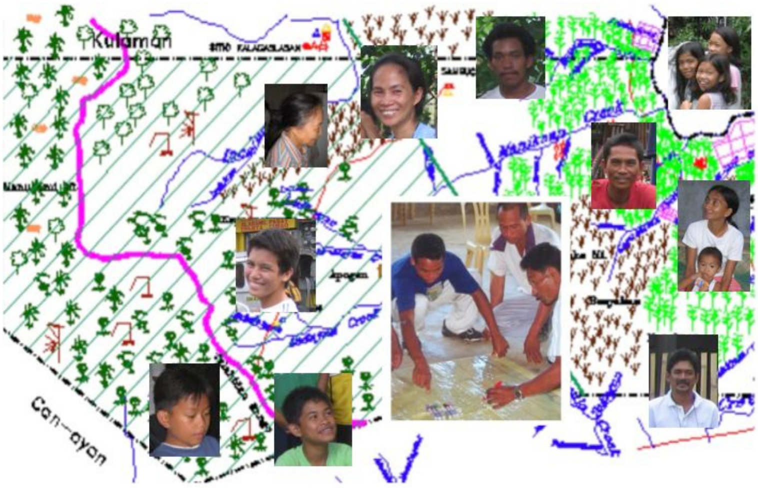
PARTICIPATORY GEOGRAPHIC INFORMATION SYSTEMS AND LAND PLANNING

LIFE EXPERIENCES FOR PEOPLE EMPOWERMENT AND COMMUNITY TRANSFORMATION

FRANÇOISE ORBAN-FERAUGE
FUNDP, NAMUR, BELGIUM
FRANCOISE.ORBAN@FUNDP.AC.BE

In collaboration with V.Aguilar, E. Alarcon, A. Carmona, N. Daix, B. Denil, A. Ignacio, J. Martinez, M. McCall, G.Miscione, E. Olivarez, M. Pandan. G. Rambaldi, R. Teruel, J. Verplanke



« I cannot think for others,
through others,
without others"

(P.Freire)

To Abet, Ana, Andres, Ating,
Barbara, Baudouin, Belle, Bernard,
Cesar, Cherie, Ching, Denise,
Frédérique, Gérard, Gussy, Eric,
Gwénaël, Ian, Iris, Jean-Paul, Jo,
Joel, John-Paul, Julie, Laurent,
Lito, Liza, Louie, Minmin,
Mummy, Nenita, Nicolas, Nilo,
Noel, Ophélie, Pedro, Pierre,
Popoy, Rachel, Riggs, Rita,
Robert, Romy, Roni, Ross,
Sabine, Sharon, Stéphane, Sylvia,
Terai, Vincent, Vir, Weng, Yvan.

Thank you for your sharing.
Thank you for your friendship.
Thank you for embracing our common cause.

Françoise

Preface

It appears that there is a seemingly unstoppable excitement about geo-referencing our human physical, biological and socio-cultural worlds and making the information accessible in the public domain. Stunning innovations (e.g. Google Earth) are now available to all those with adequate access to the Internet or to the modern Geospatial Information Technologies (GIT).

In a participatory context, the community members themselves, the technology intermediaries, the practitioners or the activists, and/or the researchers may use the GIT at the community level. Community workers, social scientists, anthropologists, ecologists, and many others may acquire the GIT competences useful for collaborating with professionals with an IT background. Alternatively, GIT may be introduced at the community level by IT people willing to map social, cultural and biophysical territories, and who can team up with social and environmental scientists. Participatory GIS is an emergent practice in its own right; developing out of participatory approaches to planning and spatial information and communication management. . PGIS practice is geared towards community empowerment through measured, demand-driven, user-friendly and integrated applications of geo-spatial technologies.

Geographical data and community maps may support the participatory approach during the data integration process on the condition that the practice of PGIS will follow some recommendations. Basically, maps represent an intermediary output of the long-term process and need to be integrated into the networking and communication initiatives. The maps produced and the spatial analyses represent important steps in the process. A good PGIS practice is embedded into long-lasting spatial decision-making processes, is flexible, adapts to different socio-cultural and bio-physical environments. The power of maps, GIT and modern communication technologies calls for greater responsibility of all those involved in practicing PGIS. Cartography is a political process. The actors detailing knowledge and information must be highly reliable. The adoption of a code of good practice is a priority. The debate is highly critical, given that the GIT are now easily accessible and affordable to the wider public.

PGIS as a practice depends on multidisciplinary facilitation and skills and builds essentially on visual language. The practice integrates several tools and methods whilst often relying on the combination of 'expert' skills with socially differentiated local knowledge. It promotes interactive participation of stakeholders in generating and managing spatial information and it uses information about specific landscapes to facilitate broad-based decision making processes that support effective communication and community advocacy. PGIS practice promotes an effective interactive participation of all actors, producers and managers of the geographical information. While the GIS technicians tend to focus on the gathering and computerized analysis of data resulting in the production of maps, PGIS practitioners focus on the process itself. Therefore, PGIS should be considered as an operational practice rather than a tool used to produce maps. A successful PGIS practice is demand oriented; it proactively implements collaboration between the people detailing the local and traditional knowledge, and the moderators experimenting in PGIS and technical information transfer to the deciders. The whole process must be participatory from a good comprehension of the law and rules/references to the formulation of adequate strategies and the selection of management tools for the geospatial information.

PGIS practice is about empowering ordinary people in adding value and authority to their spatial knowledge through the use of GIT and maps as a media to effectively communicate by increasingly using Web 2.0 applications and related multimedia. GIS may be one of the technologies used in the process, but this is not a must. In many developing countries, people do produce maps without using GIS. There is no doubt that GIS adds value and power to the analysis, but when it comes to PGIS practice, in most cases, spatial analysis is done by the people and not by the software. PGIS practice is the result of the merging of Participatory Learning and Action (PLA) and Geospatial Information Technologies (GIT). As defined, PGIS is embracing low and high tech GIT, from ground mapping (drawing in the sand) to participatory interpretation of remote sensing images, modeling, networking, communication and alliance building.

The process that leads towards the production of maps is more important than the output itself. The highly motivating process frequently reinforces the identity and the cohesion of the community members. Moreover, maps add power and authority to communication and are quite effective in raising awareness among policy and decision makers concerning people's concerns and aspirations.

The more the PGIS becomes a welcomed practice that serves development, the more the local elites may want to control such an emerging discipline, as they have done for decades with conventional development projects. If controlled from outside and focused on data mining rather than on supporting community empowerment and local management of traditional knowledge, PGIS projects may slip far away from their original people empowerment objective.

This book highlights the effectiveness of "participation" as the key ingredient of good PGIS practice. It positively invites the reader to reflect about it through the sharing of a range of experiences and case studies.

Giacomo Rambaldi

Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA)
Wageningen, The Netherlands

Introduction

Land Planning participatory processes aim to develop a common project through dialogue. As soon as meeting the people's needs and expectations are made the priority, these processes become compulsory. The objective is to consider everyone's interest in formulating original alternatives after all the actors have been identified and have agreed to reach a consensus. Such an approach presupposes empowerment, transparency, dialogue and negotiation from existing positions; it also assumes the attainment of case studies' consolidation and common hypotheses.

Through a common process wherein visions, objectives and projects are elaborated, the formulation of a future that will offer to all a better life becomes possible. Such a process requires information, which is able to reveal a common interest for consultation and data exchange. The geographer, due to his ability of focusing on the spatial dimension of human life as well as on the territory dynamics, has the highest interest in local consultations because these may produce innovations on how to appropriate, live, organize, and monitor the territories. Multidisciplinary by essence, the geographer exhibits his ability in combining and integrating various perspectives into a systematic analysis facilitated by Geographical Information Systems (GIS).

As an integral part of any democratic process, the participation of any territory actors must be implemented with a "bottoms- up" approach, rather than "top-down" (Beuret & Cadoret, 2010, p.180) mention a "participative" democracy versus a " representative" democracy. They recommend focus on the following selection criteria within any Land Planning proposal:

- consultation,
- governance,
- concerted management,
- participatory approaches,
- local initiative,
- inter-category dialogue,
- innovation,
- reproducibility,
- territory.

They distinguish between an exogenous Land Planning process, dictated and monitored by the local decision-makers who acquire legitimate power from the voting process, and an endogenous Land Planning process, wherein the local politicians provide support and guidance to their electorate's initiatives and desiderata. Far from opposing "top" and "down", the target is to create synergies between these dynamics through showing convergence in their objectives. While the local actors fear that the public sector might trap their creativity, the decision-makers fear that the reinforcement of an existing local particularism might counter the rules' uniformity.

Real and efficient participation is in action more than in opinion. It is about breaking the concentration of the power to confer capacity to many, done properly and democratically, in Land Planning decision processes. Bringing together various actors in a common approach, the participatory scenarios for Land Planning and Management are looking for general interest solutions wherein every actor identifies his own benefit in a common formulation of a consensus for a sustainable implementation of win-win solutions. The autonomy of the actors is such that it is the fruit of much more than the basic listening to their positions, or their public action participation initiated by others. Participation means bringing together people in a cooperative way towards a global interest, with no hierarchy, and in a flexible equilibrium. It is better to have one thousand suggestions expressed from the "bottom" even if these are hard to reconcile-- rather than a unique solution imposed from the "top".

Whatever, the notion of participation may take various modalities in the field. Its practice may start with a traditional survey moving towards a complex building of sustainable public policies. The ladder of participation as initially formulated by Arnstein (1969), revisited by Craig (2002) and Collins and et al (2006), expresses the multiple faces of participation practice.

Learning from numerous applications mainly led by the author in the Philippines, this e-book aims to clarify the notions of Participatory Geography, People's Empowerment, Quadripartite Partnership, and Power Sharing, in an action-oriented research that highlights the use of Geographical Information Systems (GIS). The roles and responsibilities for every territory actor are discussed, paying specific attention to the ethical aspects of a Participatory GIS (PGIS) practice.

The first chapter is derived from literature review and the personal experiences of the author. It summarizes the history of PGIS enriched by the diversity of methodological visions. PGIS methods are presented as social organizational approaches. The role and responsibility of the scientists are analyzed, facing the ethical challenges and the limits of the approach.

The second chapter gathers a sequence of several specific experiences that share, criticize and widen the perspectives of the many former collaborations of the author in the Philippines. It will go over several themes such as the participation of Indigenous Peoples (IP), the collaboration of Non Governmental Organizations (NGO), the technical contribution of PGIS to community development, the success of an operational partnership, and the implementation of participatory policies. The applications cover various environments including the management of forest resources, surface and subsurface waters, solid waste, urban and peri-urban agriculture, as well as the assessment of community basic needs. As a conclusion, PGIS perspectives are discussed in the emerging e-governance environment as a new challenge for the 21st century development.

A third chapter aims to assess PGIS practices based on their added value. It includes a critical overview of the new cyber techniques' practices in the influence spheres of Web 2.0 and neo-geography.

Chapter 1. Concepts and Methods

1.1. History

1.1.1. Participatory Rural Appraisal (PRA)

Participatory approaches in spatial analysis are rooted in the implementation of Participatory Rural Appraisal (PRA) methods during the 198Os. Their success shows the fast growth of people's participation (Oakley, 1991).

Paolo Freire, a Brazilian Marxist activist, was the first in reflecting on adult and marginalized population education during the early 1960s. As the one charged with the alphabetization program implementation in Brazil and Chile between 1962 and 1967, he highlights how awareness is important for all transforming action (Freire, 1974). Participation was introduced in the United States at the end of the 1960s in order to integrate the indigenous perspectives and knowledge into research (Chambers, 1983, 1989). Successfully extended to the development of rural communities, Freire's philosophy moved towards PRA methodology during the 1980s (Chambers, 1980). His objective was to help marginalized communities in analyzing their own reality. This was made with a view of correcting the lack of efficiency of the previous approaches.

From Rapid Rural Appraisal (RRA) methods that initiated the venue for various interest groups to discuss survey outputs (Ellman, 1981; McCracken et al., 1988), until the emergence of Participatory Rural Appraisal (PRA) methods, a lot of methodological approaches were developed during the 1980s. In parallel, many people's organizations and cooperatives (Oakley et al., 1991) were born in rural areas, and spread out rapidly to urban communities, mainly in the areas of education, health and resources management (Hadi, 2000; Gasteyer et al., 2000). From purely statistical approaches to the exclusive listening to rural populations approaches, through all the possible integration levels, numerous authors/actors came together for promoting the listening to the people as the foundation of any reality learning.

Conceived from the start for quickly gathering data on rural reality, PRA methods have progressively integrated the population as the key actor. At the same time, they associated partners from various disciplines and activity sectors (Chambers, 1990, 1993). They benefited from cross-reflections with an empirical urban tourism wanting to discover rural reality, as well as with theoretically long and boring academic research (Bahndari, 2003).

Actually, participatory models aim to empower the communities through providing help and support for them to control their development. Through this, every community is invited to become an active agent capable of influencing its own destiny. Specifically appropriated tools have been and are still developed covering data gathering, data processing, experience sharing, output communication, policy implementation, and evaluation by the populations themselves (Sedogo, 2002).

The concept of Participatory Rural Appraisal (PRA) includes all methods that invite a community to share, improve, and analyze its knowledge and life conditions within an action oriented research (Chambers, 1994). Such a research is automatically systemic as it focuses on the global ecosystems; biophysical, social and economic components are taken into account. Early in PRA history, the spatial character of the information became crucial in all forms of analysis and/or decision. PRA methods integrated cartographic modeling tools and gave participatory geography a priority role in the integration of the local population's and the regional land planners' perspectives into any resource management approach (Sedogo, 2002). More than just simply being a research tool, Participative Cartography (PC) constitutes a philosophy that shapes development projects given that the efficiency of its action is subordinated to the good practice of the Participatory Geographical Information Systems (PGIS).

1.1.2. Geographical Information Systems (GIS)

Effective GIS first appeared in the early 1960s. In 1962, Canadian Tomlinson made the first large land use inventory for Canada using geo-referenced and computerized data that were encoded as several overlapped layers (Tomlinson, 2007). The development of GIS during the 1970s and 1980s remained largely Anglo Saxon until it exploded during the 1990s.

GIS helps in formulating scenarios for the future due to their ability of visualizing, integrating, analyzing, and modeling giant databases associated with spatial references – also known as "geo-referencing" (Heywood et al., 2006). The specificity of GIS is that they associate a spatial reference to all data in at least two dimensions (latitude, longitude), or three (latitude, longitude, elevation). Therefore, each information type (infrastructure, housing, land use, population, sounds, video, etc.) corresponds to a specific "layer" map that may be linked "spatially" with the other layers. These links may be used to produce outputs such as thematic maps, crossed maps, analyses, and scenarios; they may also be processed through spatial analysis tools to produce new information layers. From a simple interrogation answering the questions of "Who? Where? When? How? … " to complex integrated interrogations like "Who with who? Who with what? When and why there and not here? …", GIS are very powerful in connecting information that may look like patchwork, as well as in formulating scenarios for the future answering the question "And if?".

At the end of the 20th century, costly classical software invaded the market (ESRI, ERDAS, INTERGRAPH, etc.). They now try to compete with powerful open source GIS software like GRASS, QUANTUM, MAPWINDOW, etc. that brought a revolution to the GIS world through their easy and free access (Steiniger, 2009). More recently, automatic cartography has been made efficient through the web, with the most famous tools being offered by Google or Bing-Microsoft. They contribute to the demystification of thematic cartography. Currently, online cartography shows few problems of data consistency that might itself soon be easily solved through daily used auto-validation processes (see 2.6).

Nevertheless, every GIS user has to rigorously learn about basic cartographic and statistical techniques to avoid any wrong message transmission. The formats and designs of GIS products seem to have no limits. Every day, sometimes with questionable success, one can see new representation techniques (pretending to?) improving the communication of the results. From a simple 2D thematic map to the most complex 3D model representations, the user may choose to share their analyses by way of tables, maps, schemas, 2D or 3D products, paper printed outputs, screen vision or digital format information.

1.1.3. Participatory Geographical Information Systems (PGIS)

During the 1990s, Participatory Rural Appraisal (PRA) and Geographical Information Systems (GIS) came together for delivering Participatory Geographical Information Systems (PGIS). This association is rooted in the frustration of many researchers when they realize that they cannot answer the big emerging social and societal challenges by means of the practice of a traditional GIS (Weiner et al., 1995). Some GIS practitioners decided to integrate a digital representation of the social reality into their classical GIS databases. They also showed openness in considering a perception of the natural phenomena that might be different from their expert vision (Weiner et al., 1995). Various interests groups joined them immediately and PGIS were born.

A common interest for participatory studies grew immediately due to the sharing of the information by the communities and the acceptance by some GIS experts of these communities' capability of analyzing their way of life and ecosystems. The real participatory studies did not aim to inform an external expert on local life condition; they focused on a local community with a view of helping its members in leading their own situation analysis and developing their own agenda (Chambers, 1994). In a sense, the first PGIS innovated only the way of integrating digitalized community vision and perspectives into a traditional GIS. Indeed, the communities have been using mental maps (soil, paper, stone, etc.) for a long time to express their reality. They have always been using spatial representations during their tribal and/or territorial negotiations (Weiner et al., 1995). It is only that the traditional ability of these communities for mapping their life was unknown or disregarded in the public spheres outside these communities. Participative cartography spread out during the 1990s as part of a new pluralist eclecticism and creativity regarding participatory methodologies (Chambers, 2006).

The digital encoding of the spatial references of the mental community maps facilitated their integration into GIS databases, as well as their overlapping with other preexisting information. With the help of the new technologies, it became easier to overlap the various actors' perceptions of a territory, making visible their individual interests as possible sources of potential conflicts. As a consequence, the dialogue between all the actors of a territory is facilitated by the use of common language and common references. To their usual "top-down" approach, the leaders/deciders became more open to a "bottom-up" practice. Most of the community information that had been kept far away from the traditional GIS databases were made accessible and were shared and used by all stakeholders (Cinderby, 1999). Such a combination of information allows the development agencies to directly interact with the life of a community so that they may propose to better serve the development of that community. They nevertheless encountered the risk to also serve external interests that might harm the community (see 1.2 for ethical reflection).

1.1.4. PGIS, pGIS, Pgis

Once PGIS practice is implemented, it is confronted by many potential problems such as, the restriction of community information when integrated into a GIS expert classification (Maguire et al., 1991), or the hiding of some community information when overlapped with an existing map (Wood, 1993). When PGIS practice emerged, a lot of data were stored with people having no idea of their usability, simply going by the "take and store all, you will certainly use it some day!" approach. Some errors, like the misunderstanding of territorial limits, even aggravated the existing conflicts more than they resolved them due to the failure in communication facilitation. PGIS practice cannot bypass the appropriate training of the participants regarding the use and understanding of maps, and their power, their ability to open the floor for discussion, instead of participants' considering maps as constituting finality (Cinderby, 1999).

The main challenge for PGIS practice continues to focus on how the participation is apprehended, how it is used, and how highly it is appreciated. Ideally, the participants must be allowed to conduct their own analysis in order to be really empowered. Some argue that, by essence, PGIS impose a quantitative representation of the social reality, versus a qualitative representation of its spatial component, which runs the risk of a positivist misleading in its interpretation (Kumat et al., 1997). During the first decade of PGIS development, few markers were implemented, while stormy debates converged towards the conviction that bringing together GIS experts and community people was the key for success. Nevertheless, that first decade remained at the level of how GIS technical experts might serve local communities instead of making the participation an efficient process for improving community communication in targeting effective people empowerment. The GIS practitioners were promoting a pGIS tool, focusing on the technical GIS aspect of the practice, instead of respecting a PGIS approach. Ideally, the development of a GIS tool to serve the community must pay respect to the balance between the Participation component and the GIS tool component (PGIS). Even better, the promotion of a Pgis practice by prioritizing the participation aspects is recommended. What practitioners/researchers must make clear is how they see their practice in terms of Pgis, PGIS or Pgis according to their own priorities.

Subsequently, fundamental ethical questions arose during the first years of the 21st century (see 1.2). A deep reflection emerged regarding the autonomy and the ownership aspects of the process and its products: Who is earning and who is losing? (Chambers, 2006).

1.1.5. Ways and levels of participation

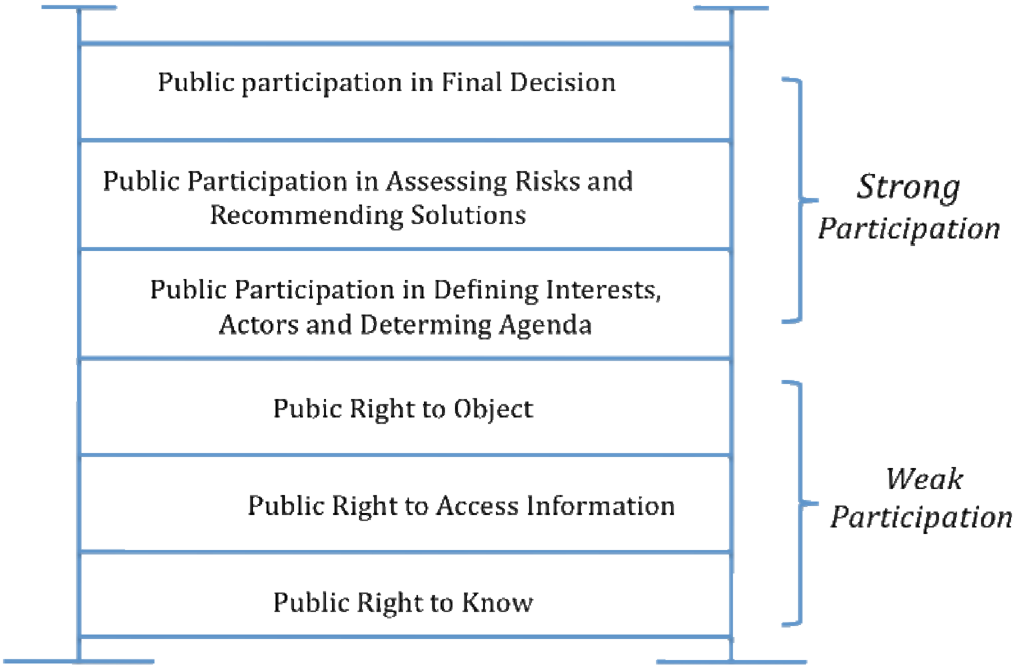
Participatory approaches have been practiced within various contexts such as in addressing gender problems, budget monitoring, human rights, health, rural development, mobility, education, crime prevention, water treatment, and resource management, among others. Before crossing the road of the GIS environment, how people all over the world fell in love with participative cartography during the 1990s contributed to the increase in academic research in spatial modeling. Far from being judged or criticized in its modeling approaches, as they proved their frequent usefulness, it appears that the power of cartography has even led to some abusive utilization of data coming from community participation.

Very early in its history, many studies were conducted to demonstrate and classify the various ways and levels of participation, from simple data transfer to effective people empowerment. Arnstein (1969) was the first in formalizing the eight levels of participation, from the manipulation of data (called non-participation) to the control of the information by the citizens (called people empowerment) passing by six intermediary stages (called symbolic cooperation):

The bottom rungs of the ladder are (1) Manipulation and (2) Therapy. These two rungs describe levels of 'non-participation' that have been contrived by some to substitute for genuine participation. Their real objective is not to enable people to participate in planning or conducting programs, but to enable power holders to 'educate' or 'cure' the participants. Rungs 3 and 4 progress to levels of 'tokenism' that allow the have-nots to hear and to have a voice: (3) Informing and (4) Consultation. When they are proffered by power holders as the total extent of participation, citizens may indeed hear and be heard. But under these conditions they lack the power to insure that their views will be heeded by the powerful. When participation is restricted to these levels, there is no follow-through, no 'muscle', hence no assurance of changing the status quo. Rung (5) Placation is simply a higher level tokenism because the ground rules allow have-nots to advise, but retain for the power holders the continued right to decide.

Further up the ladder are levels of citizen power with increasing degrees of decision-making clout. Citizens can enter into a (6) Partnership that enables them to negotiate and engage in trade-offs with traditional power holders. At the topmost rungs, (7) Delegated Power and (8) Citizen Control, have-not citizens obtain the majority of decision-making seats, or full managerial power (Arnstein, 1969).

