An Analytical Framework to Examine Empowerment Associated with Participatory Geographic Information Systems (PGIS)

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Abstract

Claims have been made that the application of participatory geographic information systems (PGIS) can empower disadvantaged groups. This article notes that the ongoing debate in this "GIS-empowerment-marginalization nexus" remains vague about a characterization of empowerment and that it fails to address how empowerment can be observed and recorded in a logical and structured manner. The article offers, and justifies, two working definitions of empowerment, differentiating between empowerment and empowerment capacity. It proposes a framework to structure an analysis of empowerment. The framework combines four catalysts of empowerment (*information*, *process*, *skills*, and *tools*) with two social scales (*individuals* and *community*).

Keywords: Empowerment, participatory GIS, structured framework, measurement

Résumé

On a dit que la mise en œuvre de systèmes d'information géographique participatifs (SIGP) pouvait rendre plus autonomes certains groupes désavantagés. D'après l'article, le débat actuel sur le lien entre SIG, autonomisation et marginalisation reste vague quant à la caractérisation de l'autonomisation. De plus, il n'explique pas comment cette autonomie peut être observée de manière logique et structurée. L'article contient deux définitions *ad hoc* de l'autonomisation et les justifie, et il établit une distinction entre autonomisation et capacité d'autonomisation. Les auteurs proposent un cadre pour structurer une analyse de l'autonomisation. Ce cadre combine quatre catalyseurs de l'autonomisation (l'information, le processus, les aptitudes et les outils) et deux échelles sociales (individuelle et collective).

Keywords: Mots clés, autonomisation, SIG participatif, cadre structure, mesure

Introduction

It has been noted that the application of participatory geographic information systems (PGIS) can be empowering to disadvantaged groups by enabling them to use the language and tools of decision makers and so influence events that affect their lives and local geography. Counter-claims note that PGIS can be disempowering or marginalizing, given the cost and complexity of the technologies, inaccessibility of data, restrictive representations of local geographic information, and low and selective levels of community participation. In this article we argue that this ongoing debate in the "GIS–empowerment–marginalization nexus" (Harris and Weiner 1998a) remains vague about a definition of empowerment and that it fails to address how

empowerment can be observed and recorded in a logical and structured manner.

The article begins by introducing how the notion of empowerment is used in the PGIS literature. It goes on to discuss the definition of empowerment, offering two working definitions. Next, previous studies of empowerment are reviewed in order to set the background for the introduction of a framework to structure reporting and analysis of empowerment. The following section introduces and discusses the proposed framework, which combines four catalysts of empowerment (*information, process, skills,* and *tools*) with two social scales (*individuals* and *community*) in a two-dimensional matrix.

PGIS and Empowerment

Substantive research on the theory and potential of social and community GIS application has begun to emerge (Abbot and others 1998; Aitken and Michel 1995; Alcorn 2001; Brodnig and Mayer-Schönberger 2000; Curry 1995; Harris and Weiner 1998a, 1998b; Harris and others 1995; Kyem 1998, 2004a; Poole 1995; Rambaldi and Callosa-Tarr 2001). Primarily involved with studies of community urban revitalization and planning in North America (Aitken and Michel 1995; Elwood 2002; Elwood and Leitner 1998; Ghose 2001), relevant commentary and discussion has appeared from other areas in the world (Alcorn 2001; Fox 1998; Harris and Weiner 1998a, 2002; Jordan 1998; Kyem 2002, 2004a, 2004b; Stonich 1998). The research field has built up a substantial following and is now referred to as participatory GIS (PGIS).

In the discipline of geography, PGIS evolved through a realization that GIS was failing to serve society as a whole, instead becoming a positivistic and technocratic tool that supported the more powerful sectors of society, often at the expense of weaker groups (Pickles 1995b; Schuurman 1999). John Pickles's book *Ground Truth: The Social Implications of Geographic Information Systems* (1995a) extended Brian Harley's "ground-breaking work on the relationships between maps and power" (Schuurman 1999, 17) to recognize an explicit link between GIS and the asymmetric distribution of power. The PGIS movement, therefore, was based on the assumption that GIS technology could provide "a critical complement to grassroots efforts that are undertaken to empower communities" (Kyem 2004a, 38). In other words, the power associated with GIS applications did not have to be monopolized by existing power brokers but could be harnessed by the more marginal sectors of society and could serve to empower them (Harris and Weiner 1998a, 1998b).

