Qualitative GIS: Mixed Methods in Practice and Theory

Chapter 5

'Representing our Reality': Geographic Information Technologies, Local Knowledge and Change.

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Abstract

Increasingly local communities throughout the world are using a range of cartographic tools and technologies to depict the complex set of relationships between themselves and their territories. These range from community produced paper maps and the building of physical Participatory 3-Dimensional models, through to the deployment of sophisticated Geographic Information Systems (GIS). Collectively they are referred to as Geographic Information Technologies (GIT). The thematic commonalities shared between these different tools and technologies are manifested through the application of processes which are typified by being initiated, guided and realized at the community level, as well as a desire to communicate information about traditional land and seascapes to decision-makers as well as future generations. The *raison d'etre* behind creating these products often rests on the assumption that the cartographic medium is a commonly understood and recognized visual language that is both effective and powerful in communicating this community-space relationship. GIT have the potential to be a medium that allows local communities to represent themselves spatially and thereby contribute to gaining recognition and inclusion in land and sea as well as natural resource claims, planning and management.

The production and use of community GIT can often have profound and at times unforeseen ramifications. From engaging in the process of creation through to their

application and use, they have the capacity to impact social institutions within the community as well as wider relationships on a social, cultural as well as political level. These ramifications and impacts to the large part are determined by a series of enabling and disabling local, regional and national environments. Drawing on case studies, research and experiences from Fiji Islands, Indonesia, Kenya and the Philippines, this paper will explore some of the social and political issues related to the creation and use of GIT in gathering and representing local knowledge in the struggle for some communities to gain local autonomy over traditional lands and development processes and safeguard their cultural heritage.

"W*e have learnt things about our land that we had forgotten.*"

"*I felt happy to see the way our land has been represented, this will help our children to know their territory.*"

"*Our rights that were hidden have now come to the light*."

These short statements were written on cards and stuck on large sheets of craft paper hanging on the wall of the village where elders had gathered to map the boundaries and resources of their ancestral territories. The mapping exercise represented a milestone in a long running process initiated by the Ogiek Indigenous Peoples living in the Mau Forest Complex in Kenya to regain their lost lands. Assisted by trusted intermediaries, the Ogiek organised and presented their spatial memories through the manufacturing of a 1:10,000 scale, geo-referenced, three-dimensional model (see **Figure 1**). The process of manufacturing the model, developing a mutually agreeable legend and superimposing mental maps on the blank model lasted 11 days, and involved 85 Ogiek elders representing 21 clans and 37 youth. Deep reflection and intense negotiation among members of different clans accompanied the process. Assisted by the model, elders would locate and articulate their spatial knowledge, often with great excitement. Each feature placed on the model, whether a pin, string or a smear of paint, captured memories that were supported by handwritten notes and audiovisual media. These multiple sources and mixed media representing the tangible and the intangible heritage of the Ogiek people were later transposed with the consent of the knowledge holders into a GIS[1].

This modelling process stimulated community cohesion, helped reclaim lost memories about the traditional ways of living as hunter-gatherers, facilitated inter-generational knowledge exchange and raised awareness across generations and participating stakeholders on the critical status of the environment in terms of depleted forest cover and affected watershed functions. Community members concluded that they had a more holistic understanding of their social, cultural and biophysical environments and that they realised the importance of working together towards a common goal. They further stated that they became aware of the value and potential authority of their spatial knowledge once it was collated, geo-referenced, documented and visualized. This example illustrates how participatory community mapping may be a kind of qualitative GIS by way of its richly interactive and reflective processes of negotiating and representing knowledge through diverse media, experiences, and ways of knowing. In this chapter we develop these linkages in more detail, characterizing processes and politics of participatory community mapping in a growing number of struggles for self-determination in the Global South.

[1] The products of the exercise (video clips, images, audio recordings, notes, written statements, drawings, diagrams drawn by the villagers and other forms of data) plus data gathered via other exercises, are ultimately intended to be compiled in a multimedia Ogiek atlas.

