, this is not always the case. A fashionable piece of equipment may trigger the admiration of others. Once noticed, one may perceive the equipment as a means to enhance professional and/or social status and behave accordingly. Be it as it may, I will first deal with the restricted question of how geographic *information* could have an impact on the definition of problems and on problem-solving behavior of individuals. In the following section I expand the analysis to the broader issue of the impact of geographic information technologies.

Assuming an impact of the produced geographic information on the definition of problems, this would imply that attention is given to that information. Attention to information, in turn, requires that it is *subjectively* valued. Generally, the latter arises out of the expected utility of that information. (To be sure, this also implies an expected utility of the supporting information *technology* concerned. I will come to this point later.) A possible basis for this expected utility is whether similar information has somehow proven to be useful in solving problems in the past. However, the use of geographic information may be diverse. It may strategically help in defining problems, tactically be focused on the solution of problems, or administratively support the community (Craig and Elwood 1998).

Information may also become valued within a group or community through *participation* in the collection and subsequent analysis, presentation and interpretation of data about their own situation. That is to say; participation in a concrete application of an information technology. Participation may bring about that observed facts are valued and trusted by those concerned and thus become an effective basis for change and improving the own situation (e.g., Cartwright 1951, p. 390; Chambers 1993, p. 97; Mayntz 1976, pp. 114-125; Morgan 1997, pp. 73-118; Schein 1969, p. 83).

When geographic information is valued and attended to—I argue—this will somehow have an impact on the definition of reality; in particular on the definition of spatial problems. *Collectively* valued geographic information may bring about *common* definitions of spatial problems. This may need further clarification. Information by itself does not necessarily bring commonness between people. It may heighten conflicts as well. We should recognize however that from a democratic perspective conflict is not necessarily bad. It may stimulate a lively debate where many voices of the people are heard. Thus, solutions can be worked out that are acceptable to all; at least, this would be possible (see, for instance, Obermeyer and Pinto 1994, pp. 169-181.) The point I am making here is related to this; though adding a specific condition. Whenever information is being *collectively* valued within a social unit this implies some degree of homogeneity within that unit. Under such condition, collectively valued geographic information indeed may contribute to common definitions of spatial problems. However speculative this assertion may look like, it fits within the social context of information technologies and the interpretation of the produced information. It should be noticed that the value and impact of geographic information arise from an intricate complex of other

social forces and processes as well; including cultural and political processes. This is precisely the reason for proposing a sociological viewpoint to look at the impact of geographic information technologies.

The impact of geographic information, however, may go beyond the creation of common definitions of spatial problems only. Collectively valued information may as well bring about collective behaviors to remedy these problems. Whether collective actions really take place depends also on the degree of activism—or *active orientation*—within the group or community. That is to say, an attitude to be in control and to improve the own living conditions (e.g., Etzioni 1968, p. 5; Merton 1976, pp. 15-21). Hence, an active orientation of the users is a major condition for geographic information ultimately to have an impact on the solution of spatial problems.

Institutionalization of GI Technologies: Normative Impact and Feedback

After having outlined the possible impact of geographic *information* on problem-solving behavior let us now expand the analysis to the impact of geographic information *technologies*. So far, my argument has been that the impact of these technologies will often be through the produced geographic information. Does this also mean that valued information will bring about valued information technologies? In some cases, I think it does. In particular, when the source of that information matters. That is to say; a concrete application of information technology. Therefore, I assume that geographic information technologies indeed may become collectively valued within a group, organization or society at large.

Over some period of time, the process of becoming collectively valued may result – I argue – in a concrete application of a geographic information technology (as in the case of a GIS recurrently producing geographic information) that has a strong and even normative impact on the definition of problems. That is to say; these definitions are shared by many and may follow almost 'automatically' from the output (*e.g.* geographic information). In some cases, the process of becoming a norm would imply institutionalization. (As we have seen earlier, I view an institution as a rather stable cluster of norms and normative behavior.) Institutionalization of geographic information technologies, then, refers to the on-going process within a group, community or society whereby concrete and recurrent

applications of these technologies would gain a normative impact on the common definition of problems. Often, as I have repeatedly mentioned before, this impact is on the definition of *spatial* problems through the produced geographic information. (Again, this supposed process of institutionalization is rather speculative at this stage.)

Moreover, I assume that a normative impact on the (common) definition of problems generally brings about collective actions to remedy these (social) problems as well. Such collective actions could aim at solving these problems *directly* or *indirectly*. Indirect solutions may involve outside parties such as government agencies wishing to carry out problem-solving actions. Another indirect method to influence public policy is, of course, voting behavior; voting for legislators who support the group's view.