The roots of PGIS lie in community mapping, a participatory map-making process that attempts to gather information about a community's lands and make it visible to outsiders by using the language of cartography (Aberley 1993; Aberley and George 1998; Alcorn 2001; Carter 1996; Flavelle 2002; Peluso 1995; Poole 1995). Community maps, it has been argued, can be a medium of empowerment by allowing groups of people to represent themselves spatially, using their own maps to seek recognition and inclusion in land and natural resource planning and management (Alcorn 2000; Bird 1995; Brody 1981; Flavelle 1995; Harris and Weiner 2002; Kyem 2002; Momberg and others 1994; Poole 1995; Stockdale and Corbett 1999). The process of making community maps has also been identified as an empowering activity that serves to unify and embolden a community (Aberley 1993; Aberley and George 1998; Flavelle 1995, 2002; Harrington 1995).

Community maps are often limited in their description of the land and, therefore, are often supplemented using the written word. The latter, however, is an imperfect medium to represent local knowledge, especially for traditional peoples who may be illiterate and accustomed to communicating orally. Martha Johnson (1992) notes that much local knowledge about the land is transmitted in the form of stories and legends that use metaphor and sophisticated terminology; thus much of the context may be lost if the information is transcribed to written text. Communication media, notably video, images, and audio, are better at documenting the oral and visual aspects of local knowledge. In order to capture the true complexity of traditional community information about the land, therefore, a medium is needed that can combine the usefulness of community-generated maps with other communication media. Geographic information systems have been identified as a spatial information management technology that has the required integrative capabilities, leading to the above-mentioned PGIS research agenda.

Building on claims made for community mapping, PGIS processes, models, and products have been argued to empower participating communities (see, e.g., Varenius Project n.d.). There are also those who claim that PGIS disempowers or marginalizes communities through the complexity of the technology, the high associated costs, the inaccessibility of data, the inability to use the technology to record diverse ways of understanding space, and a lack of genuine community participation (Goss 1995; Kyem 2002, 2004a; Pickles 1995b; Rundstrom 1995). Despite these contrary claims, the discourse on PGIS offers no commonly accepted operational definition of empowerment (Elwood 2002), nor does it establish a clear link between empowerment and PGIS. The latter is due to a paucity of discussion over the methodologies and frameworks by which empowerment due to a PGIS initiative can be measured and analysed (Howard 1998; Kyem 2002).

There is a need, therefore, for the many definitions of empowerment in the literature to be analysed in order to develop a common understanding of its underlying assumptions and meaning. A clearer understanding of the term will enable the development of meaningful models to systematically observe and compare empowerment, thereby preventing the term from being used to make false claims or to obscure debate about PGIS application and evaluation in what Harris and Weiner (1998a) refer to as the ''GIS–empowerment–marginalization nexus.''

Defining Empowerment

''Empowerment'' is a widely and often casually used term. A wide spectrum of users, ranging from business management gurus and self-help aficionados through to radical citizens' groups and development agencies, have used the term in a manner uncritically assumed to be universal. As a result of its ubiquitous application, the term has suffered from semantic inflation and so has come to mean almost nothing.

''Empowerment'' has been applied across a range of politicized issues. It has been a core concept in a number of social movements, including urban planning in depressed areas in North America (Aitken and Michel 1995; Elwood 2002; Elwood and Leitner 1998; Ghose 2001; Rocha 1997), gender initiatives and the feminism movement (de Koning 1995; Parpart 2000), and adult education in Latin America, associated with Paulo Freire's (1970) pedagogic works in Brazil. In most applications, the term has been used to imply a political and social transformation whereby powerless or marginal individuals and groups in society attempt to increase their own power base by struggling against injustice (Swift and Levin 1987, cited in Dubois and Miley 1992). As Julian Rappaport suggests, the term ''empowerment''