Figure 1: Ogiek elders are video-recorded while sharing their memories related to locations visualised on the 3D map of their ancestral lands. Nessuit, Kenya, 2006. Author: G. Rambaldi ©/CTA.

Community Mapping in the Global South

The view that "maps…convey a sense of authority" (Alcorn, 2000 p.1) has contributed to the "premise that mappers engage in an unquestionably 'scientific' or 'objective' form of knowledge creation" (Harley, 1989) that ultimately represents the 'truth' and shapes the way that we understand the spatial world around us. However, this misconception has increasingly been questioned by academic discourse seeking to reveal the subjective and manipulative nature of geographic information and cartographic communication and questioning the objective and apolitical claims of the scientific model (Belyea, 1992, Crampton, 1995, Dahl, 1992, Harley, 1988, Harley, 1989, Harley, 1990, Harvey, 1990, Monmonier, 1991, Wright, 1942, Wood, 1992).

Representation of geographic information through the science of cartography is not neutral and is in no way separate from the broader power relations present in society (Livingstone, 1992). Since the inception of Cartesian map-making, colonial and ruling powers have used maps as a tool to exert their claims over land (Edney, 1993, Wood, 1992). These claims have often been made to the detriment of societies already living on the land (for examples see Brody, 1981, Crawhall, 2001, Harris and Weiner, 1998, Peluso, 1995, Poole, 1995). As Hall (1993) states, "with centuries of distance and historical hindsight, we can see that error and bias, exploitation and colonialism, self serving centrism and ecological harm can so easily

be read into the subsoil of old maps that they may as well be listed with symbols and explained in the legend" (in Pickles, 1995 p.21).

Despite forces that have served to exclude non-experts from map-making, a growing number of local communities[2] and organizations associated and working together with communities (including development facilitators and technology intermediaries from non-governmental organizations, community-based organizations, universities, and development agencies) have begun to harness the potential power associated with maps for their own gain. These initiatives are commonly referred to as 'community mapping'. This is a map-making process that attempts to make the association between land and local communities visible to outsiders by using the commonly understood and recognized language of cartography.

Community mapping projects have sprung up throughout the world (see Chapin et al., 2005, Crawhall, 2006, Poole, 1995, Stan and Amiel, in press); from Southeast Asia (Bujang, 2005, Flavelle, 1995, Momberg et al., 1994, Peluso, 1995, Vera, 2005), through Central Asia (Jackson et al., 1994, Poffenberger, 1996), Africa (Harris and Weiner, 1998, Jackson and Bond, 1997, Rambaldi et al., 2007), Europe (Carton, 2002b, Carton, 2002a, King, 1993), North, South and Central America (Bird, 1995, Chapin and Threlkeld, 2001, Jardinet, 2006, Kemp and Brooke, 1995, Poole, 2006), the Pacific (Rambaldi et al., 2006c) to Australasia (Harmsworth, 1998). Many different types of communities have undertaken mapping projects, ranging from relatively prosperous groups in areas of Northern Europe and America, to local communities and forest-dwelling indigenous groups in the tropics.

[2]Within the context of this chapter 'local community' is defined as a group of people who regularly associate with one another in a specific geographic location on the basis of a shared interest, reliance, relations and identity. When using this definition the authors recognize that the 'community' is not a homogenous entity but rather an affiliation of individuals, and that "communities are differentiated in terms of status, income and power" (Midgley, 1986, p.35)

Figure 2: Ogiek Peoples – traditionally hunter-gatherers - using aerial images to locate their traditional lands. Nessuit, Kenya, 2005. Author: G. Rambaldi ©/CTA.

Community maps often differ considerably from more mainstream maps in content, appearance and methodology. They represent a socially or culturally distinct understanding of landscape and include information that is excluded from conventional maps, which usually represent the views of the dominant sectors of society. Community maps can pose alternatives to the languages and images of the existing power structures and become a medium of empowerment (Peluso, 1995). They have the potential to enable local communities to spatially represent themselves, and their relationship to their local physical, socio-cultural and biological environments. Yet concomitantly community maps have the potential to create tension and undermine local communities both internally and in their relationships with outsiders. Many practitioners call for caution. They note that the use of mapping tools and practice at the community level may lead to increased conflict, resource privatization, and loss of common property (Abbot et al., 1998, Crawhall, 2001, Fox et al., 2005, Harris and Weiner, 1998, McCall, 2004, Rundstrom, 1995).