Having sketched the meaning and scope of the supposed process of institutionalization of geographic information technologies, let us now turn to some of its possible factors and conditions. Institutionalization is based on *feedback* (Buckley 1967, p. 137). In the case of institutionalization of a concrete application of geographic information technologies like a GIS, feedback would refer to the cyclic "mechanism" whereby the output (*e.g., geographic information*) has an impact on problem-solving behavior. The perceived degree of its success in the solution of problems in the past influences the impact of the produced geographic information on problem-solving behavior and activities in present and future applications. Perceived positive results in the solution of commonly perceived problems will have a positive feedback on the normative impact of this application of geographic information technologies in the future. Similarly, negative feedback will deteriorate the process of institutionalization. Essentially feedback is a condition for learning; specifically for "learning *from* doing."

Feedback, in short, relies on successful problem-solving activities whereby the degree of success, of course, is subjectively determined. Problem-solving activities are not only from inside the concerned group or community. Actions from outside (like government interventions) may contribute as well to the solution of problems of a community. If actions from outside are successful in the eyes of the members of the community then these actions may also contribute to the positive feedback. This will likely be the case if the "outsiders" base their interventions on the *same* information that has contributed to the community's problem perceptions.

This leads to a most interesting property of feedback; the property of being *influenceable*. The feedback mechanism relies on, and can be influenced through problem-solving actions; both from within the group

or community or from outside. *Feedback, therefore, is a major intervening factor for the institutionalization of geographic information technologies*.

Finally, I will mention two major conditions for the institutionalization of (geographic) information technologies. First, institutionalization requires some degree of social *homogeneity*. This follows from the normative aspect of institutions. The second condition is an *active orientation* of the host. An active orientation is a condition for perceiving problems as well as for subsequent problem-solving behavior. This does not mean to say, however, that even the poorest, most marginalized, alienated, disaffected and dispossessed people cannot perceive and define their own problems; nor that they may not try to solve them. Even the most deprived people can have an active orientation as many revolutionary movements convincingly show. The point is that a passive orientation—as opposed to an active one—will make people to accept their conditions as they are and not as what they *ought* to be. [From these two conditions—*i.e.*, homogeneity and an active orientation—it also follows that the *social* process of institutionalization of geographic information technologies would imply a mutually adjusted or, what we may call, successfully *negotiated commonness* regarding spatial problems within the group or community (de Man 1996a, pp. 195-199; 1996b, pp. 276-278; 1996c; for "negotiated" see also Lindblom 1965).]

Participation as a Factor of Institutionalization

Earlier in this section we saw that information may become valued within a group or community through *participation* in the collection and subsequent analysis, presentation and interpretation of data about the own situation. We may expand this argument in that geographic information technologies *themselves* may become valued through participation in design, choice and implementation of concrete applications. Campbell and Masser (1995, pp. 159-160) for instance, consider participation as a vital component of effective implementation and utilization of GIS. Similarly, Hutchinson and Toledano (1993, p. 460) conclude that a participatory approach offers a potentially useful structure for the transfer of GIS technology because it focuses attention on the problems of the users rather than the capabilities of the technology. From these arguments then it would follow that participation in the design, choice, implementation and utilization (operation) of concrete applications of geographic information technologies is another

major factor for their institutionalization in addition to the aforementioned feedback. It should be noticed, however, that this form of participation deals with just one facet of the wider debate on "public participation GIS" (see, e.g.. Barndt 1998; Harris and Weiner 1998; Obermeyer 1998). But most of the ethical and democratic concerns in this wider debate seem to me to be also most relevant and appropriate as well to our present discussion on the institutionalization of geographic information technologies.

Empirical and Operational Aspects

In the preceding paragraphs I have outlined the view of how geographic information technologies might have an impact on the solution of problems of a group or community if these technologies were to become institutionalized. What is the significance and value of this—so far rather speculative—sociological viewpoint for the effectiveness of geographic information technologies? In my opinion, the value of adopting the view of institutionalization of geographic information technologies is in its focus on the *problem-solving behavior of individuals* within their respective social contexts. This behavior embodies two related aspects: shaping the definition of problems and with that, inducing problem-solving actions. It then follows that the evaluation of the effectiveness of a concrete application of geographic information technologies would revolve around:

- Targeted behavior;
- Those whose behavior is being influenced;
- The impact of geographic information technology on this behavior; and
- Conditions for "learning" from the effects of behavior (feed-back).