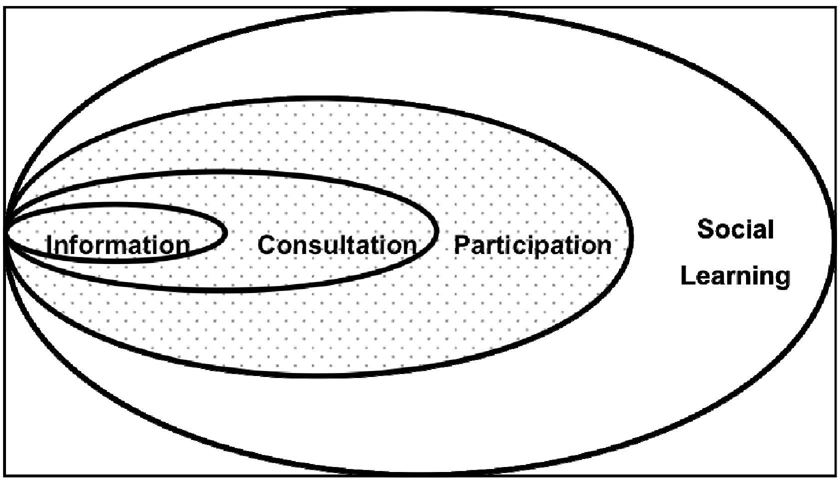
Later on, numerous graphical representations of participation levels were proposed, namely in the context of PGIS. One of the most famous is what Craig et al. (2002) adapted from Wiedemann (1998) who himself adapted from Arnstein (1969) with a view of progressively integrating the new web based technologies. The lower part of a six-rung ladder (Figure 1) distinguishes the minimum rights that an expert is supposed to confer to people after getting their information: the right to know, the right to be informed, the right to take part in the discussion and eventually, the right to object. These first three levels (called by the author "weak participation") aim to increase people awareness without any power delegation. The upper rungs progress slowly towards effective empowerment of the people through power sharing, autonomy transfer, and public participation. These three rungs (called by the author "strong participation") may be climbed from a public participation that will define the interests and the actors, and determine the action calendar towards a real and effective participation in the final decision through assessing risks and recommending solutions.



From Craig, 2002, adapted from Wiedemann, 1993

Figure 1 – Ladder of Participation

Even if most of the PGIS researchers and experts take into account this kind of ladder, Colins & Ison (2006) took the liberty to suggest the replacement of this linear model of participation by a new paradigm that they call "social learning" in order to maximize the integrated aspect of the process (Figure 2).



From Collins & al, 2006

Figure 2 - Conceptual approach for social learning

While the classical ladders of participation refer to a linear model inside the hierarchy of all possible interventions, the social learning model suggests "an emerging governance mechanism to promote concerted action that will more accurately embody the new kinds of roles, relationships and sense of purpose, which will be required to progress complex, messy issues" (Collins et al., 2006).

This model appeals for cooperation rather than for interaction. The complexity of the management of natural, human, and economic resources increases the number of actors who are requested to establish a clear statement of their respective roles, responsibilities and objectives. To inform, to consult and to participate constitute three compulsory actions that are not enough to resolve a complex problem. The nonlinear social learning model proposes inclusive ovoid figures where the common origin represents the problem to be solved. As no final position is defined, the model is recursive. It opens the perspective of a constant evolutionary research. Moreover, given that the process of social learning is specific for every actor, it allows a progression towards the formulation of global concerted solutions on the basis of the responsibilities that emerge from the participation, rather than of the restrictive relation with power. From being linear, the model of participation becomes iterative and cooperative.

Whatever model is used, any researcher and any expert are free to implement different levels of participation / social learning for as long as they pay attention to their partnership and ethics references.

1.2. Ethics

The more the information technologies and the associated data have become accessible for all, the more the question of their ethical use becomes crucial. Especially in the context of PGIS, a deep reflection is compulsory due to its participation component.

Anchored in the evaluation processes of agrarian development (see 1.1.1), the rapid growth of participatory approaches during the 1980s highlight the priority need for reflection on the ethically acceptable limits of the use and updating of participatory data. Indeed, because PGIS does manipulate, visualize, integrate, and analyze the spatial information provided by people, it raises the fundamental question of the ownership of these data. May a scientist pretend, in the name of science, to be free to, with no limits, spread out the information that was, far from any constraint, given to him by people? The visions and expectations of people regarding the territory where they live represents the way they express their social, cultural and economic identity; therefore, they are the owners of this information and must be consulted at any time their data are used.

The spatial technologies transform the perception of the territories and resources. The cartography practice commonly used in every management of the land, titles and resources deeply modifies the significance of the space (Fox et al., 2005). Nevertheless, it has become very hard, even almost impossible, for a community today to defend its land property rights and access to resources without any references to maps (Fox et al., 2005).

The implementation of a participatory approach raises more questions than it resolves. As quoted by Rambaldi, Chambers, McCall & Fox (2010), the path towards community empowerment is paved with interrogations at every step of the process: “Who participates? Who decides on who should participate? Who is left out? Who identifies the problems? Whose problems? Whose questions? Whose perspective? Who establishes the priorities? Who decides on what to visualize and make public? Who controls the use of information? Who is marginalized? Who understands the physical outputs? Who owns the data, the maps and other outputs? Who organizes the regular updating of all the outputs? Who analyzes the spatial information collated? Who has access to the information and why? Who will use it and for what? Ultimately… What has changed? Who benefits from the changes? At what costs? Who is empowered and who is disempowered? ”

If a code of ethics for a good PGIS practice cannot pretend to be exhaustive, it remains an obligation for each individual to keep in mind all these questions with a view of coming out with some guidelines towards an ethical practice of PGIS. In their “Practical ethics for PGIS practitioners, facilitators, technology intermediaries and researchers”, Rambaldi et al. (2002, http://www.ppgis.net/code.htm) recommend the following guiding principles:

- Be open and honest;
- Be certain and clear about the purpose;
- Obtain informed consent;
- Recognize that you are working with socially differentiated communities and that your presence will never be politically neutral;
- Avoid raising false expectations;
- Be considerate in taking people’s time;
- Do not rush;
- Invest time and resources in building trust;
- Avoid exposing people to danger;
- Be flexible;
- Consider using spatial information technologies that can be mastered by local people after being provided sufficient training;
- Select technologies that are adapted to local environment conditions and human capacities;
- Avoid outlining boundaries except if this is the specific purpose of the exercise;
- Do not sacrifice local perceptions of space in the name of precision;
- Avoid repeating activities;
- Be careful in avoiding causing tensions or violence in a community;
- Put local values, needs and concerns first;
- Stimulate spatial learning and information generation rather than mere data extraction for outsider analysis and interpretation;
- Focus on local and indigenous technical management and spatial knowledge;
- Prioritize the use of local toponomy;
- Make the maps a means and not an end;
- Ensure genuine custodianship;
- Ensure the recognition of intellectual ownership;
- Be ready to deal with new realities which will emerge from the process;

- Observe the processes;
- Ensure the understanding of the outputs of the mapping process by all those concerned;
- Ensure defensive and positive protection of traditional knowledge and indigenous people's rights;
- Acknowledge the informants;
- Review and revise the maps, and examine international survey guidelines.

On his side, Chambers (2006) reviewed the main following abuses as frequently observed:

- Eating people's time: poor people are specifically vulnerable as their time is preciously used for survival;
- Creating expectations: the interaction with external people constitutes a source of frustrations;
- Extracting information towards external use: such information, especially if obtained with no clear declaration of intention, may be used against the people or at least be such perceived;
- Exposing people to danger: a free public access to private community data may provoke external reactive attitudes;
- Repeating activities: the lack of consultation among the external partners induces repetitive activities;
- Increasing tensions: the integration of sensitive information and/or groups of participants may generate internal tensions, even some violence.

Beyond these detailed lists of questions, interrogations, possible abuses, the priority concerns may be summarized as the ownership of information, their use and their updating. The way experts and/or facilitators behave, according to their own technological competence, influences the transfer of information and the utilization of traditional knowledge. Indeed, if the process of making the GIS participatory constitutes a huge potential in community development, it also raises the point that PGIS might be used against the interests of a community. The more PGIS practices spread all over the world, the more the sharing of PGIS experiences shows the absolute necessity in training the community, the experts, the facilitators, the users, the decision makers, and the sponsors for a good PGIS practice. It is recommended that all actors, without any exception, reach a clear and deep understanding of the problems and avoid putting pressure on the participatory process of mapping, neither in terms of time, nor in terms of outputs. They should permanently keep in mind the concerns of ethics. When it comes to PGIS practice, the risks of abuse are as high as the potential for development. The only certain consideration is that a non-participative GIS is priority-oriented towards the interests of the dominant actors (researchers, companies, government, etc.), and seldom towards the interests of the community. The perspectives of the community itself, due to its democratic integration, versus a dictatorial integration, are at the heart of the respect and the promotion of development for everyone.

The interpersonal trust level and the institutional environment will determine the future capacity of PGIS to answer the needs and expectations of all land planning actors for the priority benefit of the community as first users of their territory. The building of a partnership that will be appropriate, efficient and effective constitutes a key marker of success.

1.3. Partnership, role and responsibility of the scientist

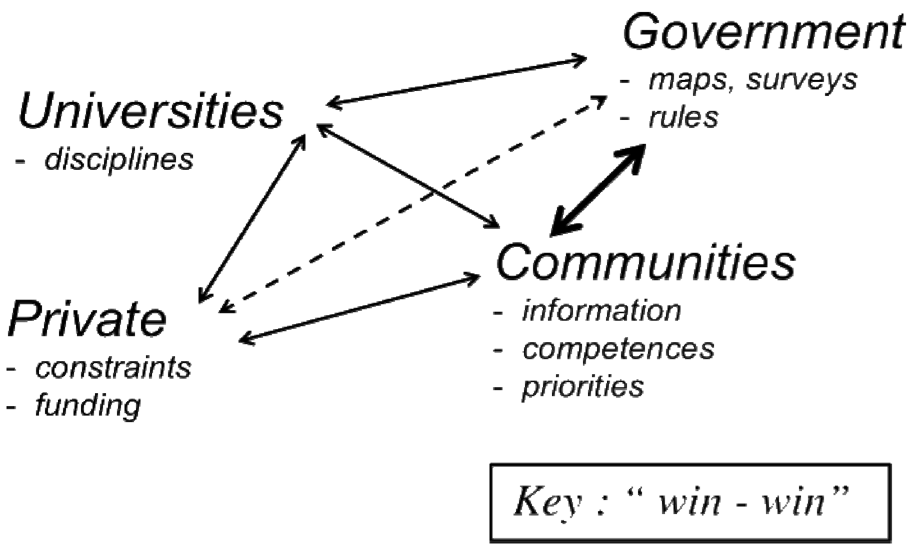
1.3.1. Quadripartite partnership

The success of any project closely depends on the quality of the partnership and everyone's commitment. It is better to have a medium quality project with excellent partners rather than medium quality partners with an excellent project. Of course, the excellence of both remains a must. Despite knowing that perfection is seldom possible and knowing that the good is the enemy of the best, the pursuit of an ideal approach must still be attempted.

Land planning-oriented PGIS are very sensitive to the quality of the partnership since the empowerment of the people living in the concerned territory is a priority focus. From an action-oriented research to the implementation of the research outputs, PGIS practice requests careful and appropriate preparation of the involved partnership to understand and analyze a territory before it suggests any changes.

Given that the first objective of PGIS practice is a participatory land planning for the benefit of everyone, it is compulsory to make sure that all the concerned actors and land users will effectively be brought together (Figure 3):

- The community, as they live on the territory where they anchor their way of life, their culture, their survival and their development strategies;
- The political and economic decision makers, as most of the time they are contractually linked to the territory, gives them the capacity to orient its development;
- The public and private financial investors, as they provide the useful resources for that territory's development;
- The scientists, as they represent the external multi-disciplinary experts, whose contribution is appreciated for analyzing the data and formulating coordinated possible actions;
- The field workers (health workers, NGO members, etc.), as they facilitate the inter-partner communication with a view of improving the comprehension of data gathering, processing and interpretation for all. They are generally perceived as associated to the community.



From Orban, 2010

Figure 3 – Quadripartite partnership

The interaction, challenge and role for every actor detailed and discussed in Orban (2010) and associated references. Specific attention has been paid to the implementation of a win-win scenario. Motivated by their individual interests, the four groups of actors put all their efforts together to get a consensus where they will identify their own perspective, while pursuing a common interest (Shafiul & Mansoor, 2004) beyond the simplicity of the dialogue.

1.3.2. The role of the scientist

The role of the scientist is very crucial within PGIS practice. Indeed, if he honestly wants to serve the interests of the community and help them towards effective empowerment, he finds himself in the heart of action-research. He has the privilege to utilize his professional competence to develop and promote a practice that may truly serve community interests. He has the capacity to develop his science with a view of expanding his sphere of influence. He has the possibility to reinforce the link between the community and the government (Figure 3) in order to initiate or reinforce community empowerment versus the risk of an abusive exclusive connection between the government and the private sector. Given this, two criteria may be highlighted to prevent the lack of respect of the partners, as well as a possible disempowerment of any partner:

- A solid scientific training of each partner/actor for a good practice of PGIS through the correct use of its technical tools and objective interpretation of its outputs;
- The observance of the basic ethical rules (see 1.2.) regarding data ownership, updating and utilization.

The active participation of all the actors (community/NGO, public and private sectors, scientists) in the building of the database provides them the rights of data ownership and feedback expectation. The scientist is then requested to:

- Train and inform all the actors concerning GIS practice, while paying specific attention to the facilitators of the communication;
- Process the data in full respect of the weighting parameters (see 1.4.1.4) as they are given by the participants;
- Guarantee transparency in the communication of the data and of the utilization of the outputs of the PGIS analysis;
- Balance the contribution of the outputs to people's empowerment, specifically by making a clear statement regarding 'who wins' versus 'who loses'.

All these principles are discussed and illustrated further in chapters 2 and 3. The problematique of development and land planning, when approached through PGIS practice, is widely interdisciplinary. The scientist/expert is in charge of the coordination between all the disciplines, which means that a permanent inter-dialogue with a view of pursuing a consensus and coming out with a common agreement is a major emphasis (Orban, 2010). The traditional GIS, because they are mainly considering the governments' and sponsors' perspectives, even if coordinated properly by a scientist, have produced poor outputs (Sharma, 2007). The scientist has the capacity and the responsibility of developing adequate algorithms to process spatial data from various sources in full respect, honest gathering and balanced integration of the perspectives and interests of every partner.

Some key concepts may be summarized as follows:

- Respect of the data ownership rights;
- Transparency;
- Win-win scenarios;
- Permanent effective dialogue;
- Empowerment for all, with a sharing of the responsibilities, and respect of the participants' weighting procedures.

Within such a complex research environment, the scientist has the immense privilege to be given easy access to rich databases, diversified and spatially referenced. Because of this, he may be fast in analyzing the data with certain originality. Whether he is adept in the modeling or not, he will find in the practice of pGIS a unique opportunity for formulating alternatives to land planning that will effectively target common interests for all users/actors of a territory. This is specifically what chapter 2 hereafter attempts to illustrate.

1.4. Methodology

Many different tools and processes may address various situations, while running after an exhaustive data survey constitutes an unrealistic task. Application fields are so diversified (agriculture, research, industry, forestry, hydrology, geology, land planning, democracy, etc.) that no one can even pretend to cover all of them. According to the application that is selected, participation raises the question of the priorities to pay attention to such as, among others, the learning of the citizenry, the reinforcement of the linkages between the community and the elected representatives, and the struggle or the adaptation facing the globalization.

The shared methodology here aims to emphasize how the local knowledge can be integrated into the decisions that are affecting a community territory of life, from a traditional survey towards the co-construction of spatially differentiated learning. It will not touch the social diagrams methods, the elaboration of problem trees or logical framework, the role playing games (for this, please refer to D'Aquino, 2003). Even if all these are part of the sphere of participatory practices, it is not a priority in line with the spatial component of the knowledge as it focuses more on its social dimension.

What follows is more centered on the integration of traditional knowledge with spatial references. It aims at a synthesis of various Pgis practices that have all been implemented in the context of land planning and resource management. They all start with the cognitive spatial perception of the community, shared with the help of a map (mental/cognitive map) that will express that community's visions, analyses, perceptions, expectations, and perspectives regarding their own territory. After both internal and external validations, the community's information is manually or automatically integrated into an information system once its legitimacy has been confirmed and before all the actors and associated partners (see 1.1.3) analyze it. An iterative approach will make sure that the impact of that information's integration and its context will be taken into account.

In all cases, Pgis practitioners face several fundamental questions: "Who will draw the first cognitive maps? How and for what purpose? For which GIS use? Under what format?" Chambers (2006) has established a very useful table that highlights the advantages and the disadvantages of ground and paper participatory maps:

Ground maps	Paper maps
More temporary, cannot be kept, exposed to animals or people trampling, rain, wind, etc.	More permanent, can be stored safely but also vulnerable to water, mold, tearing, burning, etc.
Familiar and comfortable for many	Unfamiliar and inhibiting for many
Easy to alter, add to, build up, extend	Committing, harder to alter, build up or extend
More democratic, many can hold the stick, less eye contact, less verbal dominance	More exclusive as the one educated often holds the pen, presenting own more than group view
Freely creative with local materials	More restrained, with materials from outside
Locally owned, outsiders cannot remove	Vulnerable to removal by outsiders
Cannot be used for monitoring	Can be used for monitoring, with updating
Not convincing or usable with officials	Can empower when presented to officials
More crosschecking and triangulation	Less crosschecking, fewer may see
Power and ownership more dispersed	Power and ownership more concentrated

Source: Chambers, 2006, p. 6-7

In conclusion, Chambers (2006) recommends doing both, by ground mapping first, then paper mapping after. According to his experience, no information is lost when a ground map is transferred to a paper map; on the contrary, details are enriched.

The experience shared in this book adds that it is better to invite indigenous people to draw their perceptions and expectations on a blank sheet rather than starting with a satellite image or an ancient map. Indeed, any pre-printed map/image may prevaricate their message. Even if the expert is tempted to gain time and money by providing the community a preprinted map/image, he must pay attention to the reducing and limitative impact of such a practice in terms of participation. The practice also proved that providing people a plastic blank sheet will facilitate the transfer and the digital encoding of the data for future easy use within a GIS (see Chapter 2).

Recently, the 3D participatory mapping (Rambaldi, 2000) has made the communication, understanding and the participatory representation of spatial knowledge easier for the community. Even if relatively time consuming, 3D mapping has proven its ability for an easier expression of the identified priorities and problems by the community itself. Since they are bulky and hard to transport, most of the time, the 3D maps remain with the community, which simplifies the ownership aspect of the participatory spatial information while the process also does not affect their updating, encoding and empowering dimensions. The recent development of the technology, as well as the new materials, now allow improving the lack of rigor that had been frequently observed during the early stage of 3D mapping practice.

Whether 2D or 3D, cognitive mental maps require an appropriate methodology for dealing with the scale adjustment of the data. Mapped at a local scale with a lot of details, the participatory information does not overlap easily with the public/private/governmental maps. Their generalization, integration, and modeling require that all GIS practitioners must make efforts to effectively enrich the analysis of the territories for their management and development.

The PGIS experiences shared here focus on a Pgis practice that aims at increasing people's awareness and empowerment through their territory participatory planning. Far from being univocal, the methodology here suggested is issued from that long experience mainly conducted in the Philippines (see Chapter 2).

1.4.1. Suggestion of a methodology for a Pgis implementation

1.4.1.1. Identification of the problems

The identification of the problems starts with some concerns, interrogations, even anxiety or devastation expressed by the community regarding the way their territory is organized and used. The community then becomes the target of the Pgis practice. Nevertheless, it frequently happens that partners out of the community, such as LGUs, the private sector, experts or external citizen organizations express their own problematique in terms of conflict (e.g. ownership, land use, boundaries, etc.) without consulting the community. A really effective participatory practice must pay respect to the bottom-up approach that will lead to the formulation of a holistic problem tree in order to identify the causes and the effects of a problem starting from the explicit expression of its perception. The metaphor of the 'tree' refers to a tree's structure where the trunk represents the problem to be resolved; the roots correspond to the possible causes, and the branches to the possible consequences.

The highlighting of the cause-effect mechanisms facilitates the identification of the responsible actors to be gathered together in order to analyze the situation with a view of formulating alternative land planning strategies.

1.4.1.2. Building of the partnership

Once the problem tree is established for a community territory, it becomes easy to identify the actors who are influential and have an upstream or downstream action on that territory. The users of that territory (mainly the community and some private sector partners) are invited to draw a cognitive map of their land use with respect to (or sometimes in violation of) governmental regulations. The government is usually the final decision-making power on the target territory, being the one supposed to respect environmental and existing ownership and customs constraints.

All these actors constitute the potential partnership that will allow reaching a consensus that will neither betray the users of the territory nor challenge the durability of the decision. Complementary to this partnership, the scientist acts as the link, the unifying agent, who offers his spatial analysis competencies for serving the defined objectives better (see 1.3.2).

1.4.1.3. Data gathering

It is recommended to start with a traditional thematic cartography of the available environmental, social and economic data (primary data).

As a second step, the missing data (secondary data) will be gathered through a direct or indirect survey, making sure they are effectively connected to the causes and/or effects of the problem. It is important to avoid the collecting of useless extra data that may create frustration and affect the confidence in the project among the community.

Third, the information area that could not be covered, such as the desiderata of the actors, their perceptions of their spatial reality, and the expression of the conflicts and tensions generated by this reality, will be filled up by the integration of cognitive 2D or 3D maps that will consolidate the participatory component of the database.

At each stage of data encoding, consultation of the actors who provided the data is compulsory for internal data validation.

1.4.1.4. Data processing

The classical thematic cartography of each variable will provide a rapid useful partitioned overview of the situation. A scale adjustment is made compulsory using an appropriate GIS tool ("warping" style) for the future integration of all data.

As a second step, a simple linear combination of the weighted variables will surface the awareness arising with regard to the existing various interests. According to the epistemological approach of the practitioners – how they consider the priority of one or another data set – the GIS practice will become a PGIS, pGIS or Pgis (see 1.1.4). An iterative clustering of the variables will allow the identification of groups of data in such a way that the environmental/biophysical, social and economic variables will avoid, or at least minimize, any internal redundancy. Concretely, the weighted linear combinations are successively fitting according to the progressive building of their hierarchy.

Linear Model: $\sum_{i=1}^{n} P_i.Gr_i$ with $Gr_i = \sum_{j=1}^{m} P_j.V_j$

Where n = number of groups Gr of variables V
m = number of variables V in every group Gr
P = weighting factor for each group / variable

As an illustration:

- Environmental variables may regroup soil types, slope, exposition to the sun, etc.; social variables may regroup social and cultural population profiles, migration flows, perception and perspectives of the partners as they are captured by the cognitive maps, etc.; economical variables may regroup markets' fluctuations, money transfer, etc.
- The weighting parameters are fixed in consultation with all the concerned actors (see 2.2. & 2.5).

At every step of the data processing, a feed back procedure is performed on a regular basis. It allows all partners to validate the process before the practitioners move further. Here lies the respect component of the participation approach.

It may be necessary to code some of the variables, especially the qualitative ones. The coding will observe the consistency that will allow for fitting the objectives by setting minimal and maximal values in accordance with a common approach. As an example, variables supposed to capture (i) the bad quality of soils, (ii) the flood prone areas, (III) a poor exposition to the sun, etc. will all always receive a low level coding, or a high level coding, never a sometime-low, sometime-high attribute value.

1.4.1.5. Scenarios towards alternative solutions

After having integrated all the variables and having validated their respective weighting parameters, the method will allow the formulation of various scenarios under the form of outputs proposing several possible comprehensive land planning maps of the target territories.

The scientist/expert, the decision maker, the private sector, or any other group of interest must be given access to the GIS tool / inputs / outputs / processing in total transparency and respect of the participation procedures (data gathering, variables' weighting, feed backing and validation) so that they will be able to simulate various options for their territory development. As an example, a decision maker may select an environmental priority that may negatively affect the social impact on the target community; a private company may prioritize its own interest versus the perspective of the people, etc. (Orban, 2010). The transparency of the procedure is the only guarantee that the participatory approach will be ethically implemented with full respect of social justice within all the compromises that will be discussed. It will facilitate reaching a common agreement that integrates the constraints and the perspectives of all. Such a transparency provides the actors the necessary empowerment to honor the interest of everyone. Permanent validation, successive iterations, and mutual listening may then progress towards a negotiated consensus that, ideally, will represent the scenario that may be peacefully implemented by the decision maker.

1.4.2. Limits of the participation

Cecile Barnaud (2010) recommends much care when it comes to the implementation stage of any participatory approach. If the participation may promote effective people's empowerment, by both preventive and curative actions that reinforce people's knowledge, competencies and awareness, it may also slow down, or even block, the collective dynamics due to a too rapidly obtained consensus. Avoiding making the poor poorer implies consuming time and paying attention to the powerful rich.