Fox et al (2005 p.10) concluded after a two year study of participatory mapping projects in Asia, that "spatial information technology transforms the discourse about land and resources, the meaning of geographical knowledge, the work practices of mapping and legal professionals, and ultimately the very meaning of space itself." The paper further argues that "communities that do not have maps become disadvantaged as rights and power are increasingly framed in spatial terms" (Fox et al., 2005 p.7) and concludes on a critical note that mapping has become necessary – as failing to be on a map corresponds to a lack of proof of existence, and to own land

and resources. Overall, this must be framed in the need for developing "critical clarity with respect to mapping based on a comprehensive understanding of both intended and likely unintended consequences of our actions" (Fox et al. 2005 p. 10).

Thus, several decades of research and practice suggests that community mapping differs from conventional cartographic approaches in its processes, potential productions or outputs, and content - the sources and forms of spatial knowledge that are integrated. Some key statements used to recognize and denote community maps include:

Community mapping is defined by the process of production. Community maps are ideally planned around a consensus based goal and strategy for use (Alcorn, 2000) and made with input from a whole community in an open and inclusive process (Aberley, 1993, Flavelle, 2002, Johnson, 1997). The higher the level of participation by all members of the community the more beneficial the outcome because the final map will reflect the collective experience of the group producing the map (Brody, 1981). This level of community engagement is of greater significance in the creation and effective use of community maps than the cartographic skills required to make them. Good practice associated with community mapping usually involves providing the spaces to enable everyone to take part in the map creation process, including women, youth and the more powerless members of the community, without fear of having their views altered or manipulated by the more powerful within the community (Corbett and Keller, 2005, Flavelle, 2002, Rambaldi et al., 2006a, Sirait et al., 1994). This is necessary because it is likely that if facilitators from outside the community do not create these spaces the views of marginal groups would remain unheard.

Community mapping is defined by a product that represents the agenda of the community. It is map production undertaken by communities to communicate information that is relevant and important to the community's needs and is for use by, or else on behalf of, the community. Yet the challenge of community mapping processes is to ensure that most of the agendas of the community are included in the final maps and that these reflect the views of all relevant groups (both powerful and marginal). This can be challenging, particularly in the South. During community mapping work in East Kalimantan it became obvious that women's views of important spatial information and knowledge were focused on resources and features close to the village site, while men concentrated on boundaries and tenure related issues on the periphery of traditional lands (Corbett, 2003). Presenting these disparate views and associated values on the same map can be challenging and can contribute to internal tensions, and occasionally conflict. Furthermore there is the issue of whether a community mapping process involving an external agent or organization might be undertaken to further support and strengthen the agenda of the external agent to the detriment of the community.

Community mapping is defined by the content of the maps, which depict local knowledge and information. Community maps contain the community's place names, symbols, scales and priority features (Flavelle, 2002, Orlove, 1993) and

represent local knowledge systems via a locally defined visual language made explicit via the map legend (Rambaldi, 2005). Yet careful consideration needs to be given to how the content of the map might be used. Once a map has been created it is often put into the public domain. This turns local knowledge into public knowledge and conceivably takes it out of local control (Abbot et al., 1998) . Documenting sensitive information and presenting it on map might serve to make that information more vulnerable to exploitation; this is particularly the case when maps draw attention to high-value natural resources or archaeological sites (Flavelle, 2002, Rambaldi et al., 2006a, Stockdale and Corbett, 1999). Maps make this information visible to outsiders, and therefore open to misuse. Furthermore there might be information within the community that is 'owned' by certain individuals and families; this information cannot be shared with other community members, let alone decision-makers and other groups from outside the community.