> conveys both a psychological sense of personal control or influence and a concern with actual social influence, political power and legal rights. It is a multilevel construct applicable to individual citizens as well as to organizations and communities. (1987, 121)

Empowerment is often referred to as both an outcome and a process (Dubois and Miley 1992). The outcome describes the final state; in other words, a certain level of power achieved. The process of empowerment implies ''gain[ing] mastery over'' Rappaport (1987, 121) or ''exercising psychological control over personal affairs, as well as exerting influence over the course of events in the socio-political arena'' (Dubois and Miley 1992, 209). In order for power structures to be altered and for the powerless to gain a level of control over the distribution of power and decision-making processes in society, there must be tangible and measurable impacts in the wider political arena (Ristock and Pennell 1996; Thomas 1992) and a visible demonstration of change that the world around is forced to acknowledge, respond to, and accommodate (Rowlands 1997).

However, the social work literature notes that if power can be freely given, it can just as easily be withdrawn. Therefore, the simple handing over of power does not involve a structural change in power relations; indeed, it may hide an attempt to maintain control (Rowlands 1997). Critical to an understanding of empowerment is the fact that this process is undertaken by an individual, group, or community; it is not something done ''to'' or ''for'' these social units (IRED 1996; Rowlands 1997).

Examining the process of empowerment is important, therefore. In essence, the process of empowerment involves growth and development leading to deliberate efforts to participate in, share control of, and influence social, economic, and political events and institutions (CPFP 1992). Empowerment can take place within individuals or communities, and the growth and development needed, at these different social scales, to bring about increased influence or power can take many forms. For example, for an individual the acquisition of new knowledge and skills may bring about social influence and political power, while a community needs to develop a common identity and vision (Fetterman 1996; Parsons 1991; Rappaport 1987; Ristock and Pennell 1996; Thomas 1992). There is no generic formula that can be followed in order to achieve empowerment. The process is multifaceted and multidimensional (Rappaport 1987); it is ''a philosophical orientation[;] the process emerges and solutions evolve that are uniquely tailored to each situation'' (Dubois and Miley 1992, 210).

Thus we can see that an observed change in power may not be permanent or meaningful unless it is linked to some deeper process of change in the condition of an individual, group, or community. As a result, this article adopts not one but two working definitions of empowerment for the purpose of evaluating PGIS projects:

1. *Empowerment* is an increase in social influence or political power. Conversely, *disempowerment* is a decrease in social influence or political power.
2. *Empowerment capacity* refers to aspects of the deeper process of change in the internal condition of an individual or community that influence their empowerment.

Empowerment Studies

One of the limitations on using the term empowerment in a useful way is related to the level of confidence one can have in the observation and measurement of this phenomenon. As noted by the Centre for Population and Family Health (CPFP 1992), the ''serious assessment of

empowerment as a result of a particular program or approach is hindered by the lack of tools with which to document and measure the process.'' The challenge remains to translate the ideals of empowerment and empowerment capacity into a series of recognizable indicators that can be observed, monitored, and perhaps even measured.

Indicators are defined as specific or explicit verifiable measures of change or results brought about by social action or activity; they are standards against which to measure, assess, and show progress and change over time (IISD 1999). For example, evaluations of Bangladesh Rural Advancement Committee micro-credit programs used indicators to measure women's empowerment, including mobility, economic security, involvement in major household decisions, political and legal awareness, and involvement in political campaigns (Oxaal 1997).

More recently, frameworks to categorize and analyse empowerment have begun to emerge (see, e.g., Elwood 2002; Friedmann 1992; Rocha 1997; Scheyvens 1999). Regina Scheyvens (1999, 247), in her study of the links between ecotourism initiatives and empowerment, offers a framework to examine different kinds of empowerment (each with an associated set of indicators) at the community scale. Scheyvens notes that empowerment manifests itself on four levels: *economic empowerment*, related to equal and lasting economic gains for the local community; *psychological empowerment*, related to the enhanced or eroded self-esteem of community members; *social empowerment*, related to the local community's equilibrium and cohesion; and *political empowerment*, related to a fair and just political structure.