Any debriefing of the practice of participation shows how big are the intrinsic limitations, horizontally and vertically. On one hand, the institutions may be not ready for a power sharing, and then force the methodology to remain widely top down. On the other hand, because the results are limited in time and space, they may remain at the local scale and lack sustainability because their institutional anchor is too weak. Sometimes, even, the dream itself of a community social cohesion may increase the risk of empowering the already powerful and make them monopolize all the benefits. A simplistic perception of the power and a bad comprehension of the social political context may create incongruence between the proposed land planning scenarios and the spatial social economic reality that is constantly changing.

Some technocrats advocate for an important transfer of the GIS technology with a view of consolidating the PGIS projects' sustainability. Whatever the case, there is no way to avoid answering the following questions when a PGIS practice is implemented at a community level: "To whom does the PGIS belong? Who addresses the questions that initiate the process? Who establishes the calendar of activities? What will happen when the experts quit after the completion of the PGIS project? What will happen after the initial funding stops? What benefits remain with those who generated the data and shared their local knowledge?" (Rambaldi et al., 2010).

PGIS practice is actually facing numerous problems of methodology and of implementation as well. The social political context, as the ground of PGIS applications, often alters the essence of the interaction between PGIS organizations and local institutions. Indeed, it is a frequent occurrence that the pre-existing structures agree to keep the new organizations out of the game (Rambaldi et al., 2006b). Moreover, PGIS community organizations in the Southern countries are mainly poor in terms of resources; they are often forced to observe pre-established regulations, software, and orders coming from the local elite or from external experts without being given any opportunity to discuss their suitability (Sieber, 2000). All these make PGIS practitioners vulnerable to the coercive actions of public officers and/or of actors who are objecting to their project.

Respect, dialogue, vigilance, transparency, and forging complementarities constitute intrinsic concepts that are all potential keys for practicing an efficient and effective PGIS.

Chapter 2. Applications

My PGIS journey

After more than a decade of PGIS practice in the Philippines, several methodologies have been tested (by the author and her collaborators) within various contexts such as the management of natural resources, the sanitation of landfills, and the implementation of survival and food security strategies. Throughout all of these, the contributors have been motivated to use their technical skills to provide better service to communities that are marginalized by the local Land Planning system of governance. A few of these applications, which have been selected with a view of covering various experiences, are here discussed.

First, collaboration between a local NGO and communities that, with the help of GIS scientists, aims to build a public Land Planning management tool is presented. The power and dialogue position conferred to the Local Government Unit (LGU) is discussed.

Second, people empowerment is evaluated after all the actors have been kept together from the start up to the end of PGIS practice. Populations that are usually not consulted have been brought into the partnership while the private, the public and the scientific partners constantly tried to maintain a balance among all actors.

Third, the governmental aspect, including the difficulties encountered in implementing participation into the governmental programs, is exposed. Specific attention is given to initial alliances as a key for success.

Fourth, the technical and scientific contribution to PGIS practice is assessed in the context of participatory environmental approaches.

Fifth, the need for statistical indicators to support the participatory practice of GIS is argued.

Sixth, a contribution is shared about the hopes, the risks and the limits of Voluntary PGIS practice in today's virtual world.

The comparison and sharing of multiple experiences have brought maturity and wisdom into both the dream and the reality of implementation in the context of people's empowerment in the planning of their own land. More than a decade of PGIS practice, mainly in the Philippines, has given a chance to the fulfillment of dreams in spite of the constraints and pressures. Teaching patience, tolerance, and lucidity, GIS practice has shown its time consuming character more than its need for sophisticated expensive means. The attainment of a preliminary consensus prior to any democratic decision is only possible if all concerned actors are willing to listen and share their time.

The practice of PGIS constitutes building significant bridges between local knowledge, the scientific world, the private actors, and the Local Government Units (LGU). The various actors perform by feeding the group's dynamics and consequently positively contribute to enrich and validate/legitimize the data, to build capacity for capturing any changes, and to establish a solid basis for mutual trust between the partners. Thus, they act in favor of a successful negotiation process. Far from always reaching a perfect consensus, the comprehensive practice of PGIS has to deal with the risk of multiplying the high interests' priority zones that might generate conflicts. It also highlights the risk that small communities might increase their marginality at the end of the process due to their lack of competence regarding the new technologies. Therefore, PGIS practitioners must pay attention to the preparation of the community in handling issues that might emerge from PGIS practice in the long run. They have to initiate a common reflection on the mapping outputs and other products to prevent the misuse of information by external actors violating community privacy and data/outputs ownership. Nevertheless, the efforts that are put into the integration of marginalized people within the GIS system of the decision makers and planners have fundamentally improved these peoples' capacity to interact and negotiate with the LGU. The external validation of the community maps and information is a requirement that is essential for ensuring trust and recognition among the decision makers and the private sector.

The rapid development of the second GIS generation, as well as of the virtual geosystems, has opened the door towards a new risky PGIS era wherein the traditional barriers between the citizen and the decision maker are collapsing. PGIS practice has benefited from the voluntary aspect of information sharing, as well as from the explosion of multimedia and mobile sensors. Indeed, all these facilitate the gathering, the organizing and the processing of the data. Moreover, the technical sophistication of PGIS practices is increasing their products' legitimacy. Through the offer of a (P)GIS training to all by the way of academic curricula and public seminars, the integration of data issued from various community, private and public sources appears as a (sometimes risky) guarantee of success for the participatory management of human and natural resources. This success is dependent on the dynamics of identification and integration of the contextual critical factors that are constantly changing.

Concretely, the data that are gathered the participatory way cover such a wide range of various origins and formula that their integration into a GIS is made very challenging. The possible subjectivity, even the possible lack of coherence, the status, the quality, the legitimacy, etc. vary a lot from one dataset to another, whatever their origin (community, private sector, LGU, satellite, etc.). This adds to the challenge of their successful integration into a PGIS. Nevertheless, the experience has proven that there is relevance for sophisticated technical training of every participant. The scientist may act as the stage director of a participatory Land Planning based on dialogue and information sharing that will respect the specificity and the competence of each actor with the condition that a fully ethical approach is observed. The many experiences conducted led the author and her collaborators to strongly recommend an atmosphere of free expression and openness to listening to everyone with respect for his capacity for sharing his own perspective and expectation. This is greatly facilitated by PGIS practice if and only if it is made transparent, intelligible and applicable to all.

The community members who are marginalized and/or isolated are not used to interacting with the LGU. They showed specific inclination towards cognitive/mental mapping activities as they could understand and express their concerns much more easily and rapidly than when facing theoretical concepts. All PGIS experiences have allowed the collaborating scientists to better identify their role in the development of methodologies that can fuse exact and human sciences.

By broadening the concept of possible spatial representation of local knowledge, PGIS practice led every actor to a better mutual understanding and a better support of the negotiation process. The social, cultural and political relationships have been challenged and, in all cases, have benefited from large data sharing and a good level of communication. An equitable role has been recognized for everyone in the management of the resources. The integration of spatial qualitative and quantitative data into the process has improved the reflection and the dialogue based on the spatial perceptions of the actors, their customs, their priorities and constraints. Considering the ambitious objective of gathering the commitments of everyone, and of integrating the benefits of the new technologies, PGIS practice helped in moving towards the study of fundamental societal paradigms based on participation as a flexible and accessible process. The practice of PGIS through the various experiences such as the ones shared in this book has increased the capacity for each researcher to better understand the notions of knowledge, identity, situation and power. The main implication of PGIS practice lies in its being a driving force of the actors' empowerment.

Through its ability to facilitate a dialogue, a negotiation, a mutual understanding, and a concerted action, PGIS practice is part of the peace process as every actor gains a comprehensive understanding of his personal environment and his interaction with his partners. Given that it takes into account the spiritual, political, economic and biophysical dimensions of everyone's living environment, PGIS practice highlights the close dynamic interaction between the citizens and their territory. It integrates flexibility and fluidity resulting from a ceaseless adjustment to the ecological, economic and demographic changes. PGIS practice is aware of the risk that the encoding of the cognitive maps might affect that fluidity.

2.1. *Contribution of PGIS through Community Mapping in Water Resource Inventory: The Case of Barangay Alangilan, Bacolod City, Philippines*

Ana Rosa Carmona
University of Saint La Salle(USLS) Bacolod, Philippines
arcarmona2002@yahoo.com

Water is a precious resource that needs to be protected and properly managed so that an adequate supply and acceptable quality of water can satisfy and reconcile the increasing need for it for the economic productivity of the area and social well-being of the people. Now, more than ever, the limited nature of the water resource and how various natural and social systems interact and greatly affect water quantity and quality are widely recognized.

In the light of this situation, it is necessary to take a look at the present water situation in the area and to conduct scientific studies towards water resource utilization and management. However, critical to this is the need for good information that describes the condition, trend, spatial location, and variability of water resources in the given area (Adjomah, 2010). This is considered as a fundamental tool for the proper utilization and management of water resources. In the study conducted by Robinson (2003), he noted that many of the local government units (LGU) do not have the capacity or know-how to manage water resources. Therefore it is important for other sectors, like the academe and Non-Government Organizations (NGO), to assist the LGU especially in creating a comprehensive data bank and inventory of the natural resources, which will be made available to all various stakeholders especially the decision-makers. The provision of this information will form a first step in understanding the conditions of the water resources on which sound judgment can be made (Adjomah, 2010). The information that will be gathered can be used for temporal monitoring and can provide a feedback loop to the decision-making process, making the LGU and the community more empowered to manage their water resources.

2.1.1. The Challenge

In the case of Bacolod City, available reliable information about the state of the water resources of the City is very limited and can only be found in few offices like the city water district office. Gathering quality data and consequently building a comprehensive database for water resources and other resources that will be made available to the public is a challenge for the local government and for research institutions. On the other hand, the lack of access to technology, like computers and necessary software, and even a lack of access to information, are some challenges that the community is facing. This new divide, between information and communication, is evident in a variety of global development projects, where various stakeholders and diverse groups require common information about a project, but understand and use this information differently from one another. In some cases, information is both available and relevant, but it is represented in a form that is too general or too specific to be useful for the intended audience (Vaijhala, 2005).

The project, *Building local capabilities through participative water resources management in the Philippines*, funded by the Belgian Commission Universitaire pour le Développement (CUD) provided an opportunity to answer this challenge. Our University participated in this project in partnership with three other universities in Belgium (FUNDP – Facultés Universitaires Notre Dame de la Paix, UCL – Université Catholique de Louvain, and FUSAGx – Facultés Universitaires Agronomiques de Gembloux) and a research institute in the Philippines (ESSC - Environmental Science for Social Change). Moreover, two enabling factors set in by the project made sure that the process and the approach in doing this can bring forth better output. These are the use of a geographic information system (GIS) and recognizing that an effective study of water resources requires the full and active participation and the local knowledge of the community.

However, the GIS environment is highly technical while water study is scientific in nature. Bringing these two together and introducing them to the community at the language they best understand may be tricky. Thus, public participatory GIS is considered an effective approach in bringing into convergence the scientific and the technical components with the local community's knowledge and participation. Participatory GIS implies making Geographic Information Technologies and Systems (GIT&S) accessible and understandable to disadvantaged groups in society in order to enhance their capacity in generating, managing, analyzing and communicating spatial information (CTA, 2008). A variety of existing methodologies for facilitating participation have emerged to fill this gap and promote equitable development (Chambers, 1994; Cornwall & Jewkes, 1995).

One such popular tool for spatial data collection is participatory mapping. Participatory community mapping has been one of the tools promoted by non-government organizations to increase public participation in decision-making and local control over resources.

To ensure that the voice and knowledge of the locals will be integrated into the whole process, a community mapping process was conducted. Community mapping is one of the participative approaches and tools that provide a venue for the community to spatially express their situation, culture and issues in a drawn map. It provides an opportunity to involve community members in developing baseline data and a common understanding of their place. Because of this, it also becomes a practice (Rambaldi, 2006a). Moreover, a community mapping exercise allows the members to realize that their community is not isolated from the broader environment and that there are social and ecological linkages across the landscape of their community that are essential. This experience allows them a better understanding of their environment and how they see themselves in relation to the various dynamics that exist in the area. The generated map and the documented realizations and insights of the community members are significant inputs into a development plan that integrates the social and economic essentials into the quality of their place. In this light, the whole process of integration of community participation with GIT&S and its consequent applications have become widely known as PGIS practice (Rambaldi et al., 2006). PGIS practice has greatly helped facilitate knowledge integration, brought general understanding of the water resources in the area, and benefited many stakeholders in managing their water resources.

2.1.2. Objectives

Recognizing the importance of community mapping as a way to actively involve the members of the community and as a venue to allow for exchange of scientific, technical, and local knowledge about the condition of the water resources in the area, this paper documents the experiences of the author in the entire process of studying the local condition, particularly in terms of water resources, with the community in Barangay Alangilan, Bacolod City. It provides special emphasis on the appreciation of the use of the mapping process as a means of intensifying community participation and awareness. Moreover, it highlights the utility of the finished integrated community map with the technical aspects of learning more about the environment and in various discussions regarding the present and future developments in the area and its vicinity.

2.1.3. Methodology

The attempt to take an inventory of the natural resources, particularly the water resources, through GIS and with the participation of the community members was conducted in Barangay Alangilan, one of the sixty-one barangays of Bacolod City. Barangay Alangilan was chosen for this process as this area has rich water resources. It is the location of the city's naturally occurring springs, which provide water to the neighboring barangays and supply water to some headwaters of the major rivers of the city. It has the highest elevation in the city (300-800 m) and has a steep topography. Its soil, generally having a texture of sandy-loam, greatly affects the rate of water infiltration and leaching of nutrients. This type of soil is also vulnerable to soil erosion. Due to the area's cooler climate, land use conversion from forested area to predominantly agricultural area and later on, to game fowl breeding, high value crop farming and residential subdivisions' area, has speedily increased with significant potential effect to the water resources. Moreover, the leaders of the barangay openly expressed their concern of finding a way to efficiently provide safe and adequate supply of water to the demand of an increasing population. With all these considerations, a community mapping activity to inventory the area's resources was conducted by the University, with the Balayan Office as the main facilitator, between 2006 and 2007.

The community mapping methodology used for Barangay Alangilan was adapted from the methodology formalized by the Environmental Science for Social Change (ESSC, 1998) from its years of experience in working with the marginalized sectors of the country in the protection of the environment. This methodology involves seven phases which are: (1) initial consultation with leaders and networking, (2) data preparation, (3) initial consultation with the community and site analysis, (4) community mapping activity, (5) community validation, (6) technical integration, and (7) presentation and submission.

The principle of community engagement in terms of community learning through capacity building was applied through the training and process observation conducted for the barangay health workers (BHW) who acted as co-facilitators of the actual mapping activity in the twenty-two communities. These barangay health workers, who normally conduct surveys for the government and deliver health services to the community, know the lay of the area quite well and at the same time familiar with the people and the social dynamics. Local people were also tapped to be field assistants in gathering GPS points and other pertinent data during field and community validations.

Wider representation of different sectors of the community was also ensured in every mapping activity. Community officials, young people, elders, and women were invited to participate (see Figure 4). There were times when representatives from the barangay and the city, through its city planning and development office, also joined as process observers. It was also made sure that all those involved in the mapping process would have a higher level of acceptance, a deep sense of ownership of the activity, and the commitment to bring into fruition the activity.

Figure 4. Community participation during community mapping

The atmosphere by which the mapping activity with the community was conducted was friendly and open. This allowed every participant to be more receptive and participative in sharing more than the location of the features being drawn on the map. They freely shared, with little prompting, what their thoughts are especially on how they view their environment and the changes, developments, and challenges they face in their community. It also allowed them to validate with one another the correct information and clarified some issues. Their stories provided an insight for the researcher to glean about the local knowledge of the community members and served as an opening for the researcher to initially complement their indigenous knowledge with scientific knowledge. In this way, a good exchange of the two knowledge systems was facilitated.

Information about the water resources and other related features found in the Barangay Alangilan community map were integrated into the water resource inventory map of the city. Insights from the stories of the community members depicting the realities in the field were also incorporated in the supplementary report accompanying the inventory map.

After the maps were completed, validated and officially turned-over to the owners, the members of the community (see Figure 5), the researcher and the GIS specialist who helped prepare the map once again sat down with the members of the community to open a discussion on the significance and utility of maps that were produced. Moreover, with the map as visual aid, issues and concerns regarding the barangay water and soil resources were brought to the fore. This also became the venue for the researcher to share with the community the state of the city's water resources and how it is related to their own locality. In this way, it was hoped that community understanding would lead to improved use and management of their water resources.

Figure 5. Turn over of the printed maps to the community

2.1.4. Conclusion

The methodology for the community mapping adapted after that of the ESSC proved to be an effective way of engaging the community from the start until the end of the assessment process of the local water resources. It provided a lot of opportunities for the community members from the purok level to be actively involved not only in the drawing of the map but also in interacting with the researcher and each other in field validation or for map validation. The activity was successful also because of the active participation and support from the members of the barangay council, purok officials, barangay health workers, barangay tanods (security volunteers), and other community mapping participants.

However, the engagement with the community did not end with the printing and turn over of the maps. Results of two independent reports on the soil quality assessment (Carmona, 2007) and water resources inventory of the city (Carmona, 2008) were integrated with the insights of the community documented during the mapping process. The integrated community map was used together with informal discussions with the community for further analysis. The analysis provided a picture for the community in the assessment of the current situation and the potential management of the locality in terms of its natural resources. Through the map, an integration of the local knowledge system and the scientific and technical knowledge system was made possible to present a better picture of the state of the soil and water resources of the area and of the pressing management issues and concerns for the generation of ecosystem services and ecological resilience. This is now the process of utilizing the information found in the drawn paper map, documented group discussions, and results of scientific studies to aid the barangay officials in drawing up a 5-year barangay development plan. In this way, concerns of local people from the purok level were communicated to the barangay officials and consequently increased the participation of the community members in the planning process.

In addition, the community was also satisfied and happy about the clarification of barangay and purok boundaries. After the twenty-two puroks were mapped out, appreciation of the areal extent and the richness of each purok boosted the morale of the purok officials because they acquired more information related to their area and they expressed a sense of a higher level of responsibility and accountability.

From this experience, one important feature present in the preparation of the water resource inventory map of the city is the increased community participation and understanding in water resource management. The process allowed the community and the researcher the opportunity not only to show the location and the extent of the existing resources but at the same time to determine actively the present or future use, needs or protection of their water resources that can be incorporated into the inventory map and report and provide the community with the basis for land use planning efforts.

2.1.5. Lessons learned

Your journey is your destination (Webley, 2002). It is not the final map that is the be-all and end-all of a mapping activity, though it is also considered a significant output. Rambaldi et al. (2006a) consider mapmaking and the maps as a means, a practice, and not an end. The map itself is actually seen as just instrumental to the marriage between the scientific/technical knowledge and the indigenous knowledge toward a more holistic characterization of the environment and in coming up with more informed decisions in its management. The threads that link the two knowledge systems can be generated from the interaction between the researcher and the community. More importantly, the interaction between the two groups may be considered as a valuable opportunity for learning for the researcher to know about the water resources in the area from the perspective of the community as seen from their eyes and understood through their experiences of relating with the environment.

If a picture is worth a thousand words, a map is worth a thousand pictures (Binnie, 2008). In teaching-learning experience, teachers use pictures to aid instruction. With pictures, learning is improved by twenty percent in terms of retention rate (Silberman, 2005). In the same way, learning about the water resources can be easily facilitated with the use of the map. Primarily, the map provides answers to the questions of *what* and *where* the resources are. But using the map as a visual aid can also raise the understanding to a higher level by answering questions of *why* and *how*.

There is more to the map than what meets the eye (Lyman, 2001). The power of the map should not be easily underestimated. When the integrated community map of the barangay was completed, it was understood that its immediate use was for the framing of a better comprehensive barangay development plan. It was also with the hope that the process of mapping the community underwent was a process of advocacy, of informing, and of influencing political process regarding the water resources. Little did we know that it could go beyond this as very practical uses by other sectors were later brought to our attention. The military used it to understand the lay of the area to monitor on-going stealing of expensive game fowls in the area; the city water district also studied the map in deciding proper protection of the areas where their production springs are located; and the community, with the social action center of the church, used it to discuss the effects of the continuing quarry activities in the area on their water resources. Indeed, the map did not just stay hung on the wall of the barangay hall as decoration, it served the people especially in helping resolve big issues affecting the community. This brought deep satisfaction to the researcher, knowing that many benefited from the process and the output of participatory GIS.

The maps are never final or static (Rambaldi et al, 2006). The community is continually growing and developments in the said area are to be expected. Because of this, there is a need to continually update the community map. The question as to who will maintain and update the community map poses a bigger challenge among the partners; especially for the University and the local government unit. In the interest of long term sustainability, applicability, and accuracy of the community map a good data management system should be set in place. But data management entails resources that cannot be easily provided by the University after the conclusion of the project. And this is the area identified as the limitation of this engagement. Until either the partner academe and/or the local government provides or secures another set of funding resources, the community map can only then be updated and improved.

2.2. Urban and Peri-Urban Agriculture: Quadripartite Partnership and Community Empowerment. The Case of Bacolod City, Philippines

Barbara Denil,
Facultés Universitaires Notre Dame de la Paix, FUNDP,
Namur, Belgique.
barbaradenil@hotmail.com

One major problem among Southern cities lies in the rapid demographic growth while agriculture remains export oriented (Cohen, 2004). As a consequence, when less subsistence agricultural products are made available while the urban population is constantly growing, the local market cannot meet the local demand anymore. As a consequence, too, the North, through cooperation programs, feeds the Southern cities. In order to increase their autonomy, the Southern cities are forced to look for alternatives such as Urban and Peri-urban Agriculture (U&PuA), as Cruz & Medina (2003) say.

The current literature reports this latter as a contribution to food security for fast urban growth communities (Holmer R. et. al., 2003). Among the numerous tools (technical, social, economic, etc) that may be integrated in the U&PuA process, cartography is compulsory, land planners say (Thapa & Murayama, 2008). The integration of community perspectives into the traditional GIS may lead towards more sustainable cities by providing them the capacity for a listening participatory process that will better meet the needs of the community.

The following case study aims for the elaboration of a Participatory Geographical Information System (PGIS) that will allow the integration of both perspectives from the land planners and from the community. The users and the developers themselves l devoted specific attention to the easy updating of the system. Data provided from the Local Government Units (LGUs), social and economic surveys, participatory cartography, remote sensing, as well as from some private local companies, was integrated to produce a Comprehensive Land Use Plan (CLUP) capable to elaborate scenarios for a sustainable future.

2.2.1. The geographical context

With a view of testing the efficacy of the methodology, the city of Bacolod, Philippines, has been selected according to the following criteria:

- Poverty;
- Food insecurity;
- Existing links between local NGO, urban communities, university and LGU;
- Motivation of all stakeholders for elaborating sustainable planning; and
- GIS availability at the LGU and the university.

The last decade's average growth rate for Bacolod City is 1.4%; its population density is 3,355 inhab/km2 (National Statistics Office, 2010) with 27% of the population living in squatters' areas (Bacolod City, Development Office, 2005).

The methodology was tested at Barangay 7 as target zone, which has an area of 0.4 sq.km subdivided into 4 puroks. The selection was made according to its municipality classification as urban poor area, and to its leaders' motivation for participation in the project (Denil, 2008).

2.2.2. Quadripartite partnership

The originality of the current research lies in the implementation of a quadripartite partnership consolidated by the scientific partner within a win-win environment.

2.2.2.1. Partners' profiles

1. The scientific partners were the Belgian University of Namur, Belgique (Facultés Universitaires Notre Dame de la Paix, FUNDP), and the Philippine university in Bacolod (University of Saint La Salle, USLS). Since 2002, the two universities have achieved many cooperation projects with the help of their two campus-based NGOs, FUCID and Balayan, respectively. They co-signed a Memorandum of Agreement that cements their institutional collaboration by promoting sustainability and resource- sharing between all their partners, including the local communities.

2. The participatory partners were the communities in association with some local NGO. The community of Barangay 7 already developed a high motivation for the management of their solid waste, which constitutes a solid basis for building a compost and agriculture project. Balayan had previously implemented Barangay 7 community based projects such as streets kids' programs, or recycling products production and commercialization. Very early on, the education component of the program was already in place and this was perceived as a fundamental project pillar.

3. The land planning department GIS office of the City Government, previously in close contact with USLS, was looking for a venue for implementation of its GIS equipment funded by AusAid. It immediately expressed its high interest in collaborating within a U&PuA project with the other partners. It was aware of its own benefit regarding the reduction of the city landfill volume made of compostable and recyclable waste for two thirds of its volume.