Community mapping is not defined by the level of compliance with formal cartographic conventions. Community maps are not confined by formal media; a community map may be incorporated into a GIS, be a cardboard terrain model or a drawing in the sand. Whereas regular maps seek conformity (Edney, 1993) community maps embrace diversity of presentation and content. Indeed idiosyncrasy and variety have been encouraged in some cases (Wright et al., 1997). Conversely a community map might lose its effectiveness to influence decision-making if it is not presented in a format or through a medium that is considered formal or professional.

Thus, community mapping is process focused, with emphasis upon participant-determined goals, content, and representations. With these characteristics in mind, the following sections illustrate the multiple purposes or applications that tend to motivate community mapping, the diverse tools and techniques that are employed, and the complex outcomes that are often produced.

Range of uses

Community mapping has been implemented in a broad spectrum of contexts. These include collaborative research initiatives (Hampson et al., 2003, Quan et al., 2001, Tan-Kim-Yong et al., 1994, Trong et al., 2002) community-based planning and monitoring (Bersalona and Zingapan, 2004, Denniston, 1994, McCall, 2004, Poole, 1995, Rambaldi et al., 2002, Zingapan and Vera, 1999), asserting territorial claims, managing land related disputes and supporting related negotiations (Chacon, 2003, Cook et al., 2003, Poole, 1995, Wood, 2002), preserving and revitalising indigenous cultural resources and intangible heritage (Crawhall, 2006, Crawhall, in press, Rambaldi et al., 2007) and consultative policy making (Carton, 2002a).

There are three main purposes for initiating a community-mapping project. These ultimately relate to the need to communicate land-related knowledge:

- Between community members,
- Between neighbouring communities, and
- From communities to outsider groups.

These points are addressed below.

Communicate information within communities

There are a number of ideal outcomes intended from a community mapping initiative. Perhaps one of the loftiest is for the mapping process to contribute to building community cohesion (Alcorn, 2000, Corbett and Keller, 2005, Stan and Amiel, in press) through providing a medium that allows a community to discuss and document its land-related knowledge. When elders share traditional place names and histories with other members of the community through the map-making process, it can generate a resurgence of interest in their local knowledge (Harmsworth, 1998) and facilitate intergenerational empathy (Corbett and Keller, 2004, Rambaldi et al., 2007). This can help a community sustain a sense of place (**Figure 3**) and a connection to the land (Aberley, 1993, Chapin and Threlkeld, 2001).

Figure 3: Minority groups involved in the Pu Mat Mapping initiative: Dan Lai, Thai and Kinh. November 2001, Nghe An Province, Vietnam. Author: G. Rambaldi ©/ARCBC

The mapmaking process can also act as a focus for discussions that will assist with recognising concerns and issues within the community. Discussions might raise community awareness about local and regional environmental issues or amplify community capacity to manage and protect lands (Bujang, 2005, Hardcastle et al., 2004, Poole, 1995, Vera, 2005, Zingapan and Vera, 1999). During the course of these discussions a community can formulate a common vision, which in turn may help to develop an effective community-based plan for future development (Harrington, 1995).

Community mapping is not about being an expert cartographer, but about community building, networking and communication. Once a community has an articulated vision and representation of its identity within the context of its physical, biological, economic and cultural landscapes, ideally it will be in a stronger position to effectively communicate and deal with external agencies, and it will be more likely to be involved in planning for its own future. Community maps might also become a medium that allow communities to record and archive local knowledge. Local communities and indigenous groups are increasingly using community maps as a means to record, store and manage important local knowledge and cultural information. Under threat from development and change, indigenous groups have used mapping projects to collect and preserve cultural histories (Crawhall, 2001, Crawhall, 2006, Crawhall, in press, Harrington, 1995, Rambaldi et al., 2007, Rambaldi et al., 2006c) and to record the knowledge of their elders about the land (Flavelle, 1995). This information is being recorded (**Figure 4**) in the fear that it will otherwise be lost as the older generations pass away and traditional ways of life change.

Figure 4: Fijian elders sharing knowledge with a student while marking resource areas on a 1:10,000 scale relief map of Ovalau Island. April 2005, Levuka, Fiji Islands. Author: G. Rambaldi ©/CTA

However, these ideal outcomes noted above are by no means assured during a mapping process. Shared decision-making and visions are sometimes irreconcilable

even (and often times especially) at the community level[3]. Furthermore, processes leading to ideal outcomes are often facilitated (and in turn the results are then shared) by 'experts' from outside of the community, which again raises the issue of whose agenda is incorporated into the map, the map making process and the communication of the results.