Three of the levels of Scheyvens's framework are drawn from John Friedmann's (1992) theoretical work on empowerment, which claims that empowerment involves households gaining one of three related types of power; Friedmann argues that these follow each other in a linear progression from social to political to psychological power.

Sarah Elwood's (2002) model was developed specifically in response to calls in the PGIS literature for a clearer and more in-depth understanding of the term ''empowerment'' (Brodnig and Mayer-Schönberger 2000; Elwood 2002; Kyem 2002). Because of its association with PGIS initiatives, Elwood's research is possibly most relevant to the research described here. Elwood's (2002) study outlines a ''multidimensional conceptual framework for assessing empowerment (and disempowerment) . . . in examining the impacts of GIS use by community based organisations'' (Elwood 2002, 905). Her framework draws from propositions made in PGIS literature as to the mechanisms through which GIS use negotiates and alters power relations between neighbourhood organizations and local government institutions. Elwood notes three interrelated conceptual groups of empowerment: empowerment related to *distributive change,* which refers to outcomes such as increased access to goods and services; *procedural change,* which infers shifts in perceived legitimacy of groups; and *capacity building,* or an increased ability of citizens or communities to ''take action on their own behalf'' (Elwood 2002, 909).

All of the above frameworks are limited to providing categories of empowerment outcomes. These categories do not differentiate between empowerment capacity and empowerment, and therefore they do not indicate the relative closeness of each category to actual power shifts, even though some (i.e., increased access to goods and services) appear less related to power than others (i.e., changes in perceived legitimacy).

Another comment on these frameworks is that although they are useful for determining whether and what type of empowerment has taken place, they are less beneficial in determining *how* it has taken place. One way to help reveal the mechanisms and processes that influence empowerment in a community is to examine empowerment across different social scales. ''Scale,'' in this context, refers to a hierarchical and relational interplay between different individuals and communities across space, place, and environment (Marston 2000). However, Scheyvens's (1999) study, while recognizing that the communities are not homogeneous units, establishes her scale of analysis at the level of the community and so fails to examine empowerment of the individual and how this interacts with the wider community. There is also no examination of the community's enhanced power in relation to the wider socio-political environment. Friedmann's (1992) use of households as the social unit that undergoes empowerment is also questionable, as it ignores power inequities within the household, commonly related to gender or age. Elwood's (2002) framework focuses on the power dynamic between the neighbourhood and local government. It does not clearly examine the way in which empowerment may occur differently at the individual and neighbourhood levels.

Elizabeth Rocha (1997), however, presents an empowerment framework that explicitly examines empowerment across different social scales. She employs a ladder metaphor similar to Sherry Arnstein's (1969) ladder of participation. The aim of her model was to allow practitioners to ''clarify their goals and methods in their empowerment initiatives'' (Rocha 1997, 31). Unlike the previous studies, Rocha's model shows that empowerment varies between distinct scales because, ''in a manner similar to citizen participation, all empowerment is not equal'' (Rocha 1997, 31). Rocha describes five loci, or rungs, across which empowerment is manifested. The loci progress sequentially along an axis from the individual to the community. The first rung relates to individual empowerment; by the second rung, the individual views

him- or herself as embedded within a larger context; by the third rung, the empowered has accumulated the knowledge and information necessary for community decision-making and action; the fourth rung, referred to as ''transformative populism,'' focuses on the process of change within a community in the context of collaborative struggle to alter social, political, or economic relations; in the fifth rung, the community experiences political power. Rocha notes that

> These models of empowerment are not evaluatively arranged along an axis that characterizes one as less beneficial and one as more beneficial. They are arranged on the ladder based on the intended locus of their outcomes: from individual to community empowerment. (1997, 34)

Rocha believes that empowerment manifests itself differently at each of these different social scales. She refers to the scales as ''empowerment types'' (1997, 33). Rocha's framework uses David McClelland's (1975) classification of power, which describes a range of different power experiences that can range from deeply personal changes to the individual through to broad political changes at the community level.