The institutionalization view, therefore, expands the evaluation of the effectiveness of geographic information technologies beyond the limited scope of meeting some sets of identified information requirements. In my opinion this focus is the major merit of this sociological view. But can we make "institutionalization of geographic information technologies" measurable and the underlying assumptions empirically testable? The answer to this legitimate question is, at first sight, disappointing. The operationalization of the concept 'norm' will be problematic because empirically (for example through interviews) a norm can hardly be distinguished from its resulting behavior. This is an inherent difficulty encountered in all empirical research regarding norms and institutions. On reflection, however, this operational difficulty appears to be modest. Institutionalization refers to a process of *becoming* an institution and may therefore as well

cover the stage of an application of geographic information technologies that is increasingly being valued. This allows the impact on common definitions of problems to be operationalized in terms of the impact of a collectively valued and relevant application of geographic information technologies. Testable propositions can be formulated accordingly. The higher the collective value of a concrete application of geographic information technologies, the stronger its impact on the common definition of problems will be. *Value* is essentially subjective as we have seen and therefore could be observed by asking those concerned directly. It is important that the value is not simply expressed in money-terms but rather in terms of utility and/or the reasons why people attach a value to a concrete application. In doing so, different scores for this independent variable can be obtained. The *impact* of information could be observed in terms of the correspondence between what people define as a (problematic) situation and how the information describes it. (The dimensions of collectiveness and commonness could be dealt with through direct interviewing.)

The definition of problems may be viewed as *intervening* between concrete applications of geographic information technologies and problem-solving actions. Therefore, an alternative proposition can be formulated which is to be empirically verified: the higher the collective value of a concrete application of geographic information technologies, the more coherent individual problem-solving actions will be. An example may illustrate this. Assume a government agency addressing poverty. Assume also that so far the agency's interventions to remedy poverty are piecemeal and scattered without certainty that the poor are reached. GIS may help in identifying so-called poverty pockets. When the produced information is being valued and attended to within the organization this may "shape" the minds of the concerned government workers and this, in turn, may bring about coherence in individual activities and increasing their effectiveness.

The operationalization of the feedback-mechanism in any process of institutionalization would involve, strictly speaking, observations at different points in time. In the case of the institutionalization of a concrete application of a geographic information technology, a simplification may be to see whether a mechanism exists for "learning-from-doing" and, if so, whether this mechanism has an impact on the value attached to this (recurrent) application. The existence of such learning-mechanism is then assumed to be a condition for feedback.

In general, the operationalization of the institutionalization-paradigm will be very much case-specific. Case studies, therefore, may be important

vehicles for empirical research. To this end, the paradigm may provide a focus both for practitioners and scientists.

Conclusion

In this paper, I have proposed institutionalization of geographic information technology as a paradigm for studying the impact and effectiveness of geographic information technology. Adding to contemporary approaches—such as economic evaluation, organizational context, or the diffusion-paradigm—it expands the realm of study into the impact of (geographic) information on problem-solving behavior; i.e., (collective) actions to remedy spatial problems. In this respect, the paradigm might provide focus for (economic) evaluation, organizational considerations, and diffusion and probably for other interpretative perspectives as well. Many of the factors that supposedly contribute to the very process of institutionalization like, for instance, feedback and participation, will be important for the effectiveness of any application of geographic information technology; whether institutionalized or not. In conclusion, institutionalization of geographic information technology indeed appears to be a unifying concept and promising for studying diffusion and use of geographic information technologies comprehensively. The paradigm does not compete with contemporary approaches but, instead, provide an "umbrella" and focus for them.

However, its practical usefulness needs to be explored further. (Hence the question-mark in the paper's title.) First, developing interesting concepts is one thing; the operationalization of these concepts in concrete and observable terms is quite another. For example, we have seen how to observe *value, impact, use* and *effectiveness* of geographic information technology, and we have learned how to define *participation*. Further theories are needed to explain crucial relations between these concepts and to guide planning, design and implementation of geographic information technology. To this end, we may have to draw from adjacent disciplinary fields and related research activities. Probably, theorizing should include cognitive and other sub-fields within psychology as well. It seems that the institutionalization-paradigm provides fruitful opportunities to this end. Finally, carefully selected case studies are needed to further explore supposed mechanisms and to verify assumptions. This, then, calls for an empirically rooted and challenging research agenda.

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