To communicate information between neighbouring communities

Increasingly communities in the South are producing maps that are used to record land-related agreements and communicate information between communities. Uncertainty and flux relating to lands rights, as well as increasing conflict over natural resources, has encouraged communities to map the extent of their traditional lands; in particular this form of community mapping focuses on boundaries negotiation and determination (Chapin et al., 2005, Chapin and Threlkeld, 2001).

For example, during the establishment of map-based community information systems in East Kalimantan in Indonesia, members from the participating communities of Benung and Tepulang decided it was necessary to document the location of the boundary between the two villages. On a prearranged day, elders from both villages met and walked the boundary between the two villages, agreeing on the position of the boundary without conflict. Using a Global Positioning System (GPS) and video camera, people from Tepulang recorded the entire process.

Six months later Tepulang began logging in the vicinity of the boundary between the two villages. Soon after operations had commenced Benung claimed that the logging operation was straying onto their territory. A joint village meeting was called. The map, GPS and video material captured during the boundary walk were displayed in this large meeting. Much discussion emerged related to the previously documented information with all community members I the meeting constantly returning to the multimedia and map data for reference to support their arguments. As a result of the community meeting discussion and mapping material, the conflict was resolved, and the logging operations withdrew from the contentious area leaving the felled timber behind. However, several community members from Tepulang expressed a high level of frustration with the meeting's conclusion; they blamed the unfavourable outcome on the 'inaccurate' information contained on the community map and associated multimedia information, as well as the entire community mapping process within their community (Corbett and Keller, 2004). For these community members on the losing end of the 'maps ability to influence decision-making', it was an overwhelmingly negative and marginalizing process.

Communicate information to outsider groups

Community maps have proved to be an effective, legitimate and convincing media to demonstrate to external agencies how a community values, understands and

[3] However, the mapping process can help identify and document divisive issues so that they do not interfere with a larger consensus building process.

interacts with its immediate space (Fox et al., 1996, Peluso, 1995, Poole, 1995, Rambaldi et al., 2006b). They have helped communities to communicate their often "long but invisible history of managing resources" (Hitchcock 1996 cited in Alcorn 2000 p. 9). Provided community members have generated the map and the legend, community maps present complex information in a well-understood and easily accessible format. This enables groups with language and cultural barriers and differences in values to easily communicate and understand the information presented. In the words of Aberley (1993 p.4) "maps can show a vision… more clearly than thousands of words."

Communication of community spatial information can ultimately enable communities to apply pressure for change. In some cases maps have been used to request ownership over areas of customary land that have been claimed by the state (Bersalona and Zingapan, 2004, Bujang, 2005, Denniston, 1994, Nietschmann, 1995, Vera, 2005). For example the Gitxsan and Wet'suwet'en First Nation bands in British Colombia, Canada have used maps in their attempts to have their native sovereignty recognised by provincial and federal governments (Olive and Carruthers, 1997, Sparke, 1998). Community maps have become a tool with which communities can seek recognition and inclusion in governance and decision-making processes, particularly in reference to land and natural resource management (Fox, 1994, Sirait et al., 1994). At times they have also succeeded in empowering grassroots efforts to hold governments accountable. In this sense, map making is a form of political action that is capable of bringing about change.

Range of tools

A broad and growing number of community mapping tools are now available and the choice of which one to use will ultimately be determined by the way in which the map will be employed and to maximize the intended impact on the target audience. The tools chosen need to be appropriate to the available resources (financial, human and equipment). The decision of which tools to use might also be influenced by whether the mapping initiative occurs within a community-driven process or whether it occurs within an externally driven process.