4. The private sector acted as a compulsory partner since its titled authority was required on most of the free-of-occupation parcels of land that would potentially be allocated for U&PuA.

2.2.2.2. Implementation of the partnership

Given the a priori linkages between USLS and the City Government, technical data such as environmental maps, land affectation information and population statistics were made easily accessible with no restriction. Moreover, any data exchange, importation or exportation of data, were easy to operate due to the use of common GIS software. As a result, dialogue and complementarities became a daily practice.

The City data-based social and economic profile of the community was enriched by several surveys. Interviews of community members were conducted with the help of the local university NGO. After a first adjustment of the questionnaires to pay respect to the local culture, overall when it came to family privacy or revenue information, the NGO made a second adjustment to better fit the priorities of the community. The purok leaders frequently met the scientific partners and the NGO members to ensure the individual and collective liberty of expression for every one, the good understanding of the process, and transparency. Many meetings aimed to make sure that the process remained a win-win process and sustainability a priority. All the meetings were held in the local dialect, with lots of photos and interviews recorded and validated with respect to the community's perspectives.

Northern and Southern NGOs played a key role in the promotion of dialogue between the three actors. The excellence of USLS' scientific and social competence as local university partner facilitated the interviews, their encoding, integration and GIS processing in coordination with the LGU.

The private side of the partnership took part in the working group meetings at the start and at the end of the process. Indeed, as the final objective is to implement concrete urban gardens, the identification and accessibility of free-of-occupation land parcels was a key determinant. Only the private owners can ensure and validate this information, as well as provide free access to the parcels. With the help of GIS processing of the public database, the scientist identified the location of the parcels with high potential for successful implementation. A constant multi-actor dialogue effectively increased the motivation for all stakeholders. The private owners became aware of the increased value that the implementation phase of the project could provide to their lots.

The quadripartite dialogue could identify some individual interests for each of the stakeholders, setting them in a win-win scenario (Orban, 2010). Once a common interest consensus was obtained, the feed back validation procedure, data exchange and working decisions were easy to implement. Emerging tensions were aborted by addressing them as they came up, given the regular participation of each actor in the process, and the central flexible role of the NGO in discussion-monitoring and dialogue orientation.

2.3.3. Illustration

Considering the participatory aspect of the process, the main challenge for the scientist was to successfully integrate the views and perspectives of every stakeholder with respect to their own priorities.

In the particular case study of Barangay 7, Bacolod, the community expressed its views and perspectives by way of mental (cognitive) maps (Orban, 2010). A Participative GIS (PGIS) operation facilitated their encoding and integration with the other existing data, such as the social, economic and environmental profiles made available by the LGU, and the private and community surveys (Denil, 2005; Orban, 2010). A two-steps' procedure allowed the participatory quadripartite partnership to formulate various scenarios for a Comprehensive Land Use plan (CLUP).

2.2.3.1. Step 1: Indicators' computation

Two indicators were calculated based on the mapped information: an Interest Density Indicator (IDI) and a Social Survey Indicator (SSI):

1. IDI aims to capture quantitatively, pixel by pixel, qualitative information through the computation of the density of the priority ranking ("weight") as given by the community. The priority levels for each affectation item are coded (Table 1) in such a way that they will cover a range from 1 (high priority) to 10 (low priority). Each item density will be calculated by dividing the item code ("weight") by the surface occupied by that item. The higher the priority is and the smaller the surface is, the higher the indicator will be.

$$IDI = Weight_{item} / Surface_{item}$$

Domain	*Item*	*Weight*
Social and Services Infrastructure	Basket Ball Court	7
	Health Center	9
	Church	10
	School	9
Solid Waste Sorting	Recovering Facility	5
	Compost	5

Table 1 – Bacolod Barangay 7: Participatory weighting of land affectation items

2. SSI is using the community survey data weighted according to community perception. This information is then merged with the municipality data. The answers were classified into 4 major domains following the regrouping suggested by the community in the perspective of U&PuA development: households' livelihood, population density,

employment, and solid waste (sw) management awareness and practices (Table 2). As examples, a vendor or a cook is perceived with a higher potential for implementing U&PuA than an employee and waste recycling is perceived as a big move towards sustainable land planning. SSI aims to capture urban poor communities characterized by high agricultural skill, waste management motivation, and high population density.

SSI = Livelihood&Density + (Employment* sw Awareness) + sw Practices

**** Household's Livelihood and Population Density***	***Weights***
Rich & low Density	1
Rich & high Density	3
Poor & low Density	8
Poor & high Density	10
**** Employment***	
Drivers	1
Cooks	10
Employees	1
Vendors	10
Construction Workers	2
**** sw Awareness*** **** sw Practices***	1 à 10
sw Sorting sw Composting	10 10
sw Burying	4
sw Burning	2

Table 2: Bacolod Barangay 7 : participatory weighting of survey variables

In order to moderate this indicator, the scientist added an objective measure: the distance that every household member was forced to walk daily to connect his house to the potential lots for U&PuA implementation. A Distance Indicator (DI) captures the average distance between the geographical center of the community and every lot using the Thiessen Polygon Method (Denil, 2005).

$$DI = (MD - LD) / MD$$

Where : MD = Maximal Distance between a household location and C
LD = Real Local Distance between a specific household and C
with C = geographical Center of the community

SSI may be moderated by multiplying this by the DI, as follows:

SSI * DI

2.2.3.2. Step 2: GIS integration

All participatory data were integrated into a PGIS that pays respect to the community's participation via its capacity through taking into account the weights given by the community members for each variable. The integration may be performed by a simple visual overlapping of the mapped information, or by a weighted linear combination modeling of the variables. The use of complex modeling does not confer adding consideration to the participatory side of the process; on the contrary, it might just make the process tedious and the outputs hard to interpret.

The maps' visual overlapping or a simple linear modeling allows the process to integrate the participatory data with classical data such as:

- Public LGU maps (e.g. soils map, land use map, infrastructure, cadastre, topography);
- Satellite images (e.g. land use changes);
- Lots market value;
- Pollution;
- Flood prone areas; and
- Others.

Based on this integration, various scenarios for a Participatory Comprehensive Land Use Plan (PCLUP) were elaborated (Denil, 2008; Orban, 2010) and discussed in quadripartite until a win-win consensus was reached. The community was called to validate the information and the way it has been integrated with respect to their priorities. The private owners of the lots selected by the PGIS process were invited to contract their lots' occupation in the perspective of a U&PuA implementation for a minimum of 3 years' duration. The LGU expressed its satisfaction in witnessing the volume reduction of the municipality landfill. The community got access to some lots and could develop its own food security and livelihood (composting, recycling) strategies. The scientists and the NGO appreciated the maturation of their reflection in PGIS research, as well as their multi-actor interfacing role.

2.3.4. Discussion

The consolidation of the participatory approach for a Comprehensive Land Use Plan (CLUP) is made possible only if all the actors are invited to intervene, from the start to the end of the process, with full respect to their equitable contribution and interest. The selection of one scenario for implementing U&PuA in the pilot site was performed in consensus with full respect to the formulated priorities and perspectives of all stakeholders.

The key for success lies in the respect of every one's position, in the application of an ethical code for good practice (Rambaldi, 2010), and in the formulation of a win-win output. The participatory approach implementation is highly time consuming. It requires regular stakeholders' validation to confer confidence and legitimacy to the suggested scenarios. Nevertheless, only a slow and long social and technical learning may lead to real mutual respect among the actors for a politically, socially, economically and scientifically anchored procedure that contributes to authentic people's empowerment.

2.3. Community Resource Mapping in Forest and Water Resources Management: Bridging the Divide between Community and Government in Mindanao

Jose Andres Ignacio,
Institute of Environmental Science for Social Change, ESSC,
Malaybalay, Philippines.
andresignacio@essc.org.ph

Community resource mapping has been practiced in the Philippines since the mid-1990s and has developed a wide following among NGOs and POs in management initiatives dealing with forests, ancestral domains and watersheds, and has even been adopted by a number of national government programs (e.g. CBFM - Community-based Forest Management program of the Department of Environment and Natural Resources) as key components in the process of planning and implementation for resource management. With the initial devolution of forest management functions, covering a limited area, to local government through the Local Government Code of 1991, there has existed a window of opportunity for local government to be more actively involved in forest resource management. But even with the increased localization of management responsibility to LGUs, the divide with the community is still great and needs to be overcome to achieve effective and sustained forest management with the latter acting in true partnership with the LGU.

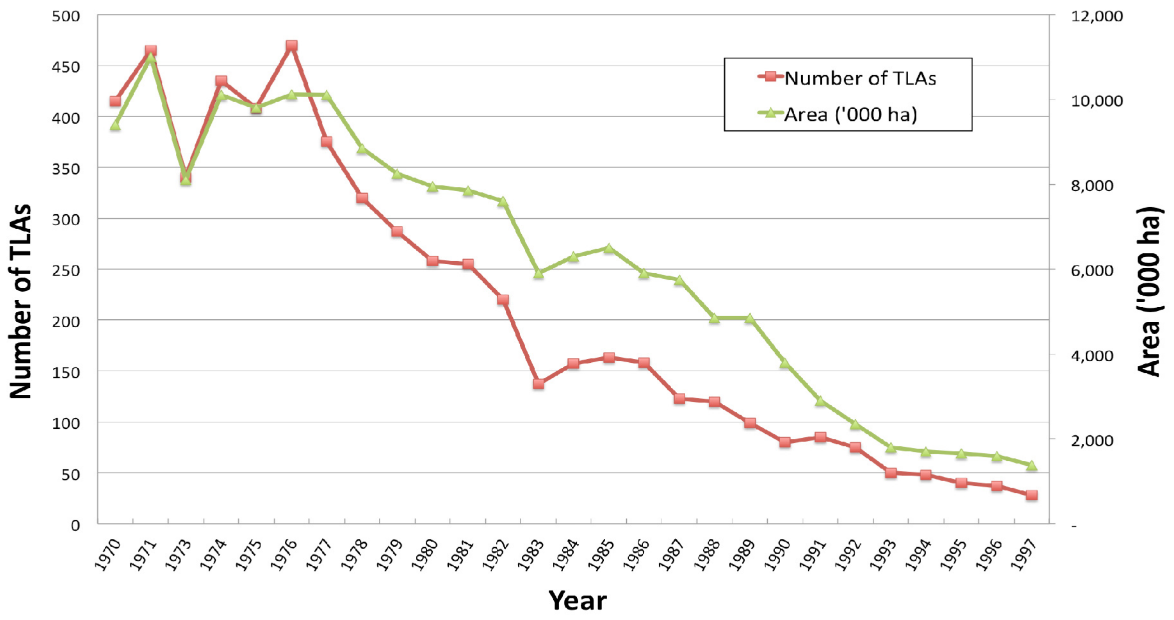
Community resource maps integrated with data processed from satellite remote sensing give technical value to community-drawn maps which are a primary source of land use information in an area, and have been observed to facilitate a meaningful resource-centered dialogue between community and local government. Integrating community resource mapping with existing local government initiatives in forest and water resources management, as in the case of the Allah Valley Landscape Development Alliance, has contributed to greater efficacy of member LGU interventions constituting a much larger area of influence.

2.3.1. A brief history of forest (mis)management in the Philippines – from centralized extraction to distributed stewardship

During the Spanish rule in the Philippines (1521-1898), the concept of the Regalian Doctrine was introduced declaring that forests and forest lands are owned by the state and therefore under its control (Borlagdan, Guiang, and Pulhin, 2001; Gould, 2002; Pulhin, 2003). The Americans, after taking over the Spanish in 1898, continued to adopt this principle of state ownership and applied it into law through the first Constitution of the Philippine Republic in 4 July 1946, primarily serving its own commercial interests in the country's forest resources (Gould, 2002).

At the onset of Spanish colonization, there were an estimated 27 million hectares (ha) of forest covering the Philippines' 30 million ha.- land area (Lasco, et al., 2001 as cited in (Chokkalingam, et al., 2006). By 1900, the country's forest cover had declined to 21 million ha (ESSC, 1996a; Pulhin, 2003). A forestry sector and industry were institutionalized by the Americans beginning with the introduction of the first modern logging operation in 1904 and the creation of the country's first Forestry School, now the College of Forestry and Natural Resources of the University of the Philippines in Los Baños in 1910 (Chokkalingam, et al., 2006). Together with the build up of a forest-based economy, the Americans also saw the need to rehabilitate degraded areas both inherited from the Spanish and resulting from intensified logging operations under their watch.

By 1920, the forest cover of the Philippines had decreased to 19 million ha. and between 1934 to 1941, forest had declined to 17 million ha. (Chokkalingam, et al., 2006). After the 2nd World War, forest cover continued on its decline, peaking during the period between 1965-1975 where a total of almost 3 million ha were lost (DENR, 1990). Figure 6 shows the number of Timber License Agreements (TLAs) issued through the years vs. the total area covered (Lasco, Visco, and Pulhin, 2001). This chart reveals that in 1971, the total area covered by the TLAs were more than a third of the entire area of the Philippines or 67% of the total classified forestland of the Philippines.



from Lasco, Visco, and Pulhin 2001

Figure 6 - Number and area ('000ha) of TLAs in the Philippines 1970-1998

In 1987 a World Bank loan financed a project undertaken by the Swedish Space Corporation (SSC) with the National Mapping Resource Information Authority (NAMRIA) for the first ever national land cover assessment using satellite remote sensing technology. The project revealed that a total of 6.99 million ha of forest remained throughout the country (ESSC, 1996a).

ESSC (2010) in its most recent analysis of ca 2000-2002 Landsat satellite imagery, reveals that a further loss of 0.68 million ha had occurred putting the most recent estimate at 6.31 million ha. The Forest Management Bureau of the Department of Environment and Natural Resources (2008) released its own assessment based on the same image collection and showed that net increase of 0.177 million ha had occurred in the same period, putting the forest cover at 7.17 million ha. This discrepancy can be traced to a redefinition of what constitutes forests by the DENR according to FAO standards (ESSC, 2010) and its inclusion of registered plantations into the list.

2.3.2. Paradigm shift in Forest Management

ESSC (1996b) showed that a great majority of the remaining forest blocks of the Philippines, based on the 1987 SPOT imagery conducted by SSC, are to be found within the domains of upland indigenous ethnolinguistic groups in the Philippines. The importance of this observation is in the fact that in much of the forest areas of the Philippines, it is the indigenous peoples who are de facto managers of the resources. The fact that the state, until late, still claimed ownership of these public lands has been unfortunate as these people who have been living out of these resources since time immemorial through their practice of traditional *kaingin* (slash and burn) farming have even been blamed for the degradation of the past decades (van den Top, 2003).

The decades of 1980 and 1990 saw a major shift in forest management from the extraction-heavy outlook of the 1960s and 1970s to a more people-centered and community- driven paradigm. The perspective did not change overnight, and was greatly influenced by community development approaches, i.e. community organizing, capacity building, and community development (Hess, 1999) that flourished through the 1980s and 1990s (Duthy and Bolo-Duthy, 2003).

The pursuit of effective and genuine participatory forest management had been a major challenge since the inception of community forestry in the 1980s. Various approaches had been attempted with various degrees of community involvement, as illustrated by Arnstein (1969) in her seminal paper.

The enactment of Letter of Instruction 260 in 1982 ushered in the era of community empowerment by establishing partnerships with the citizenry in the management of the forests and its resources, through the Integrated Social Forestry Program (ISFP) of the Department of Environment and Natural Resources (DENR) . Although the ISFP was clearly a step in the direction of community participation in forest management, it was still plagued with major limitations which prevented it from achieving its goals, i.e. "weak implementation, low participation of beneficiaries, neglect of ancestral domain rights and uncertainty with respect to sharing of benefits from forest products." (Sajise, 1998).

2.3.3. Community resource mapping as an approach to empowered community participation in environmental governance

In July of 1995, the Community Based Forest Management (CBFM) Program of the Department of Environment and Natural Resources (DENR), through Executive Order (E.O.) 263, was adopted as the national strategy for sustainable forestry and social equity (Gould, 2002). Through CBFM, the DENR intended to empower upland and forest dwellers "to exercise their rights and responsibilities as frontline managers of the country's forest lands" (CBFMO-DENR and ESSC, 1998). The adoption of community resource mapping (CRM) as one of the key components of the CBFM Program was a major move by the DENR to employ bottom-up approaches to community planning and management for forests.

The CRM approach employs a participatory process of consultation and definition of the local domain and resources by the community members themselves – in their own terms and without the aid of any technical spatial reference, i.e. topographic or planimetric maps. In this way, the local stakeholders are not obliged to adapt to a predefined characterization of their domain, but are given the freedom to collectively express what they consider as important. The CRM facilitator is key in the process as he guides the conduct of the exercise, following preset criteria and procedures, to ensure that basic standards are met in drawing out the information from the community. This is important both in assuring a high level of participation of the community members and in documenting quality information on the output maps themselves.

The actual CRM exercise not only provides information on the output maps, but is also a venue for resolving conflicts among community stakeholders, identifying key problems and concerns within the area, and most importantly motivates the people to participate in a collective and engaging manner. The facilitator again is key in assuring that stronger personalities (e.g. local officials) do not dominate the process. The quality of the engagement is seen in the community's willingness to participate and the richness of the output maps.

2.3.4. Integration of CRM outputs in government planning

Though CRM outputs have great value locally for community-based resource management efforts, the challenge still existed in bringing the rich outputs made by the community to a level that government can appreciate, accept and incorporate into their official land use plans and in facilitating dialogue that would allow greater participation of the community in the government management framework. Otherwise, the community outputs and participation were merely isolated initiatives that were disjointed from existing programs, thus preventing them from fully achieving genuine participation in government.

The challenge had always been to put technical geospatial reference to community derived maps so that these can then be integrated with existing geographic information, and thus be a crucial basis for planning and management decision-making. Various methods had been developed, including one that relied on common reference features on community and technical maps (i.e. river junctions, rivers, roads, ridges, etc. see figure 7) to serve as the

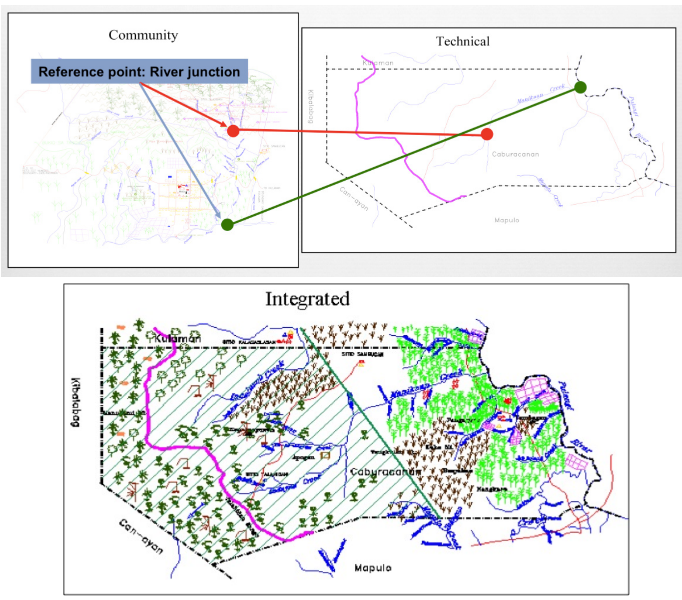


Figure 7 - Manual integration of community and technical maps (Bukidnon)

basis for warping the community map features onto a technical spatial reference (CBFMO-DENR and ESSC, 1998).

Although this had been an initial attempt at a technical integration of community resource maps, it gave acceptable outputs with community data being geolocated onto technical maps, which are used by government in planning efforts. The output technically integrated community resource maps served an important role in community-government dialogue in resource management. It gave the community the opportunity to be recognized by government as partners in resource management efforts and it gave the government a strong basis to recognize and accept community-derived data into their more technical land use planning efforts. The CRM process, because of its highly grounded nature on the actual stakeholders working the land, allows government to validate its strategies at the local scale (internal validation).

However, it had been observed that there was an inverse relationship between the technical accuracy of the output integrated maps and the area of the community domain, making large areas less likely to be technically acceptable. This is particularly true in the case of forest-based communities whose domains cover thousands of hectares. This is understandable in that it has also been observed that areas where the community are more in close contact with (e.g. the village center or farms lots) appear larger on community maps than on technical maps. The inverse is true for areas that are not visited on a regular basis. The challenge then existed for more accurate geographic control of community data. This called for a different approach to the integration of community and technical information.

Satellite imagery provides a relatively cheap and potentially accurate representation of land cover in any given area. Given a well implemented supervised statistical classification of satellite images, it has proven to be the new standard in land cover mapping. This approach was investigated as a means of accurately mapping the distribution of community-derived land use classes and of externally validating the community inputs.

Since the value of a technically integrated community resource map is in the presence of community information in a government technical reference, it is of great importance for a community to find their data on this hybrid map, which attempts to geolocate community-identified features onto a technical reference.

Conventional satellite-based land cover classification uses standard or universally accepted legends to label land use types. As community land use types, particularly in the case of indigenous cultures, have greater variety or sub-classes than conventional typologies, there was an opportunity to capture the richness of the community land uses through remote sensing image classification. There is always a physical basis for community or ethnographic classification of land use types - dominant vegetation types, presence of certain species, etc. Since these land use classes represented physical characteristics of the vegetation or land cover, there was no reason why these ethnographic land use types could not be used as the bases for the statistical classification of the images.

The resulting image classification showed the distribution of community forest land use classes. Figure 8 shows a comparison between maps resulting from manual integration of CRM onto a technical georeference (Figure 8 sup) and satellite image classification using community land use classes (Figure 8 infra). Note that map 3a captures more community-derived data, such as hunting and fishing areas, rattan stocks, and mineral resources. It is clear from this example that the manual method has its limitations in terms of technical accuracy of the distribution of land use. The satellite image classification captures the actual ground distribution of community-identified land use classes, particularly forest types, which have particular significance to forest-based communities. This provides a solid technical basis for government to engage forest communities in the management of the resources as a major step in the process when information on the actual location and distribution of resources has been taken. The resulting land use map, which reflects community information derived from satellite imagery, is now a common reference of community and government with great potential in participatory forest management.

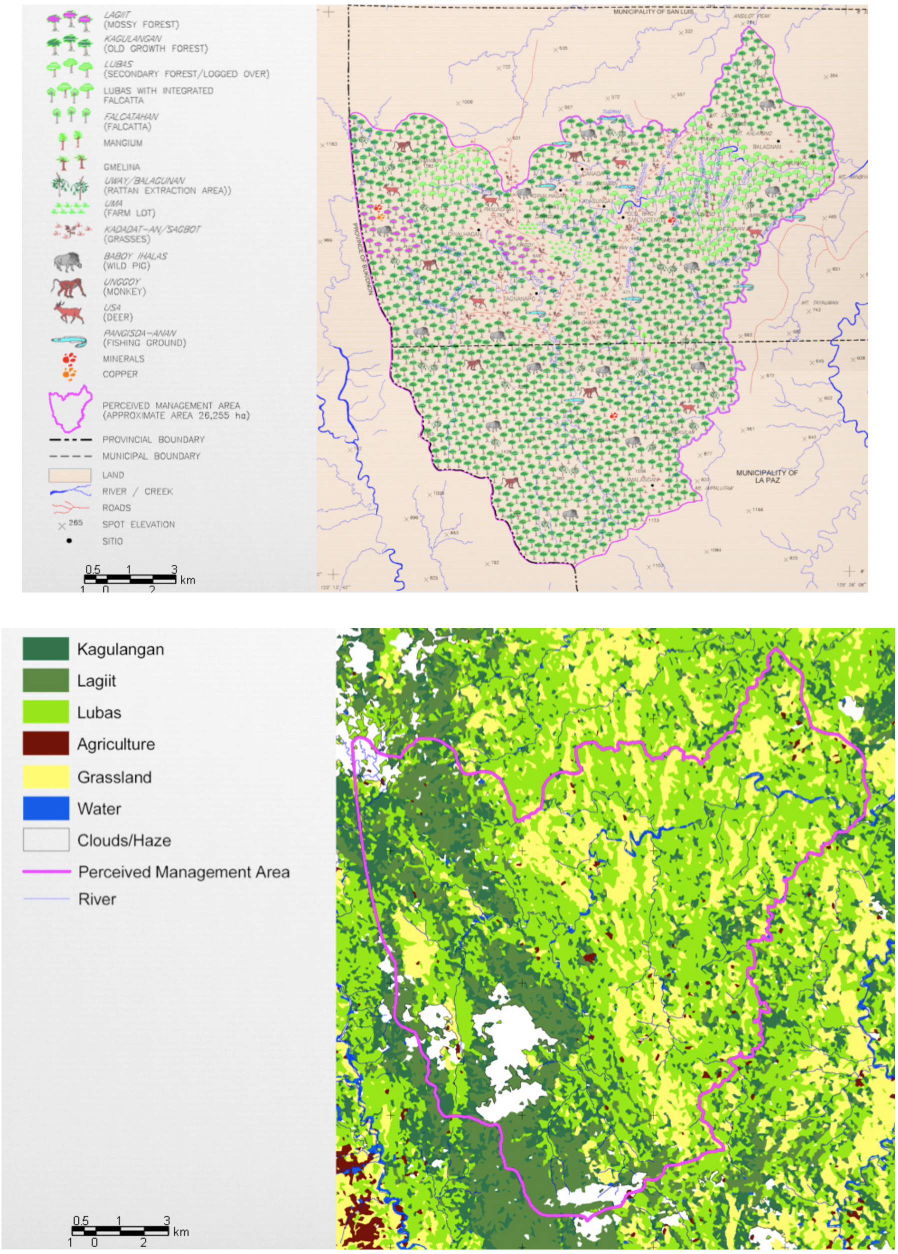


Figure 8 - Comparison between manual technical integration of CRM (sup) and satellite image classification (inf) using community land use classes (Mindanao)

2.3.5. From outputs to management – the challenges of participation

Following this highly technical process of bringing the community data onto a geographic reference, the integrated community maps are not the final stage in the process of bringing community into the framework of government resource management initiatives. Now with a common reference with government, the community through the integrated maps can finally be in a position of dialogue with community. The final stages in the process of including communities in government planning necessitate a continuing dialogue between the two. This requires that government, through various venues of consultations and meetings, is able to draw from the community an expression of their perceptions, needs and goals. Appropriate management structures need to be put into place that gives the government the competence to work in partnership with the communities. This is manifested in the form of meetings with communities using the technically integrated community maps as the centerpiece of dialogue.