Rocha's model is a conceptual model of a linear progression; it is helpful for understanding the dynamics underlying the overall accumulation of empowerment in a community. It is less useful for analysing how a specific intervention or project empowers a community. Nonetheless, this article is influenced by Rocha's (1997) claim that empowerment is experienced differently at different social levels.

If analysis of empowerment is restricted to looking at the impacts of a project as a whole, it is difficult to apply the lessons learned to other initiatives. This is particularly the case in evaluating PGIS initiatives, which may employ a complex collection of technologies and methodologies to enable a community to document, manage, and communicate information.

Below we introduce a framework for reporting empowerment that differentiates between social scales and allows for observations of empowerment, using as a guide a set of key catalysts.

An Empowerment Framework

We propose a simple two-dimensional framework for examining empowerment. The framework incorporates two social scales, namely the *individual* and the *community,* and four catalysts of empowerment, namely *information, process, skills,* and *tools* (see Figure 1). The framework recognizes that both empowerment (i.e., an increase in power) and a change in ''empowerment capacity'' (i.e., a change in internal condition that influences empowerment) occur at both social scales. The analysis of empowerment involves exploring how the different catalysts cause empowerment as well as changes in empowerment capacity at the individual and community levels.

Consideration of each cell of the framework can be used to structure an examination of indicators drawn from field data that relate to empowerment and empowerment capacity. Indicators in the context of the proposed framework are pointers, facts, stated opinions, or perceptions that look into and represent changes of specific conditions or situations relating to a PGIS project. These indicators will show both the rise and the decline of empowerment and empowerment capacity. In the following sections we begin by discussing the two social scales (individual and community), then move on to discuss the four catalysts (information, process, skills, tools).

THE SOCIAL SCALES

Social scales of relevance to a PGIS project include the *individual*, the *community*, and the *region*, as well as the overlap between them. These scales are used as defining parameters for structuring the framework and for analysing the impact of a PGIS project. Figure 2 helps readers to visualize these social scales and the way in which they interact.

The third social scale, the region, was added because empowerment of the community involves the community interacting with the wider environment. Empowerment of the region is not included in the framework shown in Figure 1 because the focus here is on examining

	Empowerment of the individual	Change in empowerment capacity in the individual	Empowerment of the community	Change in empowerment capacity in the community
Information				
Process				
Skills				
Tools				

Figure 1. Framework for structuring an analysis of empowerment.

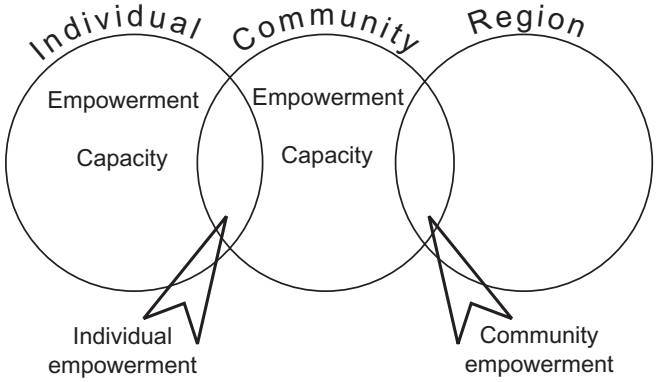

Figure 2. Empowerment is influenced by the empowerment capacity of individuals and the community.

the impacts of empowerment on the individual and the community. The region is included in Figure 2, however, to help provide the wider geographic dimension of the model.

The three circles in Figure 2 represent individuals within the community, the community as a whole, and the region that surrounds and interacts with the community. The overlapping areas between the circles represent the interactions between the different social units in terms of power. In other words, it is in the overlap that empowerment of the individual within the community, and of the community within the region, occurs. Inside the circles we see the changes occurring within each social unit, in other words, the changes in empowerment capacity that will influence its empowerment. As empowerment of the region is not a focus, the circle representing the region is left blank.

These issues of empowerment and empowerment capacity are discussed below for the individual–community and community–region levels of empowerment.