These tools range from low cost, low resource-input activities (such as sketch maps drawn in the sand – referred to as ephemeral mapping) through medium cost, medium resource input activities (such as Participatory 3-Dimensional modelling (**Figure 5**), or the production of a scale map using basic surveying techniques) through to high cost and high resource-input programs (such as developing and deploying computer based Participatory Geographic Information Systems). Although all these cartographic tools are now being used in community mapping initiatives there exists an inverse relationship between the technology used and the levels of participation attained - the greater the cost and complexity of use of the mapping tool, then the less likely community members will be to participate in the mapping initiative.

Figure 5: Ogiek Peoples visualizing their traditional lands using a physical 1:10,000-scale 3-dimensional cardboard model. Nessuit, Kenya, 2006. Author: G. Rambaldi ©/CTA

Although community maps have proven useful tools for communicating local knowledge they are limited in describing the complexity and extent of what is known about the land. For this reason maps are frequently supplemented with the written word. This is often an imperfect medium to represent local knowledge, especially for traditional people who may be illiterate and accustomed to communicating orally. Johnson (1992) noted that much local knowledge about the land is transmitted in the form of stories and legends that use metaphor and sophisticated terminology that might be lost if the information is transcribed. In Northern Canada Inuit groups believe that the written word fails to capture the depth and power of the spiritual relationship with the land (Johnson, 1992). There is a need for a tool that can combine the usefulness of maps with other digital media, such as video, images and audio, which are better at documenting the oral and visual aspects and the complexities of local knowledge.

Some practitioners argue that geographic information technologies (GIT), particularly GIS, can help demonstrate the close relationship between local people and their land by illustrating the multiple dimensions of human-land relations and as a result are well suited to preserve, revitalize and disseminate local knowledge (Corbett and Keller, 2006, Harmsworth, 1998, Poole, 1995). These technologies maintain the benefits of the Cartesian map to organize and reference spatial information and combine this with the capability of linking to attribute databases and other information in the form of digital images, audio and video. Increasingly GIS

technologies are being utilized to address land related issues with examples springing up around the global South (see Participatory Learning and Action 54 special issue *Mapping for Change: Practice, technologies and communication* for examples). Interestingly these applications have usually been adopted without the significant re-design of GIS. To an extent this reflects the flexible nature of GIS software, in particular its inherent ability to combine spatially referenced media (video, photographs and text) and other cartographic data. The emergent field of Qualitative GIS with its focus on 'multi-methods' and 'mixed methods' provides a useful framework to better conceptualize the potential application of GIS technology for community representation.

However, as a rule, the more advanced the technologies employed, particularly in relation to computer-based mapping tools such as GIS and internet-based mapping, the greater the risk of a community failing to take ownership and long term management of the maps and the tools and processes being driven and controlled by external agents. Furthermore, the more technologically advanced the mapping system the greater the long-term resources required (human, financial and equipment) to update and maintain those mapping systems. This calls into question the long-term sustainability of these projects (Fox et al., 2003, Poole, 2006). However, this needs to be weighed against the potential impact and persuasiveness of the map product might be stronger when presented in the digital medium than information presented using less formal cartographic tools, such as ephemeral and sketch mapping. Finding a balance between the intended purposes of the map, the available resources, capacity in the community and the duration of commitment to the project is vital to achieving a successful community mapping initiative.

Range of impacts

The ideal outcomes noted above are influenced to the large part by a number of interacting factors including the presence of enabling or disabling environments, and the role of technological intermediaries and the complexity of managing relationships between the actors involved in the mapping process. These will be talked about in turn below.

Presence of enabling or disabling environments

A formidable challenge to the realization of the potential offered by community mapping applications is the widespread lack of effective administrative mechanisms and structures through which decisions reached through community mapping and participatory GIS applications could be incorporated into mainstream decision-making (Kyem, 2004).

Although in some countries legislation has created the space for community mapping practice to be operational and the map products to be fed directly into land use planning activities (e.g. Mozambique), lack of enabling environments or even the

presence of disabling legal and regulatory instruments (e.g. Malaysia) present a serious obstacle to its widespread adoption, application and ultimately influence (Bujang, 2005).