In the end, it is important that government takes the lead by being the active listener in this process to draw the community stakeholders into effective participation in the management process. Government needs to develop sensitivity to the expressions of the community in a way that allows the latter to share their aspirations and concerns. As these social skills are not readily present in this traditionally technical branch of government, a retooling of its workers needs to be put in place that would give them the capability to interact with community on a level of collaboration. Without such openness from government, a genuine dialogue cannot be achieved and true partnership and participation cannot take place.

2.3.6. Creating an enabling environment for participation in forest and water resources management – the AVLDA experience

2.3.6.1. Beginnings

In 1995 and 2002, Lake Holon at the headwaters of the Allah River released huge volumes of water into the Allah River after landslides temporarily dammed the lake outlet. The catastrophy affected more than 20,000 families and damaged about 9.5 million euros worth of crops and infrastructure facilities. Eleven municipalities in the provinces of South Cotabato, Sultan Kudarat and Maguindanao suffered the heaviest damage. These disasters drastically changed the biophysical condition of the Allah Valley Landscape (AVL), which are attributed to the degradation of the upper reaches of the watersheds

As a result of these events and guided by genuine concern for their constituents, the local government units of the affected areas decided to come together towards a common cause – to address the problems emanating from the degrading conditions of the AVL. Utmost in their priorities was the assessment, monitoring and management of the remaining forest resources of the Landscape, which are perceived to have the greatest impact on the conditions of the rivers of the AVL.

On March 2003, with support from the Canadian International Development Agency through the Local Governance Support Program, the Allah Valley Landscape Development

Alliance (AVLDA) was created through a memorandum of agreement signed by and among the local chief executives of Sultan Kudarat and South Cotabato provinces and Regional Directors of member National Line Agencies and representatives of civil society groups (Bansuan, 2008). It is an alliance of local governments having geographical and political jurisdiction over the Landscape, including other stakeholders such as concerned national government line agencies and civil society organizations operating in the area.

The formation of the AVLDA as an alliance was not under the directive of any law or government program, but was solely a collective effort led by local government and supported by concerned sectors of non-government organizations, church, and national line agencies, to seek action on managing the shared resources of the Allah River Watershed. This spontaneous initiative was prompted by a perceived intensification of degradation from the uplands down to the lowlands of the Allah Valley Watershed. The fact that the motivation had come from within and among the members of the Alliance had made effort more focused, driven and sustainable. Even the core funding for the Alliance had come from local government fund allotments and not from external sources. This is partly due to the lack of legal personality of the Alliance to make it eligible for grants from funding agencies. Even with this major limitation, the Alliance had surpassed great odds in pursuing a creative and effective path towards the sustainable management of the AVL.

2.3.6.2. Adoption of participatory methods for community-based resource management

The first task of the Alliance was to form the AVLDA Project Management Office (PMO), which serves as the alliance secretariat and implements policies passed by the AVLDA Board (composed of the local chief executives and top level representatives of the Alliance) through coordination with concerned members (Bansuan, 2008). Once the organizational setup had been approved and positions filled, the PMO set out in search of a suitable participatory model for community-based resource management. After conducting a field visit to Agusan del Sur province in Eastern Mindanao, it learned about CRM conducted by the Environmental Science for Social Change (ESSC), as well as other tools for management it had introduced in the province in a prior engagement. After an initial interaction with ESSC, the PMO was convinced that it would adopt the former's tools and approaches to jump start its initiatives in AVLDA.

From this, the Allah Valley Landscape Resource Mapping and Community Based Resource Assessment and Mapping Project was designed by ESSC based on the needs of AVLDA. CRM was at the heart of the participative approach which targeted forest and water resources management. The links between forest and water were strengthened through the adoption of the watershed paradigm in the management framework, highlighting the close interaction between the two and the need for a better understanding of biophysical process which shape the AVL. This required, first and foremost, the acquisition and consolidation of data throughout the AVL, which included community-generated information as well as satellite image classification and GIS.

CRM was aimed at encouraging participation at the level of the local stakeholders, typically at the village level. The PMO, together with staff from member municipalities, were trained to facilitate the CRM exercise to give them the skills to conduct the activity in other communities not covered in the project. At the same time that the CRM activities were being conducted in the pilot communities of the project, a parallel activity initiative was being undertaken to provide the AVLDA Technical Working Group (TWG), composed of technical staff of the members of the AVLDA Board, the data, tools and analysis to work together towards a more consolidated approach to manage the broader watershed area of the Allah River. The TWG is the workhorse of the AVLDA Board, who relies on the former for technical inputs and recommendations for policy directives and management decisions. The TWG constitutes the middle-level tier in the participatory management spectrum of the AVLDA. It is on this level that the community information gets integrated with technical data layers into a consolidated management plan for the subwatersheds of the AVL, which reflect from the very beginning the participation and data from the communities.

It is important to note that in adopting this more community-centered approach, government had to acquire the proper facilitation and other technical skills through trainings. The process of involving communities necessitates numerous consultative meetings and discussions with the local stakeholders, which serve are venues for drawing out community perceptions and laying the ground for shared responsibility in resource management. This inclusive process can be very demanding in terms of time, but the results are lasting as there is a genuine sense of ownership from the community of both the data and the process as a whole. This encourages an enduring participation which is based on transparency and trust.

2.3.7. Discussion

Forestry in the Philippines has gone a long way in terms of paradigm through the 20th century, from more industry-centered extraction in the early decades to community-centered management towards the latter part. At the turn of the last century, forests began to be associated with watersheds and water resources due to a deeper understanding of the important role they play in maintaining water supply and quality. In the recent years, forests and their impact on floods and related disasters have once more sparked great interest in understanding the connections due to their increasing severity and frequency, with climate change as a major factor. The drive towards carving out more effective forest and watershed management models has never been stronger.

A sustainable approach in forest and water resources management is one that brings together community participation into a government framework of planning and management, but bridging the divide between community and government is not always easy and constitutes the challenge. Various tools have been developed and are available for use where appropriate, but a key component is always the openness and willingness of government to engage communities on an equal footing. Conversely, communities need to be brought to a level of empowerment that allows them to be confident enough to work with government. The tools and approaches described in this paper facilitate this leveling of the playing field so that community and government can then focus on working together in the management of the resources. This process involves the establishment of venues for dialogue and validation with community and the need for developing the capacity of government to facilitate this process through skills training.

The rich experiences of the Allah Valley Landscape Development Alliance have shown that in order to be truly effective, participation in resource management not only means bottom-level participation of communities, but requires participation at the various levels of governance as well. Stakeholders exist at each tier, which means that there are opportunities for participation at each level. At the Board level, the main stakeholders are the local chief executives and heads of the regional line agencies and non-government organizations (NGOs). At the level of the technical working group (TWG), the stakeholders are the heads of the planning offices, environment natural resurces management offices, other technical

personnel from the regional offices and NGO field workers. Finally, the community is represented by its members. It is however important that each of these levels of participation recognize that they are part of a broader initiative of concerted action acting in a mutually inclusive and concerted manner. Finally, it is also important to see that each of the tiers constitutes a "community" in itself – the village, the TWG and the Board – and each of these "communities" needs to keep its focus on their priorities based on their mandates and their specific roles in the global management framework of the Alliance, in order to move towards a better and safer life for all.

2.4. Bridging Communities Using Participatory Geographic Information System (PGIS) in Environmental Management: The Experiences of the University of St. La Salle, Bacolod City

Mary Ann Pandan and Ericson Alarcon,
University of Saint La Salle, USLS, Bacolod, Philippines.
maryannpandan@yahoo.com libriggs@yahoo.com

Social policies and programs, though with good intentions, do not always reach the poor people that they target as beneficiaries. The success and the relevance of poverty-reduction strategies are not realized because social relationships are not given importance. One way of resolving this is by acknowledging the critical role of participation, transparency and accountability at the local and national levels. (World Bank, 2000). Participatory Geographic Information Systems (PGIS) is one method, which could encourage this.

PGIS is a community-based management of spatial information and works towards community empowerment through measured, demand-driven, user-friendly and integrated applications of geographic information technologies and systems. (Rambadi et al, 2004)

With this in mind, the University of St. La Salle (USLS) adapted PGIS to their social development programs to promote long-lasting interventions with the vision that with appropriate utilization, it may stimulate innovations and social change.

2.4.1. Context

In 2003, USLS used PGIS methods in defining a Community-based Solid Waste Management Program for an urban barangay of Bacolod City, Barangay 7. PGIS was used to gather information on the local perceptions and social acceptability of dealing with the solid waste problem in the community.

Then, the PGIS method was replicated in a coastal barangay of the same city (Barangay Punta-Taytay) in dealing with the solid waste program. However, analysis and some methods were innovated to be more responsive to the needs of the barangay.

Furthermore, in 2007, USLS applied PGIS methods to a rural mining community in the southern part of the province. This is in relation to resource management mapping in that area.

These three (3) cases represent the PGIS involvement of USLS and there is a need to assess the implications of this practice to the partner communities as well as the GIS specialists of the institution.

2.4.2. Objectives

The paper aims to:

1. Study and compare the use of PGIS in different partner communities of Negros Occidental such as (a) Barangay 7, Bacolod City (b) Barangay Punta-Taytay, Bacolod City and (c) Sitio Dung-i, Sipalay City;
2. Assess the impacts of PGIS to the (a) community and (b) GIS specialists;
3. Identify ways of improvement for the practice of PGIS in the university.

2.4.3. Methodology/experiences:

The use of PGIS in the three (3) cases is very similar and involved community mapping in the area. The main flow of the method was adapted from ESSC (1998) and this involved but was not limited to the 7 phases as follows:

- **Networking and initial consultations**: Solid relationships were built with key people in the area.
- **Data preparation**: All available data were studied and inventoried (topographical maps, socio-economic and demographic data, livelihood, etc.).
- **Initial consultation with the community and site analysis**: Familiarity with the culture and the features of its environment were developed.
- **Community mapping activity**: Actual mapping activity (the community produces a map of the area where they live) was done.
- **Community validatio**n: The community checked and validated the digitized community map. Further details and concerns that are relevant to the activity were also discussed.
- **Technical integration**: Spatial accuracy of a topographical map was related to the community map. The integrated map was subjected to field verification and community validation resulting in the finalization of maps.
- **Presentation and submission**: The validated community map and integrated map were given to the community. The significance and uses of maps were then discussed with them.

However, these 7 phases were altered. In order to be responsive to the objectives and needs of the community, the methodology was customized to the local context. Social preparation and organization were given major focus in the USLS involvement. Added phases in the methodology were designed to increase people participation in the GIS data acquisition and analysis. Furthermore, as the GIS specialists gained more experience and insights, the GIS software was also maximized to involve more steps and outputs. Thus, the GIS database progressed to more accurate and representative models of the social realities in the area.

2.4.3.1. Barangay 7, Bacolod City

In order to define the local knowledge and perceptions of the community regarding solid waste, community mapping was done in Barangay 7, Bacolod City. Local leaders and key informants were asked to draw their community with the objective of defining the solid waste interventions that could be introduced by the local government units such as (a) materials recovery facility (b) collection points (3) compost gardens and (4) hazards. In the GIS technique, local leaders were involved in data gathering procedures and validation in the area. From here, a community-based program was developed.

In this project, it was observed that:

- Importance of spatial information was not recognized by the community;
- Although the community appreciated the generated information, it was not fully utilized by the decision-makers;
- There was a discrepancy on the spatial delineation of the community as boundaries were not truly defined;
- Sustainability of the project was not realized since the political will of the leaders were not consistent with the objectives of the project. It can also be seen that the participatory component was not clear as the GIS access of the tool was not available to the community;
- A lot of data can be used in learning about the culture, practices and views of the community.

Based on these observations, it can be seen that there is a need to let the technology reach the people to the extent that they will be able to internalize it. No matter how helpful a technology is, its relevance suffers if its beneficiaries cannot relate to it. Consequently, the program that it aims to help also suffers. As a technical person, there is always an assumption that the logic and the processes used in GIS do not have to be understandable to the people but this is not the case. In this light, one realization for the GIS specialists is that an investment must be placed in preparing the community and giving them access to GIS and its procedures. Also, it is important that social relationships are fostered in the use of the tool, and that the community (translated to political will of the leaders) and the GIS specialists working in a project equally share the desire for change. Lastly, there is a need to resolve data issues in the community such as geographic boundaries and symbology, which are critical in the use and understanding of PGIS.

2.4.3.2. Barangay Punta-taytay, Bacolod City

Taking the learning from Barangay 7 in the project of USLS with Barangay Punta-Taytay, the involvement of the community was improved. As an understanding of the participatory nature of GIS was increased, community-mapping procedures were enhanced and the appreciation of the GIS was first ensured. Furthermore, GIS analysis was developed such that constant consultation and validation of the parameters were done with the community. All results were also shown for review in every step of the process.

These changes had a positive impact because the local leaders not only became the source of valuable information but more importantly, they also became the facilitators in generating knowledge. In line with this, appreciation of the power of PGIS was seen and thus, decisions reached were more sustainable. One insight from this application is the significant importance of the role of the political will of the local government unit. In applying PGIS, it is very helpful if the openness of the leaders to the tool will first be encouraged and as a result, their appreciation will lead to its optimal use for decisions and planning in relation to community problems.

As the response of the community improved, procedures and analysis generated in GIS also increased. From community resource mapping applications, it now evolved to route analysis, prioritization, assessment mapping, which are more helpful to the community. There was also added accuracy and technical soundness in PGIS as more data and information are generated.

It was also noticed that ownership of the maps and GIS data were now seen in the local people. They are able to identify with the elements in the map and are able to define their needs and plans from them.

2.4.3.3. Sitio Dung-i, Sipalay City

For the mining community, Sitio Dung-i in Sipalay City, more focus was given to the social preparation and integration of the local community to the process.
This was done by:

1. Training a member of the community in Geographic Information System (GIS);
2. Letting a local explain and facilitate the community mapping activity;
3. Doing validation activities with the community and allowing them to use the Global Positioning System (GPS);
4. Conducting Focus Group Discussions (FGDs) to finalize the map;
5. Being in constant dialogue with the community to ensure the accuracy and acceptability of the map.

2.4.4. Conclusion

It was seen that the process developed more appreciation and confidence of the tool in the local people. Because a local did facilitation, the people were more open to the process and more participative in sharing their knowledge. Details on the resources and the lay-out of their community became clearer and better understood by the people, which encouraged them to use this to resolve inconsistencies with the proposals presented by the mining companies and the city local government unit. Possible environmental effects of activities in their area were further established and thus, aided them in defining possible conservation initiatives.

The strong point for the GIS specialists in the experience with Sitio Dung-i is that their role as mere promoters of PGIS was realized. In this case, the driving force of PGIS was the community and not the GIS anymore. It is important to know that the center of PGIS is the participation of the people and not the technology. As GIS technicians, this realization will greatly helped in defining the ethics and the respect one uses in dealing with communities. If this realization is also developed in the community, they go beyond empowerment towards taking a proactive stance in protecting and appreciating their geographic area and resources.

2.4.5. Discussion

The practice of PGIS in the partner communities of USLS led to insights and lessons for both the community and the GIS specialists.

2.4.5.1. Impact on the community

The three cases generated different results for the community. Barangay 7 did not fully appreciate the tool and did not use it. This can be attributed to the lack of awareness building and exposure to GIS of the community. Also, the community was not able to fully realize the need to work towards the objectives of the project. However, Barangay Punta-taytay and Sitio Dung-i were able to fully utilize the tool and exhibited appreciation of the tool. The process truly empowered them and facilitated their involvement in the process of decision-making and communicating. PGIS gave them a sense of power, authority and control over their knowledge and aspirations for themselves and their community. This can be attributed to the increased involvement of the communities in the PGIS process.

2.4.5.2. Impact on the GIS specialists

As GIS specialists, important lessons were gained, most especially in the need to truly focus on social relationships in the conduct of the process. It was realized that the involvement of technical people must be confined to assist the community in facilitating information and thus, they can make no claim on authority or control. In terms of the programs, the sustainability of the program is dependent on the initiative of the community and so, planning tools must be consistent to their present needs and conditions. There was a great challenge in attaining the balance between technical soundness and social acceptability in all PGIS involvement of the technicians. The skill in creating this balance can only be gained through constantly working with communities. It was also realized that PGIS as a technology will not be significant if the social perspective of the technician is not developed. As GIS technicians, one must also learn to develop one's knowledge of social realities and dynamics in one's study area.

2.4.5.3. Perspectives

It has always been said that information is power and in the context of PGIS increasing their access to data, this is translated to the empowerment of the local community. However, some communities, as well as their corresponding LGU, are not ready for the data. Some communities find it hard to identify themselves with the data and thus, are not able to use these to express their issues and advocacies to their leaders. A possible reason for this disparity is their lack of exposure to and knowledge of new technologies such as computers and GIS. On the other hand, LGUs also find it hard to seek the balance between putting value in GIS maps and using traditional methods of planning. Some local LGUs are not adept in interpreting and analyzing geographic data and thus, cannot find ways to optimize the technology. In line with this, it is truly important to invest in trainings and knowledge transfer to all stakeholders so that readiness and the openness to PGIS is given importance. Therefore, change can truly be effected.

There is also a need for us to go beyond ownership and appreciation of the map. Success of the process can be fully realized if behavioral change is effected in the local communities and leaders involved in the project.

Emphasis should be given to the involvement of the communities in all steps of the process. It is not enough that they are aware of PGIS as a process but must be immersed and become able to facilitate the process and operate the equipment used. This is one way of building their confidence and consequently their trust in themselves, the technology and the GIS technicians.

PGIS is one way of bridging the divide of education, which exists between the decision-makers and the people in the ground. If spatial information is well understood by all, it can represent a common way of communication between parties regardless of different educational attainments, dialects and mindsets. Thus, this understanding is one challenge that the PGIS practitioner must always keep in mind.

As specified in World Bank (2000), “Social capital is central to people’s ability to chart their own future within their communities...” and this is one thing that PGIS can foster. By building up social capital in the communities, it will pave the way for new initiatives in the field of participatory methods in social development programs.

The processes that should be employed must foster respect, motivation and integrity and so, it is very important to define and internalize ethics in the use of PGIS.

2.5. Making Geographic Information System (GIS) Relevant to Community Development Research in the Philippines: Integration Process, Experiences and Challenges in the Poverty Mapping Research in Barangay Punta Taytay, Bacolod City

Romeo G. Teruel, Virgilio R. Aguilar, Elvis A. Olivarez,
University of Saint La Salle, USLS, Bacolod, Philippines.
rgteruel@yahoo.com, vremv65@yahoo.com, Elvis_olive@yahoo.com
Nicolas Daix,
Facultés Universitaires Notre Dame de la Paix, FUNDP, Namur, Belgique.
nicolas.daix@fundp.ac.be

Addressing widespread poverty remains one of the most important policy challenges facing the Philippine government. Poverty incidence in the country is way above the figures in other countries in East Asia (EA). In addition, the implementation of poverty reduction programs is so snail-paced that the country has become the basket case in the East Asian Region.

Poverty in the Philippines has to do largely with its inability to achieve and sustain an economic growth substantially higher than its population growth. This poor performance can also be attributed to poor access to infrastructure and social services across the regions and the island groups. Thus, the problem of poverty is also related to regional socio-economic inequality.

Negros is one of the islands in the Philippines where socio-economic inequality is evident. In the 1980s, the island was considered as the most impoverished following the collapse of its monocrop sugar industry (Pistorius, 1994). The dire economic condition gained both national and international prominence because of widespread hunger and malnutrition and the proliferation of poverty alleviation initiatives by non-government organizations (NGOs) and private volunteer organizations (PVOs). However, since the 1980s, poverty-related programs, especially in the province of Negros Occidental, focused mainly on alleviation but failed significantly in addressing the root causes of poverty, which have been mainly attributed to socio-economic inequality.

As poverty and inequality are intimately linked (Fields, 1980; Leimgruber, 1994; Mehertu et al., 2000), one of the effective ways to alleviate the problem of poverty is to address socio-economic inequalities and to design spatially and community-targeted poverty reduction programs (Craig and Porter, 2003; Elbers et al., 2007). This task requires a systematic process of generating data or information about the target community so that whatever poverty alleviation program could be designed it is based on community basic needs. The development of composite indices and their mapping allow obtaining a vision of spatial inequality within the community and the targeting of appropriate development policies.

This chapter aims to highlight the relevance of community data integration in poverty studies using GIS, and actual experiences and challenges of project implementers in poverty mapping projects.

2.5.1. Context

The University of St. La Salle (USLS), in its effort to contribute to poverty alleviation initiatives in Negros Occidental, launched a poverty mapping research project in 2009, which could be used as benchmark data by local government units (LGUs), non-government organizations (NGOs) and other stakeholders in coming up with their poverty reduction programs and initiatives. The study was spearheaded by the USLS-University Research Center in collaboration with the Department of Geography and Fucid NGO of Facultés Universitaires Notre-Dame de la Paix (FUNDP), USLS-Balayan, the Institute for Negros Development (IND) and the Barangay Development Council of Barangay Punta Taytay (selected as Pilot Site, see 2.5.3. infra).

2.5.2. Methodology

As the monetary approach is not sufficient (i) to capture the multiple aspects of poverty (Anand and Sen, 1994; UNDP, 1997; Ki, 2009), (ii) to give an actual picture of socio-economic disequilibrium and, (iii) to formulate concrete and applied strategic recommendations, the project employed a community “basic needs assessment” approach (CBNA). This method was used and recommended by many (Neuber et al., 1980; Williams and Yanoshik, 2001). A specific objective of the study was to propose a composite index on using indicators, which represent levels of deprivation. As the spatial dimension is crucial for the understanding of the poverty mechanisms (Kanbur and Venables, 2005) – at all spatial levels –, the use of a geographic information system (GIS) appeared as a key tool in developing a systematic process of generating data and information about the target community so that poverty alleviation programs designed for the community will be specific to its spatial socio-economic realities.

Two methods were tested in the development of a basic needs index namely, (1) the Linear Combination Method (LCM), and (2) the Principal Component Analysis Method (PCAM).

2.5.2.1. The Linear Combination Method (LCM)

A composite index was proposed by the University Research Center (URC) on basis of the same principle used for the Human Development Index (HDI) and the Human Poverty Index (HPI) developed in the 1990 by the UNDP. Both indices measure gaps in several dimensions: health, education and the standard of living for the first; life expectancy and quality of life, knowledge and social integration for the latter.

The Assessment Index (AI) is an equal-weight linear combination of several deprivation indicators (measuring the deprivation for given basic needs). The generic formula is:

$$AI = \frac{1}{n}\sum_{i=1}^{n} d_i$$

where: n is the number of deprivation indicators, and d_i is the i[th] deprivation indicator.
This index ranges from 0 to 1.