Empowerment of the Individual within the Community

The interface between the individual and the community represents the empowerment of individuals within their community. In the analytical framework, empowerment and disempowerment can be explored by examining the changing social and political role of the individual within his or her community as a result of a PGIS project. Greater participation in decision making relating to a PGIS initiative might be one indicator of empowerment (Gebert and Rerkasem 2001), as would obtaining a position of authority in the community (Parpart 2000) or being asked to represent the community in the wider political or social sphere.

Increasing the Empowerment Capacity of the Individual

Ramon (1999, 39) notes that most of the ''debate of empowerment . . . remains at the individual level.'' A common theme throughout the social work, adult education, and development theory literature has been that empowerment is a social process that helps individuals gain control over their own lives through some degree of personal development. In this context, individual empowerment has been referred to as a state of mind, a perceived feeling of greater competence or power (Dubois and Miley 1992), and the ability to ''draw on inner strength to take control of a situation and assert oneself'' (Ristock and Pennell 1996, 3). Empowerment at this level is related to ''increased individual efficacy and the process . . . of altering the emotional and physical state of the individual'' (Rocha 1997, 34).

This theory of personal development is influenced by Freire's theory of Critical Pedagogy (1970), which has emerged as a central model for discussing and understanding empowerment. The core hypothesis of Critical Pedagogy is that human liberation from existing exploitation and historical prejudice can be achieved through education (Barry and Sidaway 1999; Macdonald and Macdonald 1999). According to Korrie de Koning (1993, 34), Freire believed that traditional educational activities do not challenge inequalities in learners' lives; rather they perpetuate existing inequalities. While working with illiterate and poor adults in North Eastern Brazil, Freire developed teaching methods that combine learning to read and write with looking critically at one's social situation. The expectation of this approach to education was that by learning these new skills students would gain a clearer realization of the injustices of their own situation; this Freire refers to as critical consciousness. The same idea might be applied to a PGIS initiative. As individuals learn new skills associated with a project and begin to use those skills to represent and analyse the environment around them, they might develop the ability to critically examine their own position. This would lead them to undertake initiatives toward transforming the society that had previously denied them social and educational opportunity (Thomas 1992). Education, viewed in this light, is ''primarily a political endeavour'' (Wendt 2001, 140).

It is important to note the consensus in the literature that development of a critical consciousness is not confined to the development of the skill base and education of the individual; it also involves the ability to make connections between the personal and political spheres (Miley and Dubois 1999). Critical consciousness involves more than simple learning or understanding of facts – it entails an element of personal reflection that incorporates an understanding of how the individual positions him- or herself in relation to those facts (Higgins 1994) and subjectively within society. Critical consciousness involves an ability to deconstruct political practices (Wendt 2001). A willingness to be politically radical and attempt to initiate social change is also vital to empowerment (Barry and Sidaway 1999). There are examples in the literature of individuals becoming politicized and politically active as a result of their involvement in PGIS initiatives (Corbett and Keller 2002; Ghose 2001; Elwood 2002).

However, in addition to creating critical consciousness, the knowledge and skills obtained through education can give the disadvantaged a sense of equality with the ''educated'' classes in society and help them to overcome the sense of intellectual inferiority that can powerfully inhibit their confidence to assert their own initiatives (Marsden and Oakley 1990). This lack of confidence has been called ''internalized oppression'' (Thomas 1992; Rowlands 1997). New knowledge and skills allow individuals to overcome negative social constructions so that they see themselves as having the capacity and the right to act and influence decisions (Rowlands 1997) and the social conditions of their lives (Ristock and Pennell 1996).

Empowerment of the Community within the Region

The interface between the community and the region refers to the role of the community within the wider geographic region. Empowerment at this level is explored by examining the relationship between a PGIS project and the changing political role of the community. One indicator of empowerment might be the community reaching a successful outcome in regional decision-making processes as a result of using evidence created as part of a PGIS initiative. Another might be a community's increased ability to control and influence the actions of outsiders that affect the community. For example, PGIS-gathered data displaying areas of illegal logging by one community in Indonesia were communicated to the government and thereby used to halt these activities, representing the community's ability to influence these outside events (Corbett 2003).