For example in the Philippines the 1997 Indigenous Peoples Rights Act (IPRA) law established the rights of Indigenous Peoples to file claims and secure titles over ancestral lands or domains. The law institutionalized the leading role of the community by adopting the principle of "self delineation" in the conduct of all mapping and survey activities of traditional lands and territories. A year later this was challenged by the Philippine Geodetic Engineering Act of 1998 or Republic Act No. 8560 regulating the mapping practice and limiting the use of geodetic instruments, the conduct of land surveys and the preparation of Geographic Information System to licensed geodetic engineers (de Vera 2005), *de facto* signalling that the work of community mappers was outside the framework of the law.

Accordingly, the disconnection between formal (government) and traditional (community) institutions may have to be reconciled first in order to facilitate enabling environments that allow for effective community mapping to take place (Rambaldi et al., 2006b).

There is a reciprocal relationship between community mapping and good governance. An environment of good governance, and the underlying, though elusive, value of 'political will', are necessary preconditions for community mapping to function in a meaningful and effective manner. Though concomitantly, community mapping can also support effective good governance – it can be a practical mechanism that helps stimulate accountability, legitimacy, transparency, responsiveness, participation, respect for rights, equity, local usability, and other dimensions of good governance (McCall, 2004).

Roles and obligations of technology intermediaries

Producing geo-referenced information from local spatial knowledge and rendering it in the form of authoritative maps depends on the availability of data capturing skills, equipment and software. On the top of that, converting resulting information into effective messages for advocacy or negotiation requires communication and networking skills that are above and beyond those skills required and generated during the community mapping process. It is evident that skills needed to accompanying a demand-driven and effective community mapping process are multidisciplinary and are possibly delivered by trained technology or advocacy intermediaries operating from within the community or working closely on their behalf. Considering the opportunities and threats resulting from documenting, geo-referencing and visualising local knowledge, these intermediaries have to operate within the confines of a code of good practice (Rambaldi et al., 2006a). Although some informal codes of conduct do exist there remains an enormous range of approaches and consequently ethical behaviour in the application and delivery of community mapping initiatives.

Each profession and culture carries specific moral parameters and codes of ethics. As community mapping is a multidisciplinary practice it has to respond to a blend of different morals including but not limited to the following need to:

- Select GIT which are adapted to local environmental conditions and human capacities;
- Obtain prior informed consent;
- Put local values, needs and concerns first;
- Not raise false expectations;
- Be considerate in taking people's time;
- Consider mapmaking and maps as a means and not an end;
- Stimulate spatial learning and information generation rather than simply support data extraction for outsider's analysis and interpretation (Rambaldi et al., 2006a).

Conclusions

Community mapping initiatives in the Global South continue to expand both in extent and scope. Furthermore, local communities and their partner organizations appear committed to innovate and use new and emergent mapping tools and technologies to succeed in their desired aims of representing, documenting and communicating community knowledge in order to influence land-related decision-making. This involves using a range of tools, from ephemeral mapping through to developing and deploying sophisticated Qualitative GIS systems that combine mixed multimedia (including video and image data) material volunteered from multiple sources (men, women, young and old) with digital maps.

Despite the technology, what ultimately defines community mapping in the South is the processes by which the maps are made and put to work. Almost without exception, these initiatives require the development of linkages with groups outside of the community to assist in the map making and follow-up activities. As a result community mapping initiatives become as (if not more) contingent upon networking as they are upon cartographic expertise. In turn, this means that mapping processes are often facilitated by outsider groups (including non-governmental organizations, community-based organizations, universities, and development agencies) who are usually strongly committed to the principles of participatory development and high levels of local community engagement. However, there is still the absolute requirement that the role of these outsiders is from the position of 'facilitator' and not that of the 'expert'.

It remains that community mapping initiatives are complex processes and rife with contradictions; they have the ability to heighten the tensions and uncertainty that they seek to resolve. This is not because they are inherently flawed, but rather they reflect the complex roles and associations that already exist in every community throughout the world. However, given the uncertainty of land rights and ownership in the South, community mapping remains one of the most important practices in allowing local communities to represent their own relationship to their territories,

and subsequently engage in and influence land related decision-making processes. Its power and contribution to social justice should not be underestimated.

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