Concretely, AI is computed as follows:

$$AI = 0.2\ M + 0.2\ E + 0.2\ S + 0.2\ H + 0.2\ I$$

where:

- Employment index (*M*) is computed using the following formula:

$$M = 0.5\ Ue + 0.5\ In$$

where: *Ue* = percentage of the population15-64 years old who are unemployed
In = percentage who have monthly incomes below Php15000

- Education index (*E*) is computed using the following formula:

$$E = 0.5\ E_1 + 0.5\ E_2$$

where: E_1 = percentage of the population without formal schooling
E_2 = adult illiteracy ratio

- Health index (*S*) is calculated based on the following formula:

$$S = \frac{P}{4} + \frac{C}{4} + \frac{W}{4} + \frac{T}{4}$$

where: *C* = percentage of the population who availed of consultation
W = percentage of the population not using improved water sources
T = percentage of the population without proper toilet facility

- Housing index (*H*) is computed using the following formula:

$$H = 0.5\ h + 0.5\ s$$

where: h = percentage of the population which does not have strong materials for their roof
s = percentage of those who squat in their home lot

- Infrastructure index (I) is computed based on the percentage of the population with access to transportation, health centers, and schools.

2.5.2.2. The Principal Component Analysis Method (PCAM)

PCA-based indexes are more and more used in studies focused on poverty, marginality and development (Henry et al., 2003; Cavatassi et al., 2004; Sricharoen, 2006; Daix, 2010). Using indicators, which represent levels of deprivation, it is possible to consider the "first axis" as an axis of poverty. Classical PCA data processing generates factorial components (F_i), which are weighted linear combination of the original variables (Xi). Statistically, the first component (F_1) takes into account/summarizes the maximum of information. Formally, the first component eigenvectors (f_i) are used as weights in a linear combination of initial deprivation indicators standardized (by using mean and standard deviation values).

Formally, the *index of marginality* (M) of a spatial entity j is expressed as:

$$\mathrm{M}_j = f_1 \frac{(a_{j1} - m_1)}{s_1} + \ldots + f_n \frac{(a_{jn} - m_n)}{s_n}$$
$$= \sum_{k=1}^{n} f_k \frac{(a_{jk} - m_k)}{s_k}$$

where: f_k the first component eigenvector of the k-th *core-indicator*, a_{jk} the value of the *core-indicator* k for the spatial entity j and m_k and s_k are respectively the mean and the standard deviation of the *core-indicator* k calculated on all the spatial entities.

For both methods, the parameters were adjusted to represent the conditions of the household. For parameters which cannot be expressed as percentage, numerical assignments were defined for the related survey question. To be consistent with the percentage values of the other parameters, the scale used was 10-100, with 100 representing the most deprived condition and 10 as the least deprived (See Daix, 2010 for more details).

2.5.3. Pilot Site

Barangay Punta Taytay, Bacolod City, Negros Occidental, was chosen as the pilot area for study (see figure 1 for a location map). It is a fishing community with a population of 4,807 situated in the southernmost part of the city. One important consideration in choosing the study area is the partnership that the University of St. La Salle (USLS) through its extension arm, the Balayan, has forged with the community in implementing the Ecological

Solid Waste Management Program (Republic Act No. 9003). This USLS/Balayan - Punta-Taytay partnership was particularly needed to conduct data gathering in a participative way.

2.5.4. Data and Research Protocol

In mapping poverty in Barangay Punta-Taytay, the project employed the Basic Community Needs Assessment (BCNA) as an approach in generating poverty baseline data and basic needs analysis of the community. As an approach, BCNA requires an area-focused identification of basic needs and a needs assessment based on priorities identified by the people in the community. It works along with the participatory framework of research and community development.

The study, being essentially descriptive-evaluative in research design, made use of appropriate research methods. A survey (using a questionnaire with 86 questions) was conducted to generate socio-economic baseline profile of the households in Barangay Punta-Taytay, as well as to assess their basic needs. About 336 households were randomly chosen in the three selected puroks of the Barangay, namely, Macawiwili, Katilingban and Masinulondon. Other than the survey, the study employed key informant interviews, rapid community appraisal and focus group discussions (FGDs).

As a participatory research, the study was conducted in close coordination with all the stakeholders. The purpose was discussed first with the local government unit of Bacolod City in order to solicit their necessary support towards the realization of the goals and objectives of the study. The research collaboration was formalized through a memorandum of agreement (MOA) duly signed by both parties. Under the MOA, the LGU is expected to provide the secondary data such as city and barangay development plans and other pertinent information needed for the effective and efficient implementation of all research activities. The University of St. La Salle, through the Institute for Negros Development (IND), is expected to provide a copy of the report to the LGU.

In order to determine the variables of the study, the research team conducted a consultation with different constituents in the community. Interested community groups were also invited and encouraged to participate. This process was done to ensure broad representations in the project and in order to ensure the development of a credible and comprehensive survey questionnaire to be used for data gathering.

An important aspect of the study was the use of state-of-the-art technology in research and database system - i.e., the GIS or the geographical information system - in mapping the basic needs of the communities in Barangay Punta-Taytay. The GIS component involves 4 major phases namely, (a) Data Collection; (b) GIS Processing; (c) Community Validation; and (d) Sharing of Research Results/Strategic Planning of the Community. The geographic data were taken from the enhanced community map made by Ericson et al. in 2005 for the GEOTEACH CENSOPHIL European Union Project of the University of St. La Salle, Bacolod City.

The first phase of the GIS was data collection through the household survey. The second phase was data processing through GIS data banking. Under this, identified parameters were extracted from the survey results and then encoded into Excel. This file was attached as attributes to the purok and household shape files using the "join" tool in ArcGIS 9.2.

There were 297 households accessed for the survey. There were 41 households with no data and there were 21 vacant houses. The discrepancy was due to various problems encountered during the survey such as the moving out from the community of some residents after the survey, vacant houses, and some residents who were not present during the survey period. The resulting shape files were then subjected to analysis.

The third phase was community validation. All felt-needs which were identified during the survey were prioritized using the paired comparison technique. This technique requires the use of a matrix, which helps in comparing one need to another. A focus group discussion was conducted with selected participants from the community. The primary purpose was to validate the basic needs identified in the survey. Comparison for each set of needs can only be done once. Participants of the FGD were asked to rank the needs according to their level of deprivations. The group facilitator read each possible pair and participants voted which they preferred to be addressed first.

The last phase of the GIS process was the sharing of the results with the community through feedbacking and participatory GIS technology. The results of the study were presented for comments and validation with different stakeholders in the community through a workshop. The presentation was made and tailored to the needs and desires of the members of the community to aid them in the planning of community programs. This was done by coming up with community-based maps y spatial analysis of basic needs using GIS.

2.5.6. Results

In addition to the computation of composite indices that represent levels of deprivation for the pilot site (Barangay Punta Taytay), mapping is designed to help in the participatory elaboration of development policies.

The two methods were tested in the development of basic needs index namely, (1) the Linear Combination Method (LCM), and (2) the Principal Component Analysis Method (PCAM).

2.5.5.1. Assessment of basic needs according to the Linear Combination Method (LCM)

The Assessment Index (AI) values for the three puroks, Makawiwili, Katilingban and Masinulondon, are respectively 34.95, 33.25 and 35.73 (Figure 9). The purok with the highest deprivation and thus, considered as the most marginalized is Purok Masinulondon while Purok Katilingban is considered as the relatively less deprived community. It should be noted, however, that the differences between the three puroks are very small (0.78 and 1.7), which signifies that in terms of the basic needs, conditions in the three puroks are similar. A detailed analysis revealed that Purok Masinulondon showed greater deprivations in education, health and housing while Purok Makawiwili was the most deprived in terms of employment. Based on initial conversations with purok leaders, Purok Masinulondon is viewed as the most marginalized, which is consistent with the results as illustrated in Figure 9.

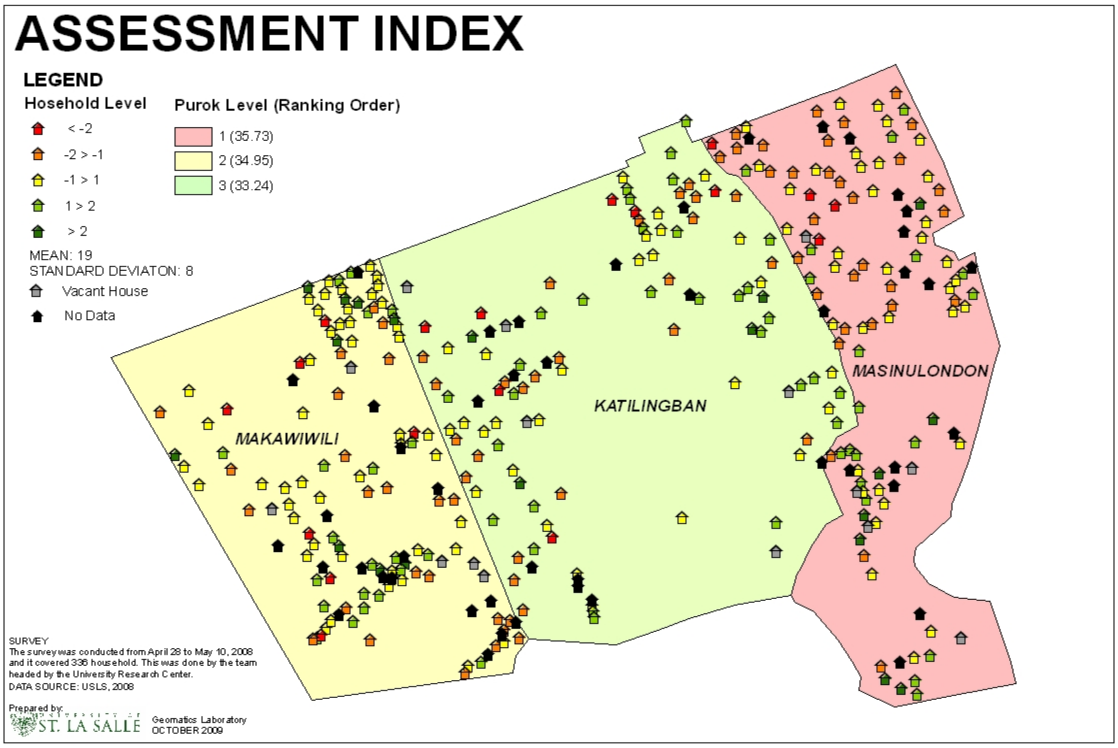


Figure 9 - Assessment Index (AI), Punta-Taytay (LCM)

Using the Linear Method, trends emerged on the indicators considered. On health, for instance, Purok Masinulondon came out as the most deprived since there is a considerable lack of toilet facilities in the area. For drinking water source, Purok Makawiwili came out as the most deprived. Medical consultation and reported sickness frequency are high in Purok Katilingban, which is understandable since the health center is within that purok so this parameter might not really signify the deprivation of health but represents more the proximity to the health center.

On employment, Purok Makawiwili came out as the most deprived while Purok Katilingban as the least deprived. However, this finding appears inconsistent with the fact that most of the beach resorts and sari-sari stores in the barangay are located in Purok Makawiwili. Taking into consideration the household income, majority were below the poverty income threshold of Php 15,000 (NSCB Regional Poverty Estimates, 2006), which also contradicted the findings of the survey and FGD. The study took note of this limitation because the parameters used were found to be inadequate.

In terms of housing, Purok Makawiwili and Katilingban have almost similar values with Purok Masinulondon having lower values than them. Based on ocular inspection, Purok Masinulondon has a larger number of squatters, which is consistent with the results.

On education, Purok Masinulondon emerged as the most deprived as shown by its high percentage value for adult illiteracy. Purok Katilingban is the least deprived. It should be noted that all puroks exhibited low values of formal schooling deprivation and have access to education. However, the problem in the barangay is the big number of people who do not stay on to finish high school. For example, in Purok Masinulondon only 48 percent of the population was able to finish high school. Trends seen in the indices are in agreement with the educational median level for each purok based on the survey.

2.5.3.2. Assessment of marginality according to the Principal Component Analysis Method (PCAM)

The PCA Method (PCAM) was based on core indicators defined by the Community Based Monitoring System developed by Nicolas Daix for Agusan del Sur (Daix, 2010). The values of the defined parameters were then extracted from the household survey. The three most significant parameters are household income, percentage of squatters and types of toilet.

For the household level processing, a similar process as the Linear Combination (HH level) was used and numerical assignment was done for those parameters, which cannot be expressed as percentages. The F1 (poverty/marginality axis) eigenvectors (Table 3) were used as weighting parameters during the Marginality Index Computation (as explained in 2.5.2.2.).

Component	*Parameter*	*F1*
Employment	Percentage of those who are 15-64 years old that are unemployed (M)	-0.14034
	Percentage who have monthly incomes below Php15000 (IN)	0.36454
Education	Percentage with no formal schooling (E1)	0.20167
	Percentage of those 18 years and above who did not graduate high school (E2)	0.37045
Health	Percentage who got sick within the last 6 months	0.32901
	Percentage who availed of consultations (C)	0.30792
	Percentage without proper water sources (W)	0.25529
	Percentage without proper toilet facility (T)	0.37770
Housing	Percentage of those who do not have strong roofing materials (H)	0.37096

	Percentage of those who squat in their home lot	0.34785

Table 3 - Eigenvectors of the first axis (F1) of PCAM, Punta-Taytay

The three most significant variables are (1) percentage of households without proper toilet facility, (2) percentage of households that do not have strong roofing materials and (3) percentage of adults who did not finish high school. The least significant variables are percentage of unemployment and percentage with no formal schooling.

The values of the Marginality Index (MI) for the three puroks Makawiwili, Ktilingban and Masinulondon are respectively 0.11, -2.47 and 2.47 as mapped on Figure 10. The purok with the highest deprivation, and thus considered as the most marginalized, is Purok Masinulondon while Purok Katilingban as the community with the least deprivation. These results are consistent with the previous results. This seems to confer robustness to both methods (LCM and PCAM) but once again some limitations were encountered during the participatory validation.

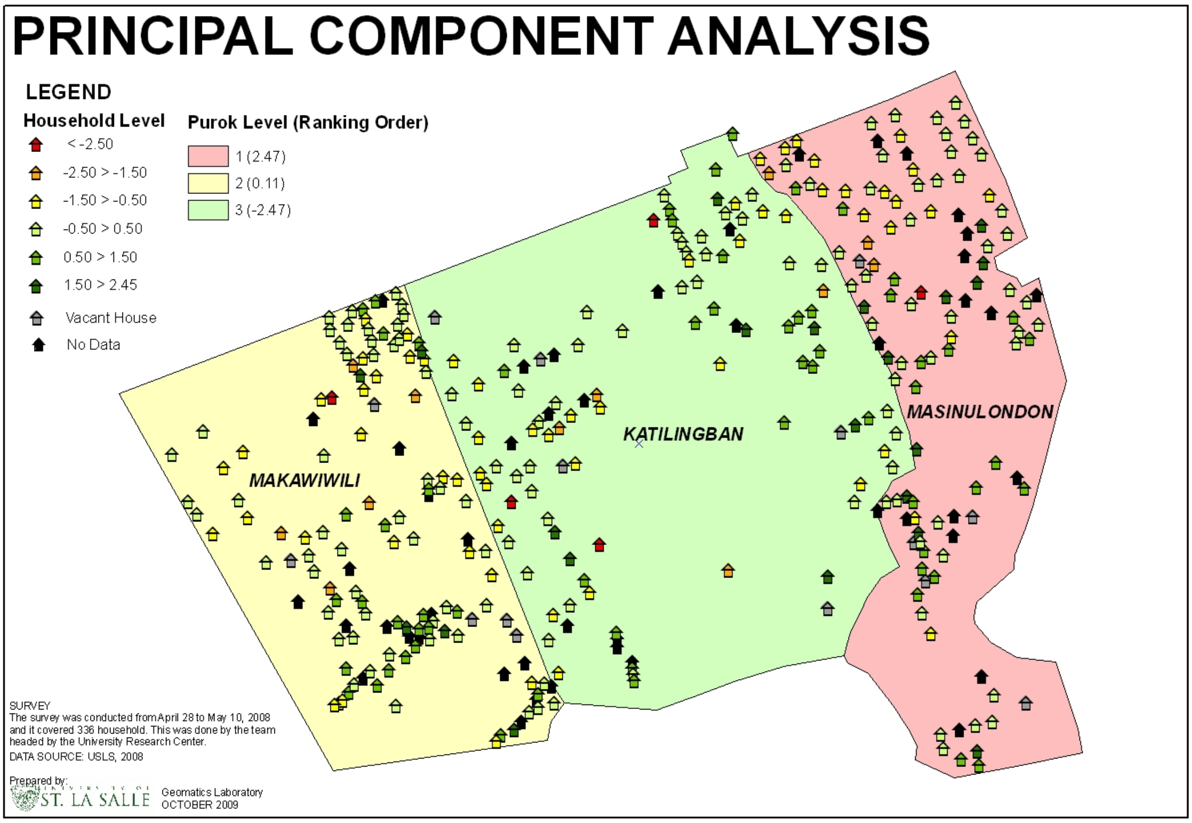


Figure 10 - Marginality Index (MI), Punta Taytay (PCAM)

2.5.6. Participatory validation

The aforesaid findings on assessment were validated during a focus group discussion (FGD) conducted with selected participants from the three puroks. The results of the study were presented for comments and validation with different stakeholders in the community through a workshop. The presentation was made and tailored to the needs and desires of the members of the community to aid them in the planning of community programs. This was done by coming up with community-based maps by spatial analysis of basic needs using GIS.

In addition, stakeholders in the community were asked to rank the five indicators of poverty given in order to determine the level of deprivation of each purok. Ranking and level of deprivation are inversely proportional. The lower the rank the higher is the level of deprivation. Table 4 shows their ranking of the basic needs.

		Puroks (rank)		Total
Indicators/Needs	Makawiwili	Masinulundon	Katilingban	Average
Sources of Income/Livelihood	1	1	1	1.00
Education	2	3	3	2.67
Health	4	4	4	4.00
Housing	5	2	5	4.00
Source of Water	3	5	2	3.33

Table 4 - Perceived ranking of 5 poverty indicators for 3 puroks, Punta Taytay

Across the three puroks, sources of income emerged as the most pressing need of the households as indicated by the average rank of 1 followed by education (2.67) and source of water (3.33). At the purok level, the second most pressing problem for Makawiwili is education; for Masinulondon is housing; and for Katilingban is source of water. Housing is the least priority for Puroks Macawiwili and Katilingban while it emerged as the second top most concern of Purok Masinulondon. Health is the second least priority among the needs for all three puroks.

2.5.7. Challenges in the use of GIS

The project on poverty mapping in Barangay Punta-Taytay is so far a pioneering effort in applying the GIS technology in community development research on the part of the University of St. La Salle in particular and in poverty studies in Negros in general. Expectedly, there are identified challenges in the utilization of GIS for community development research such as poverty mapping.

The first challenge is **data reliability and validity**. It is very important that the data to be used for GIS data banking are reliable and validated by the people in the target community. A mistake in the identification of variables and indicators would lead to erroneous results in GIS mapping. In the case of poverty mapping in Barangay Punta-Taytay, there is a need to identify the most appropriate economic indicators so that the economic index will be reflective of the actual condition and needs of the people in the community.

A second challenge consists in how to ensure the **participatory framework of the research process**. The participation of the people and other stakeholders in the community in the research process is an important consideration on how to make GIS relevant in community development research. However, this requires innovations and flexibility in making a research design with a conscious effort to always recognize the valuable role of the people of the community in the generation of baseline data for benchmarking. Feedbacking the research findings for their comments and validation not only strengthen the validity of the data but also impresses a sense of co-ownership of the data among them. The acceptance of the credibility of data is a very crucial issue in community development planning and strategizing. In the case of Barangay Punta-Taytay, the people in the community, through focus group discussions and consensus building, validated the survey findings and the maps.

A third challenge in the use of GIS is the **sustainability of technology transfer**. While the poverty mapping project in Barangay Punta-Taytay was successful in transferring the technology through Participatory GIS Technology to selected community leaders and stakeholders, sustaining the technology transfer in the future poses a major challenge. GIS as a technology is very expensive. The equipments required and the training involved in the technology transfer requires big investments. Poor communities would only have access to this technology if they have established partnership with academic institutions or development agencies, which have the GIS technology. In the case of Barangay Punta-Taytay, it was able to have access only to GIS because of the partnership it has established with the University of St. La Salle, particularly through Balayan, which is the university's community extension office.

A fourth challenge in the use of GIS technology for community development planning and implementation is **updating the data resource base**. If the engagement between the community and an academic institution or development agency is project-based, who will undertake the updating of the data after the project? The community does not have the financial and technical resources to update the data. The partner-institution, on the other hand, generally cannot operate beyond project life. This implies the need to integrate data updating in the design of community development programs which use GIS beyond the project life and greater collaboration between the community and its partner-institutions in order to sustain the relevant use of GIS technology.

Globally, the use of GIS has been pretty basic. After all, the tool has been used as a mapping interface and no spatial analysis was conducted through GIS, even if access to services (e.g., water, market access), quality and spatial configuration of transport infrastructure, etc. play a role in determining poverty levels. In other words, *distance does matter* as emphasized by many studies on poverty in the South (among others, Christiaensen et al., 2005; Kanbur and Venables, 2005; Bird et al., 2007). This key finding alone justifies the use of GIS in development projects. A further challenge would be to integrate ***distance functions*** (Euclidean distance, time-distance, cost-distance) to the current methodology.

2.5.8. Limitations and recommendations

The present study covered only three spatial entities (three puroks) for a total area of 0.4 km². As a consequence, it is rather hard to characterize the poverty / marginality of these puroks, which all-present important features of determining poverty level. No particular variable plays a highly significant strong influence on the index calculation. In other words, all the variables selected to build our indexes (AI and MI) are relevant to assess the deprivation. The global poverty cannot be explained by one dimension only, but a fuzzy combination of the four identified deprivation dimensions (education, employment, health and housing) makes sense and is recommended to help in the elaboration of any poverty alleviation program.

The present methodology has been tested in a small area. The methods tested are promising and we suggest spreading out their implementation in a larger study area with more spatial units and with a larger panel of socio-economic variables.

Given this and after having compared the two methods, the following recommendations can be formulated:

1. Come up with a sustainable and community-based poverty intervention program for the barangay based on the needs identified by PGIS and the resources available, with people's participation as a major strategic framework;

2. Strengthen multi-sector collaboration between and among people's organizations, local barangay officials, local government units (LGUs), line agencies, the academe and NGOs in community development research and planning that integrate PGIS practice. This will address the issue of access and sustainability of GIS technology;

3. Provide capacity building trainings for people's organizations and local officials in the barangay so that they will be empowered to address their own local concerns and needs and sustain whatever initiatives were started from a multi-sector collaboration;

4. Accept the need for a PGIS coding of the survey parameters. This will hasten the processing of the data, especially in study areas where a greater population will be surveyed as well as a bigger level of analysis will be done;

5. Update PGIS data for their integration in designing of the community development program so that even after the project life, the GIS can still be used. This requires greater collaboration and coordination between the community and its partner-institution;

6. Strengthen the collaboration between and among academic institutions and agencies which have the GIS technology in sharing expertise and experiences in using PGIS for community development planning and research;

7. Level off the community leaders a priori to truly capture the indicators that will be used in the analysis. This includes involving them in the preliminary identification of possible usage of the methodology in relation to basic needs programs and plans of the local community.

2.5.9. Conclusion

The use of geographic information system (GIS) in community development research such as in the case of poverty mapping in Barangay Punta-Taytay, Bacolod City through the basic community needs assessment (CBNA) approach was proven to be relevant. It has provided a more scientific and responsive means in addressing poverty by identifying immediate and priority needs of the community through the participatory data and maps it generated. It has not only identified the priority needs of the community such as livelihood, education, health, housing and water, it has also identified a list of priorities, by purok. Through this, GIS practice becomes an effective tool for planning and design of poverty intervention programs and a reliable participatory basis for decision-making on the part of major stakeholders vis-à-vis the overall goal of poverty reduction in the community.

GIS becomes relevant in community development only if it is operationalized within a participatory framework. Its sustainability largely depends on how strong is the collaborative engagement between the community and academic institutions and agencies which have the GIS technology and the will to make it participatory (PGIS), as well as the other stakeholders such as the business sector, NGOs and people’s organizations.

The experiences of poverty mapping in Barangay Punta-Taytay using PGIS show not only how access to a technology-based system such as GIS can be democratized for the wider use of the public such as communities, but also how it can contribute to the process of strengthening democratic systems in the design and implementation of community development programs aimed at reducing the incidence of poverty, especially in poor marginalized rural communities.