Increasing the Empowerment capacity of the Community

Empowerment capacity is not only an individual psychological construct. Barry Barnes (1988) states that if individuals can act and interact coherently with one another, then the total power available is considerably increased and the overall capacity for action is larger and wider ranging than that of a collection of isolated individuals. This, in turn, gives greater potential for empowerment because of the ''shared forces and expertise which a group has at its disposal'' (Ramon 1999, 41). Ramon also feels that to gain some control over power structures there must be collective public action; this can only be possible if there is a collective identity and vision.

The planning and development literature agrees that community participation processes can help create a shared understanding of problems and a vision for positive change, thereby strengthening the collective identity of a community (Agyarko 1998; de Koning 1995). This, in turn, generates the confidence of all members of a group to question and challenge the status quo; it is therefore seen as leading to the empowerment of the marginalized. As Sarah White states,

> The idea of participation as empowerment is that the practical experience of being involved in considering options, making decisions and taking collective action to fight injustice is in itself transformative. (1996, 8)

The term ''empowerment,'' as noted earlier, has now gained such widespread acceptance that it is often used synonymously with the term ''community participation.'' Rocha (1997) notes that because of the uncertainty around the term ''empowerment,'' citizen participation often serves as a proxy for empowerment. This is because the ''concepts of empowerment and community participation . . . [both] have their origins in the fight against poverty'' (Barry and Sidaway 1999, 14) and injustice. Their common emphasis has been on enabling the less powerful sectors of society to gain control over their own lives and become meaningfully involved in influencing decision-making processes.

Kenji Kuno (1998) postulates that participation and empowerment are two sides of the same coin and that empowerment needs to be seen as the ideal output of participatory mechanisms. However, Agyarko (1998) challenges the assumption that this is a given by noting participation is not monolithic and that there are significant gradations, interpretations, and variations in the term. He questions whether, indeed, all forms of participation lead to empowerment and whether all participatory processes even intend to address power relations. This view is shared by Arnstein (1969) in her ''ladder of participation.'' Yet Arnstein does recognize that citizen participation, in its purest sense, is citizen power and is specifically linked with the redistribution of power (Heckman 1998).

When considering empowerment at the community level, it is important to note that communities are not homogenous entities. De Koning (1995) points out that

much of the empowerment literature uses broad and abstract categories, such as ''the poor'' and ''the oppressed.'' She feels that by treating these groups as a single category and implying that their path to liberation is the same, this literature fails to recognize the complexity of empowerment.

For instance, a marginalized community that, through participatory mechanisms, has been empowered to take a more successful role in regional decision-making processes might in turn be marginalizing groups within the community, such as women, youth, the less educated, or the less wealthy. The introduction of a PGIS initiative might serve to disempower pre-existing power brokers in a community (Harris and Weiner 1998b). However, participatory mechanisms that take place at the community rather than the regional level should, with their emphasis on involving marginalized groups, empower these groups to take part in decision making. Nonetheless there is the potential for the empowerment of marginalized groups in a community to lead to increased conflict within that community, thereby decreasing a community's capacity for empowerment at the regional level.

THE CATALYSTS

The *catalysts* in our model are to the specific elements of a PGIS project that lead to or influence the empowerment and/or changes in the empowerment capacity of individuals and communities. These catalysts include the *information* contained within a PGIS, the participatory *processes* employed by a PGIS project, the *skills* acquired by participating communities through the project, and the *tools* used to develop a PGIS. These will be discussed in turn below.

Information

The explicit link between power and information has been noted elsewhere (Brown and Duguid 2000; Chambers 1994, 1997; Parpart 2000; Scoones and Thompson 1993). An ability to communicate one's own information can place individuals, groups, and communities in stronger positions (Yoon 1996). A link also has been drawn between communicating spatial knowledge and power (Alcorn 2001; Brodnig and Mayer-Schönberger 2000; Harley 1988, 1989; Peluso 1992).