2.6. Voluntary Information and PGIS (VI & PGIS)

Gianluca Miscione, Jeroen Verplanke, Javier Martinez,
Faculty of Geo-information Science and Earth Observation (ITC),
University of Twente, Enschede, The Netherlands.
jmartinez@itc.nl, miscione@itc.nl , verplanke@itc.nl

This chapter discusses the role of geographic IT (geoIT) and virtual globes (e.g. Google Earth) at the interface of public policy and citizens. GeoIT can potentially give citizens power -traditionally held by the government- to participate in all spheres of policy making by allowing them to produce and share geoinformation, therefore organize accordingly. Moving away from the traditional conception of bureaucracy which acts as a filter between policy makers and citizens by transforming their requirements into formal procedures, we outline an emerging framework where geoIT act as mediators between policy-makers and citizens. We show that the emerging framework holds the potential of allowing citizens concerned, in our case, about the quality of water services, to influence policy makers directly. The virtual globe acts as a mirror to the traditional eGovernment framework and lends a different societal visibility both to public services provision, and to localized citizens' needs.

Here, we focus on the role of geoIT and virtual globe technology in improving citizen participation in problem acknowledgement and agenda setting. To do that, we discuss the extent to which virtual globes can expand the limited focus of eGovernment, based on preliminary findings and insights from our own research in two empirical cases.

2.6.1. Introduction

Electronic government (eGovernment) research has focused mainly on individual government organizations and on the impacts of information and communication-technology (IT) on the capabilities of single government units (Danzinger et al.,2002). Zouridis and Thaens [2] argue that the four spheres of traditional government - policy, politics, organization, and citizens - have been affected only partly by IT. In the policy sphere, eGovernment concentrates mainly on policy implementation, not on agenda setting and policy development. In the citizens' sphere, eGovernment is mostly concerned with citizens as passive consumers of services.

eGovernment has been studied in the North, mainly. In the South, research about that is scarce, and the situation of such efforts is uncertain. Heeks (2001) estimates that eGovernment projects are 35% total failures, 50% partial failures and 15% successes. He attributes failure to the gap between hard rational design and soft political realities caused by the three-way association of IT, Universalist modernization and Western rationalism. His argument resembles Avgerou (2002), who claims that different rationalities coexisting within and around IT projects are a major issue for their understanding and actual development.

eGovernment initiatives in industrialized and developing countries hold the promise of a more citizen-centric government with reduced operational cost (Saxena, 2005). Grievance (redressal) systems are a particular type of citizen- initiated contacts within eGovernment (Ranganathan, 2008; Martínez et al., 2009). They are defined as "an expression of dissatisfaction […] about […] action or lack of action or about the standard of a service", as suggested by the British Local government Ombudsman (Hance, 2002). Generally, eGrievance systems are viewed positively (Ranganathan, 2008), in particular their potential to increase openness and transparency within the public administration (Wallack et al., 2007). Citizens can formally submit grievances through a complaint handling mechanism that offers several access points. The eGrievance system allows the formal filing of complaints and captures from the bottom the grievances of the citizens. However, when it comes to specify the sort of grievance, the citizen is limited to a top-down pre-defined list of possible categories or to the interpretation of the phone operator who finally codifies the complaint. In principle citizens are able to trace the complaint.

2.6.2. Virtual globes and volunteered geographic information (VGI)

Virtual globes are places where citizens and private sector gather to provide and acquire geo-located knowledge, experiences and information about services. The specific nature of information provided on virtual globes is the spatial information attached to all available data.
Significant visibility gains may accrue to citizens and policy makers alike if they can collectively "visualize" places identified as problem areas—places signalled and tagged by citizens' grievance reports or places where complaints are acknowledged. Locating and visualizing these places requires geographic IT (geoIT) to be integrated into the eGovernment system.

Since the launch in June 2005 of Google Earth (GE), citizens stand a realistic chance to influence policy and decision making, not because of intended government action, but due to unintended consequences of action taken by global market actors, driven by advertising revenue and market share. Are these developments inverting the panoptic power of the state and vesting surveillance power to citizens? What are the social and political implications?

The emergence of commercial virtual globes (e.g. Google Earth) and the advent of web 2.0 open new possibilities for citizens to interact with other citizens and government. Web 2.0 facilitates dispersed collaboration by providing information to central sites, and to see that information is collated and made available to others (Goodchild, 2007). Combining Web 2.0 functionalities with virtual globes is meaningful for issues where place and spatial information are at the forefront and spins creativity and good citizenship.

2.6.3. Transferring control from the state to the citizens

Traditionally, bureaucracy has the role of bridging the formal political sphere and citizens. Its main legitimacy lays in the aim of rationalizing society by channeling social relations in formal procedures, based on formal rationality, rather than value rationality. Ideally, it guarantees equal and universal access to public administration, and downplays the role of tradition and charismatic figures. In "The Protestant Sects and the Spirit of Capitalism" Weber (1920) expresses his concerns about the bureaucratization of society with his famous metaphor of the "iron cage". The last century showed that such a modernization path is not necessary, as different rationalities continue to exist and proliferate, with Foucault being an exemplar author on such line. Indeed, the universal institutionalization of formal rationality is not likely to happen any time soon, nor societies seem to be going that way. Information systems as those being discussed here -based on voluntary data production- may sideline bureaucracy rather than bring us towards an iron cage. Rather, mutual visibility and continuous negotiation appear as the way ahead of citizens and decision makers. Hoogenboom and Ossewaarde (2005) argue that such relation between state and citizens was legitimized by a 'legal-rational authority' which cannot be taken for granted in 'late modernity', characterized by different and competing rationalities. Late modernity sees the rise of reflexive organizations, which are more dependent on their actual environments. "Reflexive organizations further democratization because they force a bureaucratic elite to take the personal and social needs of the lay people seriously and they force them to communicate openly" (Hoogenbom & Ossewaarde, 2005). On the other side, these kind of organizations risk to be less universalistic, and more affected by individual qualities as mobilizing capacity of parts of society. With this framework in mind, we will introduce two examples of eGovernment efforts, which go in line with the idea of reflexive authority.

Moving to a globally interactive participation, citizen interests and international agendas become entangled drivers for political and social participation. The relative ease to provide location information with complaints through embedded GPS devices offers interesting opportunity for virtual globes to organise information spatially. Visualization of localized themes of grievances could provide citizens and policy-makers a different view into objectives and demands.

Goodchild (2007) has proposed to use "human sensors" and web2.0 to unlock the vast pool of local spatial knowledge as Volunteered Geographic Information (VGI). A VGI Network is a combination of a community of individuals who report observations through existing, widespread (mobile) communication technology and a set of (web) services that provide means to disseminate observations and means to receive feedback. Mobile phones are becoming the most widespread sensor device in the world offering the possibility to capture voice, pictures, video and location data in combination with a versatile interface to connect to global communication networks. The emerging framework in figure 11 is particularly appealing for this idea. Virtual globes offer a wide variety of ways to include VGI.

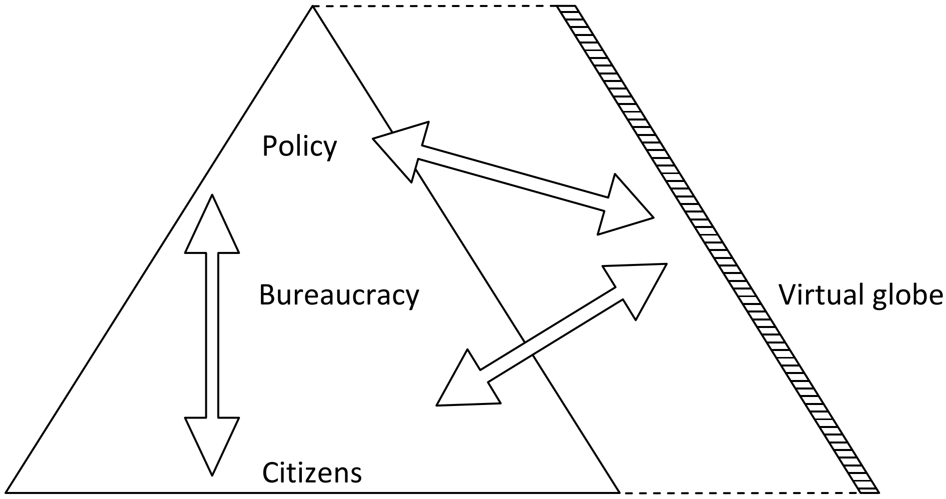


Figure 11 - Virtual globe acts as a mirror for citizens to participate in setting policy

2.6.4. Discussion and Conclusions

VGI can be dubbed "participatory sensing" given the nature of geo-data generation by dispersed volunteers, where the voluntary aspect and the personal interest and motivation to contribute information are central. As argued by Craglia et al. (2008), platforms like Google Maps and Google Earth are combining both voluntary and institutional data. Without a mechanism to clearly distinguish the different nature of the data (through metadata), it will be difficult for citizens to take action and for administrators and policy makers to make accountable decisions on the basis of such data. If citizens are to be engaged or involved more in government decisions by sharing their knowledge (data, information and understanding) it should be done in a manner that maintains accessibility but also improves reliability and backs trust. It is, of course, not only trust in the platform and whether that platform displays the "truth" (Parks, 2009). Governance innovations are required for VGI to be put to relevant use and citizens to be trusted to provide the reliable information. This organic relation between citizens, geoIT and service providers pinpoints to the importance of "validation" of data produced by undefined users. Those who advocate for openness stress the self-regulation of open systems. Such position is opposed by formally structured organizations, which legitimize themselves on exclusionary basis. A possible third way would be the adoption of automatic ranking mechanisms, which select and rate information on the base of previous behaviours.

Rather than going into the details of systems that are under continuous development, we stress how our cases aim at affecting service provision activities by managing stakeholders' mutual and external visibility differently. With respect to eGrievance, the Human Sensor Web example (or eGrievance) positions the interactions it mediates and data hereby produced, outside of the conventional bureaucratic procedures that eGrievance systems are designed upon. With this the old idea of control (Mansell, 2010) is possibly reverted, or becoming exploitable by the controlled.

By becoming a side addition to the existing tools like eGrievance, human sensed data on virtual globes act as a mirror through which policy-makers and citizens become more visible to each other. Accountability lines are therefore affected. Bureaucracy is likely to keep filtering citizen pressure, and the same citizens are likely to find workarounds to affect agenda setting. The virtual globe as a mirror (Figure 1) acts on the well known mechanism of showing and blaming: facilitating the public visualization of public interest issues like service provision, they leverage the public opinion in a less ad-hoc fashion than mass media. Quite likely, corporations or groups of citizens will be able to exploit the virtual globe to “sell” their point of view or product to a potentially broader audience. On the other hand, citizens become more visible to the state. The mediating role of the private sector is expected to focus itself on the transparent development and management of such platforms.

Chapter 3. Can Neogeography and GIS/2 satisfy PGIS?

Michael McCall,
Faculty of Geo-information Science and Earth Observation (ITC),
University of Twente, Enschede, The Netherlands.
Centro de Investigationes en Geografia Ambiental, CIGA,
Universidad Nacional Autonoma de Mexico, UNAM, Morelia, Mexico.
mccall@itc.nl

The understanding of Participatory Geographical Information Systems (PGIS) is not as contested as, say, the concepts of participation, or community, or local knowledge. But the boundaries of PGIS are always disputed, and here we take a broad view: "PGIS is an emergent practice in its own right. It results from merging Participatory Learning and Action (PLA) methods with Geographic Information Technologies (GIT). PGIS facilitates the representation of local people's spatial knowledge using map products in decision-making processes, and supporting communication and community advocacy. PGIS practice is geared towards community empowerment through tailored, demand-driven and user-friendly applications of these geospatial technologies. Good PGIS practice is flexible and adapts to different socio-cultural and biophysical environments. It relies on the combination of 'expert' skills with local knowledge. Unlike traditional GIS, PGIS places control on access and use of (culturally sensitive) spatial data with those communities who generate it." (adapted from Rambaldi, Chambers, et al., 2006a)

This chapter examines whether some of the new tools and techniques of neogeography, cybercartography, etc. and GIS/2 can be seen as helping or hindering the development of PGIS. The first two sections review what is meant by PGIS, what are the requirements for good practice in a PGIS process, and what the warnings are. The next section examines the potential value added by applying tools and techniques from neogeography and GIS/2, and the final section draws some conclusions.

3.1. What does Participatory GIS need?

3.1.1. Framing Participatory GIS and Participatory Mapping

Epistemological and methodological comparison of PGIS with standard GIS includes differences in methodology (e.g. the relative value of qualitative information), methods and tools, ways of representing space, appropriate spatial scale, time and other inputs, and – importantly – ideological, political, power and ethical dimensions. (e.g. Barrera, 2009; Kahila & Kytta, 2010; Dunn, 2007)

Strict definitions have little value; they will be interpreted differently, anyway. Here we summarize that PGIS, is an umbrella term for a diversity of community interfaces with GIS and geographic information technologies and systems more generally. PGIS practice is based on using geo-spatial information management tools ranging from ephemeral and sketch maps (including drawing mental maps), to scale mapping (overlay drawing of spatial information onto existing topographic base maps), and adding spatial information via overlays onto aerial photographs or satellite images, or creating participatory 3-D models (P3DM). PGIS encompasses community surveying of new information using global positioning systems (GPS), and incorporating this spatial information into GIS (Geographical Information Systems) format. Dynamic and web-based GIS/mapping, e.g. in Google Earth or OpenStreetMap, and Google Maps / My Google Maps., or dedicated sites, is growing fast in PGIS, and other media like photography, (participatory) video, audio recording, etc. to compose peoples' local spatial knowledge in the forms of virtual or physical two- or three-dimensional maps.

The community information input itself ranges from the classic community meetings, to focus groups, semi-structured interviews with key informant individuals, etc., via traditional questionnaire and field surveys. Also, rapidly growing are local knowledge inputs delivered via the World Wide Web (WWW), text messaging, social networks, etc. (often constructed within Volunteered Geographic Information/VGI frameworks).

All these are used as interactive (or potentially interactive) vehicles for discussion, information exchange, analysis and support (adding authority to local knowledge and community confidence) in advocacy, decision-making and action taking. On the whole, currently, PGIS is used mainly as participatory computer cartography with limited GIS functionality. Users are employing the outputs mainly as media to support their arguments, thus they are demonstrating again 'the power of the map'!

3.1.2. Downsides of working with PGIS

There are methodological issues dealing with, for instance, the appropriate scale for PGIS, appropriate accuracy and sensitivity, and handling of dynamic processes. There are questions regarding the positioning of PGIS in participatory development-transformation activities, their political-legislative contexts, and the degree of local involvement. Many critiques of using PGIS derive from theoretical concepts of participation. They concern different conceptualizations of participation in planning and decision-making, of local spatial knowledge and the linking of different knowledge systems; and concepts of good governance. And because the justification and the epistemology of PGIS are participation-based, it naturally follows that much attention is paid to the ethical issues (Rambaldi, Corbett et al., 2006). Ethical values enter the whole PGIS process, the selection of cases and topics, the choice of specific methods, involvement of whom in the PGIS activities, and above all in the ownership and dissemination of the outputs, and of the whole process.

Critiques of the PGIS practice and approach raise issues, which need to be addressed, though some are straw men (e.g. Elwood 2006; Kwan 2002; Pickles 1995):

- The intensity, authenticity, and veracity of 'participation' - a core issue which challenges the alternative interpretations and contested discourses of participation.

Notwithstanding that participation is an idealized concept, always criticisable for not living up to the purity of the intent (”a straw horse”);

- The technical problems of the hardware, software and systems support, which might be needed for implementing PGIS. A valid point in that the supporting tech system is frequently deficient in the communities and NGO, which may want to use PGIS. A perennially insoluble issue, because inevitably the innovative developments out of the universities and research centers must always be ahead of the game. On other hand, the technology in-use is always catching up and sometimes overtaking it (e.g. cell phones in Africa;
- PGIS systems, as they are now, cannot authentically represent the ‘mental maps’ of people, which exist within non-Cartesian, non-positivist, ambiguous, fuzzy, non-discrete spatial ontologies. This is a serious issue, raised specifically vis-à-vis indigenous people by Rundstrom long ago. However, even technical devices are improving to cross the divide between mental maps/naïve geography, on one side, and digital interpretations (e.g. innovations in cartography, visualization, and data structuring, etc.), on the other. The problem is authentic, but there are many incremental steps being taken towards marginally alleviating it - ‘the planets are coming in alignment’.

3.2. Three Perspectives on Participatory mapping and PGIS

PGIS (and P mapping) should be able to handle content and processes in terms of three perspectives of ‘real space’, ‘real people’, and ‘empowering the community’ in authentic social development.

CRITERIA FOR GOOD PRACTICE IN A PGIS	***Space***	***People***	***Community***
PRE-CONDITIONS, INITIATING THE PGIS PROCESS			
Participatory Design of the process			
Inclusivity, Equitability in inputs			
Represent the local Spatial knowledge. Create respect for the richness, validity and value of local (spatial) knowledge			
Good governance criteria: accountability, legitimacy, transparency			
PGIS PROCESS – THE ‘WORKS’			
Participatory Implementation of the process; especially to support more disadvantaged, less articulate actors			
User-friendly tools and procedures			
Ethics – do not cause unwarranted harm to any actors			
Validation of the process in a participatory manner			
Competence – reasonable efficiency of the process			

PGIS RESULTS – THE OUTPUTS			
Empowerment as an outcome - create and support more autonomous initiatives within the actors and community, and thus raise the potential of being sustained,			
Participatory Ownership of the output			
Results are enlightening to outsiders			
Equity in results - support the more disadvantaged, less articulate actors			
Equity in results - satisfy the majority of the actors			
Provide concrete useable output - relevant geospatial information and map-making			

Table 5 - Criteria for Good Practice in PGIS

3.2.1. Seeing Real Space

PGIS needs the capability to elicit, represent and validate local and indigenous spatial knowledge (LSK), but which is rarely available on official maps or GIS. LSK describes home and action space; focusing on knowledge about the land, land cover and resources; it is innate (often embodied) and continuously augmented and sustained; it identifies issues of immediate significance; and encodes the information about the environment in a language a region's inhabitants understand (often incorporated rather than inscribed; after McCall, 2003 and Duerden and Kuhn, 1996). This may indeed be considered the most significant and valuable component of PGIS actions.

LSK is a multi-leveled concept:

1. **Specific local spatial 'technical' knowledge,** that is similar in structure, purpose and cognition to regular 'scientific' knowledge. But, only (or only in detail) the local people do have the local knowledge of soils, plants, water sources, hazards, vulnerabilities, etc. This type of LSK is equivalent to the spatial component of local people's ITK (Indigenous Technical Knowledge) about resources, events, and activities. This is conventional information and the least controversial application of PGIS to recording and assessing technical spatial knowledge of specific resources, or natural resource management systems, or risks.

2. **Knowledge that actually represents different viewpoints**, priorities, interests and problems of different local actors. This LSK is different from the dominant 'official' view, and most likely different also from other local actors. The knowledge of local actors' needs, interests, priorities and values includes local configurations of land and resource ownership with complex multiple user rights and communal property regimes, etc., that are frequently misunderstood by external researchers. These different viewpoints can be reflected in '***counter maps'***. (Peluso 1995). Counter maps have been applied to mapping gendered spaces, especially women's maps of resource access, ownership or control (Rocheleau et al., 1995). Children, the landless, the resource-poor, subordinate ethnic

groups or castes also merit dedicated counter maps. This type of LSK includes, a fortiori, the special cases of knowledge of secret or sacred sites, historical sites, cultural artifacts, treasures, and holy locations which local people frequently do not want to become universal knowledge for several reasons – cultural heritage, physical preservation, and prevention of material theft.

3. **A more specialised LSK is the spiritual or mystical spatial knowledge** associated with cultural spaces, and particularly with specific landscapes or certain land resources, and thus often belonging to indigenous or long-settled peoples. There are urban and 'industrialized' situations also, found especially in larger and older conurbations, and the subject of films and artists and atmospheric writers such as Peter Ackroyd or surrealist Paris. These mental maps are related to psychogeography (Coverley, 2006) and maybe 'mythogeography' (Smith, 2010). This LSK is apparently qualitatively different from scientific knowledge. It is symbolic, metaphoric, and visionary, thus, mystical in 'scientific' terms, and especially related with the land and land features. Knowledge of the landscape is the embodiment of the people's identity (see Rundstrom, 1995 on hunting areas and water management from North American first peoples.). This LSK may also be interpreted as cosmovisions incorporating the origin or creation myths of cultures, therefore more usual among indigenous, natural resource-dependent, less-globalised peoples. This deep knowledge frequently holds obligations of stewardship of the land, together with specialized, location- and resource-specific, problem-oriented technical knowledge.

The implications for sound PGIS of needing to handle 'real space' are these:

- Represent what is important about place, the spatial specificity of information about local interests and priorities, values and perceptions. P mapping/PGIS is driven by and focused on spatial information about local interests and priorities. The significance of mapping local knowledge, such as of land rights and resource entitlements is shown by Nietschmann's (1995) succinct aphorism - "more land is lost by the map than by the gun".
- Related to this is the need to represent mental maps or cognitive maps of people. PGIS has a strong potential to represent mental maps / cognitive maps of people including, but not exclusive to, indigenous peoples. Cognitive maps are not confined to spatial dimensions within the sense of sight; in the human construct of mental space there are also the senses of sound and smell and feel.
- The sense of place which is associated with particular localities by many actors, especially indigenous groups, in their perceptual mental maps is qualitative, fuzzy, metaphorical, - it is not necessarily in Euclidean space, nor vectorisable. Whereas, as in Rundstrom's (1995) interpretation, standard GIS layers and relational databases, etc. are distorting 'constructions', or even purposeful re-assemblies of the original spatial knowledge.
- Translation of cognitive maps includes appropriate representation of ontological fuzziness and ambiguity. The PGIS should be able to handle the appropriate degree of 'precision', to understand the question 'precision for whom?', and to distinguish 'representational' vs. 'positional' accuracy (McCall, 2006). And just as important, is the need to recognize and to legitimize this ontological fuzziness. Uncertainty and fuzziness

should not be (mis)understood simply as a lack of knowledge, or as a deficiency of good data collection and measurement, they are intrinsic and profound.

- It has been argued that GIS and LSK are inherently incompatible because of the dichotomies between, on the one hand, the reductionism, positivism, ultra-precision, (oftentimes, linearity and stationarity) of digitized geo-data, and on the other, the fuzziness, ambiguity, organic-synthesis, emotionality, (and often spirituality) of 'natural language' spatial knowledge. This is a contrast Varanka (1996) identified as 'masculine vs. feminine'. In particular, Rundstrom (1995) expressed extreme skepticism that standard GIS can work with indigenous peoples using their cognitive concepts and 'incorporative' communication modes of LSK.

3.2.2. People demand for good governance and respect

PGIS practice is intended to be ideological; the politics are progressive and interventionist. PGIS does not pretend to be objective; it takes a stance, which can simply be summarized as promoting 'good governance'. Good governance is related to multiple dimensions of legitimacy as ownership, inclusiveness and thus participation, respect for a wide range of human rights, equity (not simply equality), empowerment which follows from those preceding, and competence (including greater effectiveness and efficiency).

These dimensions can be broken down towards identifiable criteria significant for assessing PGIS approaches. These are translated into components, criteria and measures in PGIS and community mapping:

1. **Inclusiveness** means the representativeness of regional, ethnic, tribal, class, religious, age, gender interests; (degree of) subsidiarity in decision-making. Related to devolution and participation; appropriate attention paid to 'participation'; and "spatially-grounded", which means recognizing spatial specificity (UNDP, 1997).
2. **Respect -** by the governing for the governed – for basic human rights - women's rights, freedom of expression, religion, sexual orientation, racial-ethnic equality, etc.; the Universal Declaration of Human Rights; citizens' rights, civil liberties, freedom from arbitrary detention, etc.; workers' rights, working conditions; cultural group and regional rights; indigenous (technical) knowledge, (indigenous spatial knowledge); and laws, entitlements & property rights – fairly and impartially enforced.
3. **Equity** between governing and governed - and amongst and within the governed: access to basic needs; equitable development; an important focus on gender equity; indicators of the distribution of government services, take-up rates relative to disadvantaged groups and individuals in society; degree of access to public and to private services; degree of open access to market; and laws, property rights, etc. impartially enforced for all individuals.
4. **Empowerment:** "ownership" of decisions; ability to make independent decisions; participation; democracy; enabling powers; access to basic resources needed for making decision; and self-belief, and confidence.