In the empowerment framework, the information catalyst represents the information gathered during the course of a PGIS project. The information can be in diverse formats, including maps, text, photographs, and videos. The information can be further categorized by subject matter or purpose. Categories may include, for example, cultural, documentary, political, family, and commercial information. The framework enables analysis of how the documentation, control, and use of this information contributes to empowerment and changes in empowerment capacity at the individual and community scales.

Process

Gavin Jordan (2002) and Christine Dunn, Peter Atkins, and Janet Townsend (1997) note that empowerment in PGIS initiatives is most clearly linked to the requisite participatory process. Jordan, discussing the use of PGIS in Nepal, concludes,

> It was found that the emphasis [of the project] had to be firmly on participation rather than technical issues. A system-based approach that actively encouraged participation was found to be the key requirement for a useful PGIS. (2002, 243)

In the empowerment framework, the process catalyst represents the specific participatory process used by a PGIS project. Process can take many forms and has multiple components. The participatory process may be by invitation, demand, or coercion. It may specifically include or exclude parts of a community. Deliberate efforts may be made, for example, to encourage gender- or generation-specific participation. Decision-making about what information to collect may be top-down or consensus based. Information gathering may be by targeted individuals or by the community at large.

Skills

In the social work and further education literature, empowerment is often described as an outcome of activities whereby marginalized groups learn new skills that enable them to operate more effectively in their immediate environment (Barry and Sidaway 1999; Macdonald and Macdonald 1999). This aspect of empowerment has appeared less in the PGIS literature, possibly because most PGIS initiatives are expert-driven and the technological skills remain in the in the hands of the experts.

In the empowerment framework, the skills catalyst represents the new skills acquired by individual community members and communities as a whole through the training associated with a PGIS project. These skills may include gaining software literacy, learning to operate video and camera equipment, learning to capture coordinates using a GPS, learning to manage files in a computer, or learning to record a song. The term ''skills'' refers to the ability to use the new technologies; it does not refer to how the technologies are used.

Tools

As information technologies proliferate and become easier to use, attention is being given to the role of the tools themselves in the empowerment process.

John William Higgins (1994, 12) states that "anyone expecting to be emancipated by technological hardware, or by a system of hardware, however structured, is the victim of an obscure belief in progress." Gernot Brodnig and Viktor Mayer-Schönberger (2000, 12) cite Krantzberg's First Law, which states that "technology is neither good nor bad, nor is it neutral," pointing to the importance of the social, political, and economic context of technologies. Yet, increasingly, the link between the technology – including electronic devices and software – and empowerment is being noted. This idea is represented throughout the PGIS debate as well as being promoted by commercial interests.

In the empowerment framework, the tools catalyst represents the specific equipment used during the development of a PGIS, including the hardware (e.g., a computer, video camera, or digital camera) and the software (e.g., operating systems, GIS, and video-, photograph-, and text-editing programs).

Summary

We have argued here that the PGIS literature has been debating the "GIS–empowerment–marginalization nexus" (Harris and Weiner 1998a) without paying sufficient attention to observing or understanding the phenomenon of empowerment, with a few significant exceptions (including Elwood 2002; Kyem 2004b). Furthermore, tools to facilitate a structured analysis and reporting of empowerment in PGIS case studies have been lacking. We have therefore proposed two working definitions for empowerment, including one with a focus on empowerment capacity, and have introduced a structured framework to explore empowerment; this framework is based on empowerment studies undertaken in Indonesia. The framework can be used to evaluate empowerment at different social scales, looking at the impacts of a PGIS initiative on individuals, their communities, and the regions within which these communities are found. The framework also includes criteria for examining not only the relationship of empowerment to the uses to which the PGIS was put but also the relationship of empowerment to the participatory processes used by the project and to mastery of the skills and tools employed.

Future research is needed to test whether the empowerment framework presented in this paper, developed while working with two communities in Indonesia, is universally applicable or whether it is limited by the geographic and cultural setting in which it was created. It may emerge that additional empowerment catalysts are necessary to make the framework sufficiently flexible to be useful under a range of community conditions. There is the possibility of applying the framework from the beginning of a PGIS initiative in order to examine its potential for monitoring empowerment over the course of a project as well as defining and achieving empowerment objectives, rather than for post-project evaluation alone.

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