5. **Social Inclusivity**: PGIS should be representative of the interests, values and priorities of communities, as well as individuals. A requirement is to translate group 'space value maps' (local spatial knowledge) into GIS-compatible constructs that are on a level with the legal or policy playing field with other more powerful stakeholders (Peluso's counter maps, 1995).
6. **Integrated knowledge** – Local and indigenous knowledge, sacred knowledge, gendered knowledge, values and perceptions - that is, knowledge that doesn't necessarily conform to state visions of place. This LSK needs to be integrated equitably with scientific knowledge, for example in the fields of adaptation to global climate change, globalization and urbanization, loss of rural livelihood, over-exploitation of resources; and scientists' knowledge of, for instance, soils, pests, hazards.

PGIS should manage and analyze LSK information by combining data from many different fields (e.g. hazards, socio-economic), using different formats (e.g. images, digital, paper) and consolidating different sources (e.g. local, external, scientific). Multi-sourcing involves multiple processes of people's participation in knowledge identification and selection. There are many opportunities for X-checking and validating. Kyem (2002) noted that PGIS reduced reliance on individual speculation and subjective memory by bringing individual actors together to confront their different perceptions to seek evidence acceptable to the group.

3.2.3. Empowering Community – societal development

This perspective of PGIS refers to the implications for community and society, rather than just the individuals or households involved.

PGIS needs to be capacity enhancing such that communities and groups can be empowered by involvement in PGIS processes, thereby improving self–confidence and technical/ political capacities. PGIS should place GIS at the disposal of local people, which legitimates their choice of techniques and variables; that is their understanding of space and place. PGIS should empower communities by developing their technical, social and political capital and building confidence to:

- Utilize local and indigenous spatial knowledge (technical, livelihood, cultural and spiritual) in a respectful manner.
- Equitably record, analyze and value the local knowledge of different groups in the community, including women, children, the resource-poor, the elderly, the disadvantaged and less articulate.
- Record and conserve local natural resources and cultural practices. Advocate for community resource rights (especially for native indigenous communities).
- Provide an entry into and control over handling technologies used in GIT; this builds capacity and confidence in the community.

3.2.4. Participation and Empowerment in PGIS

The principle of 'legitimacy' in good governance calls for active participation, by all actors at all stages, and therefore at all the stages that involve geographical information technology. (cf. Abbot et al., 1998). '*All actors*' implies a partnership of the tripartite of government agencies, the private commercial sector, and civil society (community representatives, traditional leaders, NGOs, CBOs). It is misleading though to model rural or urban 'communities' as homogeneous, when there are always significant divisions by gender, age, economic class, cultural status, tribe or caste, religion, historical circumstances, and life-style.

In participatory-GIS terms, the essential questions are:

- *Who* is participating? Who controls the types, inputs, analysis, and uses of data and knowledge?
- Who handles and analyses the data and information? Who has access to tools and techniques?
- Who uses, or has access to, the outputs?

A PGIS approach should not raise the expectations of the local communities unrealistically or unfairly by proffering a pretentious technology promising more than it can deliver. Rather, PGIS tool for good governance should have the capacity to promote empowerment by opening up the horizons of local users in the community. This enlargement of perspective is an aspect of 'modernization', which could also have negative consequences for the local community, but Gonzalez (2000) and others credit it for integrating and empowering local communities by mainstreaming them further into national society.

The GI technology should therefore be giving voice to local people to the extent of putting them and their local (spatial) knowledge on an equal footing with external 'experts' and decision-makers and their 'official' information. This was the intention behind the pioneering work on PGIS for land reform in South Africa. (Weiner et al., 1995).

The communication challenge is to bridge the gap between indigenous and scientific spatial knowledge by providing a translation capability between local stakeholders and external decision-makers. By building communicability between outsiders and insiders, PGIS not only legitimizes the value of endogenous knowledge, but should also make the technical GIS tools more acceptable to the local users.

3.3. Does GIS/2 and Neogeography add Value to PGIS?

3.3.1. GIS/2, Neogeography, Cybercartography

GIS/2 is a set of methods and instruments emphasizing (the participatory) process (of a GIS activity), and oriented towards communication about representations as much as toward the representations themselves (based on Schroeder, 1996). Note that this was written in 1996 at the beginning of the development of the concept.

A GIS/2 would emphasize the role of participants in creating and evaluating data; and equitably represent diverse views, preserving contradictions, inconsistencies and disputes. GIS/2 would be more capable of handling time components than existing GIS. Outputs would reflect the standards and goals of the participants, rather than closeness of fit to measurable accuracy; and it could integrate data components and participant contributions from the one interface. Finally, there is reflectivity - GIS/2 would preserve and represent the history of its own development.

The concept of **neogeography** is given as "geographical techniques and tools used for personal activities or for utilization by a non-expert group of users; not formal or analytical" (Turner, 2006), and now in Wikipedia.

This appears very similar to Tulloch's interpretation of PGIS. "[P]PGIS refers to the uses and applications of geo-spatial information (GI) and/or GIS technology used by members of the public, individually or as grassroots groups, for participation in public processes that affects their lives (data collection, mapping, analysis, and/or decision-making)" (Tulloch, 2003; Tulloch & Shapiro, 2003).

Neogeography is partly then just a response to the need for academic invention, but it also allows for a wider range of tools and methods and deliveries using spatial information. It is not necessarily standard GIS-based, and there is a generously broad interpretation of both 'spatial' and of 'information'. Roche (2010) call this the development of the "geospatial democratization process", which he breaks into 3 'dimensions'-- new types of information, new technologies and standards (Web 2.0, wikis, API); new "user-creators"; new practices and forms of materialization (like Google, VGI, geoblogs, geo-wikis, geo-tagging, mashups, etc.).

Moreover, there is overlap with the idea of **cybercartography** defined as "the organization, presentation, analysis and communication of spatially referenced information on a wide variety of topics of interest to society in an interactive, dynamic, multisensory format with the use of multimedia and multimodal interfaces" (Taylor, 1997; cf. Taylor & Caquard, 2006; Tulloch, 2007). Cybercartography has developed via innovative atlases such as the 'Living' Cybercartographic Atlas of Indigenous Artifacts and Knowledge. These atlases are on-line dynamic, interactive, multimedia and multi-sensory, using many formats in addition to maps. According to Taylor, "atlas" is used as a metaphor for the representation of both quantitative and qualitative information organized through location and is part of the social computing revolution of Web 2.0.

The questions here are how and to what extent and how some of these interesting innovations in GIS/2 and/or neogeography cope with the needs of PGIS as examined in the first part of this chapter. Do they satisfy the requirements? Are they 'fit for purpose' for dealing with the salient components of 'real space', 'real actors demanding good governance' and societal development?

3.3.2. Real Space – gaining Local Spatial Knowledge

Standing out among many developments in Web 2.0 for geospatial applications are Google Earth (GE) and its currently hundreds / thousands of mash-ups on Google Maps (Google My Maps). The strong technical basis for GE is the building block of KML programming language which allows information to be uploaded on the GE image, spatial information as photo images, links, names, metadata which can all be geotagged or geo-referenced. (Miller, 2006; Goodchild, 2007, Bugs et al., 2010; Google Earth Mashups http://googlemapsmania.blogspot.com/, and Google Earth hacks website www.gearthhacks.com.

"My Maps is a feature of Google Maps that lets you create and share personalized, annotated maps of your world." Once a map is created, descriptive text can be added, including rich text and HTML, photos and videos embedded, the map can be shared, and viewed in GE. http://maps.google.com/support/bin/answer.py?hl=en&answer=62843

Flickr is geo-referencing literally millions of photos uploaded by ordinary people, and the OpenStreetMap project is reaching to cover the whole world with local inputs of volunteered spatial information. (Goodchild, 2007, 2008, 2009; Tulloch 2007, 2008; Rouse et al., 2007). The billions of bits of information embodied in social networking like Facebook and Twitter may not yet be geo-referenced, but they will be, and this will mega-multiply the geo-information explosion overload and all the locational - ethical issues below. (Elwood, 2009)

3.3.2.1. VGI (Volunteered Geographical Information) and HS (Human Sensors)

VGI is the harnessing of tools to create, assemble, and disseminate geographic data provided voluntarily by individuals (Goodchild, 2007, 2008; Tulloch 2008; Elwood, 2008). Some examples of this phenomenon are Wikimapia (in about 90 languages including Anglo Saxon!), (http://wikimapia.org/wiki/Main_Page; http://blog.wikimapia.org/) OpenStreetMap (http://www.openstreetmap.org/), and Google Maps / My Google Maps. VGI can also be seen as an extension of critical and participatory approaches to GIS and as a specific concern within online or web credibility. These sites provide general base map information and allow users to create their own content by marking locations where various events occurred or certain features exist, but aren't already shown on the base map. VGI is a special case of the larger Web phenomenon known as user-generated content and Web 2.0.

With the proliferation of cellular phones and the Internet, there has come the acquisition technique of 'human sensors' (HS), which also accommodates VGI and 'citizen journalism' such as blogs. A growing acquisition technique is 'human sensors' (HS) and HS webs, which can also accommodate volunteered geographical information (VGI). The VGI platforms (Internet and GIS-enabled smartphones), and the virtual globes have radically changed the scene, with enormous potential as easy, cheap, sufficiently detailed, relatively transparent tools to acquire, analyse and present spatial information from a community point of view.

There are innumerable examples of many innovative mashups and VGIs.

- Many examples in Rouse et al. (2007); Bugs et al. (2010), Roche (2010), on Google Earth Mashups (see above), and earlier examples described in Goodchild (2007).
- CommonCensus - a web-driven new regionalisation of the USA based on public's affiliations with sports teams (Tulloch, 2007)
- Ownership of forest carbon rights and (ethno-) botanical knowledge associated with indigenous land claims in Brasilian Amazonia (Butler, 2009);
- Community PGIS for monitoring of land invasions, land claims and pollution from oil exploration in Amazonian Peru (Orta, 2010)
- Citizen monitoring of domestic water services in Zanzibar (Verplanke et al., 2010)
- Noise Tube, initiated in Paris: noise sensoring using a smartphone as a noise metering device with a free app to upload the readings. www.noisetube.net
- Delhi women locating, reporting and shaming 'Eve teasing' on Delhi busses via Twitter and Facebook, organised by Blank Noise, a women's NGO. (external summary in http://www.comminit.com/en/node/270751)
- Real-time monitoring of Katrina floodwater depths in New Orleans, 2005 (Tulloch, 2007)
- Smellscapes on the New York Metro system http://gawker.com/maps/smell/
- Emotional Cartography; http://emotionalcartography.net/ (Nold, 2010)

A more traditional form of working with LSK is the Green Maps project (www.greenmaps.org) with volunteers and local NGOs producing counter maps (paper and webbed) in hundreds of cities in over 60 countries devoted to environmental and social issues usually overlooked by municipal planning authorities and official maps, such as urban safety and women's security, child-friendly spaces, greenness and bicyclability.

A more radical approach is utilizing virtual reality as in Second Life, to explore alternative visions of e.g. community spatial developments, services and functions using people's inputs, priorities, preferences, like community inputs to urban park design, NYC (Tulloch 2007, 2008). It is open 24/7 and it is fun, but the obvious drawbacks are the limited access, and the balance between costly detail and over-simplification of the environment

3.3.2.2. Taking LSK into cyberspace – the doubts

The $9.99 questions here for the mash-ups, VGI, geotagging, and all the cybercartography / neogeography are:

1. *Who is involved in it?* Who are the 'volunteers' providing information? Obviously, they are people who have access to the Internet or smartphones or other platforms for uploading, but very significantly, they are also those people who have the other resources and skills needed: time Is paramount of these, operational skills, some basic awareness of the phenomena in question – crime, hazards, social hotspots, the music scene, demonstrations, raves, restaurants, bargain shopping, noise and pollution spots, traffic jams – the range is limitless. Beyond this is the motivation to get involved in uploading or adapting or sabotaging the spatial information, even though the activities require far less motivation than e.g. working with traditional media like Green Maps or participating in a PGIS mobile GIS activity,

   The answer still at this stage of development of neogeography is more likely to be young e-savvy males with low time constrictions, whether or not they are nerds. In a recent discussion about 'who can or should be the volunteers?' for local hazard reporting in Georgian Caucasus, some worries were voiced that the uploaded reports would be from a very small sample of local people, - even visitors with smartphones, or kids – with shallow local knowledge, and would not at all be representative of local needs and priorities. The conclusion was that it is better for the 'volunteers' to be selected and organized as in NGOs, i.e. not uncontrolled volunteers. It may be argued that HS is not strictly participatory, since it is usually a one-way individualistic information flow without feedback and knowledge development. On the other hand, HS represents a form of empowering people, in that the imparted information is voluntary and bottom-up.

2. *Who is checking the spatial information?* Where are the accepted procedures, criteria and parameters for checking the accuracy, precision and appropriateness of the scale, etc.? Who selects these parameters?

   Cross checking VGI or HS webs is an issue. Laituri & Kodrich (2008) and Flanagin & Metzger (2008) discuss whether the 'Crowd Sourcing' of information in VGI results in 'Crowd Wisdom' or not, and is part of the same debate as who is checking the information and how. It is obvious that the growing ability to easily generate masses of local data from masses of local people means that verification, validation and cross-checking of the exploding input material is a problem. In other Web 2.0 fields like Wikipedia or even Wikimapia, the inflow of information is not such an avalanche, and peer reviewing and a hierarchy of managers can deal with it. (Goodchild, 2007, 2008). The key value in this spatial information dilemma, as in other parts of life where we rely on other people's knowledge is reciprocated **trust.** Academics trust peer review and H factors; local rural communities may trust traditional leaders and some NGOs, but rarely trust Government, (do they trust academics?); mapmakers trust surveyors and satellite images; teenaged tweeters trust their own peer review of cool places; consumers too easily trust commercial websites. How do researchers and responsible planners know how to trust the volunteers in VGI? And how do volunteers in the community know they can trust that their uploaded delivered knowledge will be used safely, carefully and wisely? (Elwood, 2008; Flanagin & Metzger, 2008)

3. *Who owns the output products?* What are the geo-information outputs or products? What is the purpose of generating / analyzing / disseminating them? For whom are they useful? These are the ownership issues to be contended with, among others (Rambaldi, Corbett et al., 2006) The map / GIS products should be clear, understandable, testable, and convincing to the users and their purposes, as well as the usual information criteria of relevance, reliability, internal and external logic, replicability, and coherence. The current and future status of the ownership of local (spatial) knowledge must be clarified, taking into account liabilities for protection of indigenous Intellectual Property Rights. (cf. WIPO www.wipo.int). Zook and Graham (2007) have critiqued the rights conditions of Google Earth as an exercise in the privatization of cyberspace.

There is a perception that our growing acceptance of and nonchalance towards the GIS/2 milieu and its software combined with the explosion of CCTVs and other spy devices, including billions of smartphones with cameras, will expose us to unprecedented levels of surveillance and governing control (Zook & Graham, 2007; Elwood, 2009).

Roche (2010) further identified the geodata weaknesses of the VGI/virtual globe culture as in the homogenization and standardization (e.g. Google API becomes "the unique way" to represent and interact with earth), the over-simplification of cartographic representation, as well as the data quality, the misuse and misinterpretation, the 'out-of context' and verification issues, and non-expert spatial reasoning capabilities.

There is a natural reluctance amongst professionals – geographers, cartographers, spatial planners – to allow too much penetration into their professional worlds by the 'civilians', the amateurs (e.g. Roche, 2010; Tulloch, 2007; Goodchild, 2007, 2008, 2009) although there can be admiration also (e.g. Tulloch, 2007 for Common Census).

3.3.2.3. Visualization of cognitive / mental maps

People's cognitive maps work across multiple scales and topologies. Standard GIS already provides many opportunities for good representation of spatial scaling, multi-scaling, scale comparisons, zooming-in, moving/jumping scale, etc. Visual images can be considered as "spatial narratives", since pictures are rich in information and shared understanding. And - more general than just in GIS – there is incredible impact of visual images as communication and cartographic "spatial narratives". A picture is worth 1000 words (a genuine cliché!) but more than that, it is not just a quantitative increase in information, but also qualitative. This is the 'conviction' factor of visual images, though it may have negative as well as positive implications. There is not as yet much application of concepts and tools from semiotics and semiology to understand or deconstruct geospatial images similar to content analysis in helping to understand intention and attitudes and voice in written or spoken texts. Still, there is much to learn (cf. Rose, 2001).

The valuable use of spatial visualizations (maps, GIS) lies in scenario development and exploration. Civil society groups can use the capabilities of PGIS to explore the decision spaces and play around with alternative futures, based on not-necessarily-consistent perceptions of their own goals, objectives, constraints, preferences; as in the 'co-learning', 'empowering' processes of joint development of GIS, (e.g. Gonzalez, 2000; Kyem, 2002). This is evident in P3DM with its alternative visual perspectives, including its bird's eye view, and the shadowing created by changing light sources, which allow for broad participation whilst walking around the long perimeter of the models. P3DM is effective in encouraging collaborative discussions about perceptions and priorities such as in buffer zone and community boundary disputes (Rambaldi et al., 2007). However there is the problem of the immutability of the representation. It is easy to change the point and line spatial data on the models, but it is much more difficult to re-cast the areal data. There are physical limitations of over-painting, but much more significant is the social psychological barriers of making the changes, after so much effort has gone into the model appearance. This is a constraint to scenarios of alternative futures, for instance.

A specific dimension in people's cognitive maps is the spatial signifiers of **sound**, and thus the mapping of noise, which had been ignored in regular urban or impact maps. There are exceptions, even early innovative examples, like Southworth's 'sonic environment of cities' (1969) mapping sound distress or noise pollution. Porteous (1990) had chapters on 'Soundscapes' and 'Smellscapes'. But VGI, HSW and virtual globe mash-ups have revolutionized the possibilities for including these, directly in the case of soundscapes, when links to recordings or real-time live sound pick-ups can be easily added. Likewise the use of music, songs, etc. is part of coloring mental maps and group associations with places. Smell cannot yet be directly transmitted via the Web or reproduced off-site, though computer hardware developers are working on smell generators. There are also websites, which provide surrogate geo-referenced information on smells via word descriptions and pictures.

3.3.3. People demand respect and good governance

The basis of this requirement for PGIS is the need for approaches and tools and techniques which represent the views, priorities, needs, problems, and demands of the people as citizens; and specifically in terms of their local spatial knowledge in its three aspects as discussed earlier. The ethical issues in PGIS (Rambaldi, Corbett, et al., 2006) are a part of this.

This component of valuing and respecting local people's LSK equitably with scientists' knowledge (that does not mean that they are at par in all aspects) is related to the concept of Citizen Science, with the idea that LSK has its own values and validity. (Tulloch, 2007; Goodchild 2007, 2009). To begin with, as a minimum, GIS and PGIS have powerful abilities to combine data from different sources (transportation, hazards, socio-economic), formats (satellite, paper) and sources (local, external, scientific). (P)GIS combines disparate data types and modeling different problems based on any purpose-of-the-day.

Cyber Tracker, a spatial information tool aimed at integrating local and external data and data sources, by which it also recognizes and delivers value to the local actors as data providers, illustrates this. Cyber Tracker geo-references data allow users to display icons and text in fast field data collection by local community members or school children. http://www.cybertracker.org/index.html. Cyber Tracker field data capture is by a PDA connected via Bluetooth to a GPS unit; and lately in smartphones with built-in GPS antenna. Data entry can be programmed by clicking on icons following a predefined sequence (Beyers 2004; Peters-Guarin & McCall, 2011). Cyber Tracker was originally developed for wildlife monitoring in Southern Africa, and designed to be user-friendly for people unfamiliar with computers, even illiterate or innumerate. The interface is relatively straightforward, with its front end designed for ease of understanding, e.g. with a range of existing icons, thus relatively little need for programming skills. Cyber Tracker is open source for further development and free. When combined with free satellite imagery from virtual globes (Virtual Earth) and using open source free GIS software, such as ILWIS, there are major cost advantages over expensive or low resolution remote sensing, and commercial GIS software such as ArcPad.

Participatory video and digital photography record and analyze incorporative spatial knowledge. Working with photography and video allows for intensive participation, both in the filming and the subsequent stimulating discussions, in presenting actors' own sense of what is important, and the control of how they will be represented; 'in PV the subjects make their own film'. This is illustrated by e.g. children's perceptions of safe or friendly spaces in Nepal, (Plush, 2009) and Malawi (Baumhardt, et al., 2009); and the locations of social hazards for women and unsafe urban sites: 'through the eyes of women' photos, voices and participatory research tools for re-imagining place and women's spaces' in Belfast (McIntyre, 2003).

There are many more holistic and cognitive tools, which value local people's knowledge and enhance its expression through unconventional non-rigid, more holistic terms for community-based spatial planning. Thus they form part of PGIS, although not directly Web 2.0 or GIS/2, such as situational analysis, role-playing games, theatre (e.g. Kindon et al., 2007), and stories and imaginations e.g. in El Salvador, Guatemala, Peru, and Venezuela (Wisner et al., 2008; Kindon et al., 2007).

3.3.4. Empowering community - societal development

The PGIS approach is intended and expected to empower communities and individuals, in terms of capacity-building, confidence-building and long-term strengthening of knowledge, skills and initiative. The question is whether communities and local actors gain in empowerment from using GIS/2 and neogeography tools in PGIS processes. Related to the framework of ethical issues in PGIS, this perspective is significant in terms of who participates - in what form - in the PGIS activities? Who decides who participates? And who will use and control the outputs?

Many of the specific tools and the examples promoted as the new golden age of GIS/2, or cybercartography because they are interactive and empowering, are more like traditional one-way search engines than an interactive inclusive knowledge building exercise. People can only search for information nicely geo-referenced, with hyperlinks etc. but not as a wiki, i.e. no opportunity to add / detract from the information. Or, they can post comments but they are only dropped in a box without much ability to dereference or link them (c.f. critique of Bugs et al., 2010). PGIS digital preservation of information is also a boost to participation, because it enhances the ability to more equitably record, analyze and value the local knowledge of different actor groups in the community, including women, children, the resource-poor, the elderly, the disadvantaged and less articulate.

There is a reasonable assumption that a basic framework or patrimonial geospatial data is better measured, mapped and delivered by procedures other than PGIS or by neogeography tools. This is for several reasons for cost efficiency - the framework data are for a massive client base, to make use of experienced technical skills of cartographers, and for legal and legislative validity. But even this framework data can be critiqued and tested by the neogeographic community, an important instance being in toponomy – the nomenclature attributed to places and spaces is a strong factor in social cartography. Wood (1992) & Rundstrom (1995), among others, have long pointed out how naming of places and then the permanent recording of them on legal maps is a mainstay of cultural and economic control, by colonial or federal powers. Aside from naming used as a deliberate weapon of the powerful, it is common to find petty errors in map names and legends, which can be corrected by VGI.

Moving from their particular circumstances to the general, communities can use PGIS (as in web GIS) to mobilize for change, and better understand how local facts connect to wider (regional, national, international) issues. (Gonzalez, 2000) For example, PGIS can be used not just to map the local pollution impacts of toxic waste sites, but also to become aware of the sources of the wastes.

There are technical strengths over pre- or non-GIS methods like the ability to handle multiple data layers for analysis and presentation. Overlaying (e.g. different types of land use), is already known as a major 'value-adding' functionality, which GIS has over paper mapping, with the ease in overlaying multiple data sets ('what is where?'). GIS handles spatial Queries (where is …?, what is at …?). GIS capabilities handle spatial analysis e.g. proximity, threshold distances, routes, land uses, networks, simple analyses such as calculating areas and drawing boundaries; and complex analyses such as geo-coding and dynamic simulations. This is furthered by the capabilities for secure storage and ease of communication for recording, protecting, exchanging, and sharing spatial information in digital or analogue formats.

The accelerating speed of adding new information is far faster than in previous technical generations. Consider at present Wikipedia, Wikimapia, and the granddaddy of them all, Google Search. Of course this is a potential loss as well as a gain. The massive countering problem is how to validate and crosscheck this information, cf. Wikipedia's hierarchy of peer review vs. Google Earth (Goodchild, 2007, 2008, 2010).

New hardware technologies for PGIS, like PDAs (iPaqs), Tablet PCs, TomTom GPSs, and smartphones add to accessibility (user friendliness); ease in mapping, portability, for determining locations (using GPS; being able to ask 'where is?'); they also allow numerous types of output, not just maps. As example, the advantages of employing GIS within participatory land assessment (a tool called MIGIS) have been given as: it is highly visual; it stores (quantitative) data efficiently, data are credible and quantifiable; and that they are easily updated and facilitate monitoring. Although, other claims made for the benefits of the PGIS (MIGIS) are dubious: “data stored within the GIS is accessible to all” (what about access and ownership?), it “can be used to answer an infinite number of questions, only limited by ability to ask”, and it helps address conflicts. (McConchie & McKinnon, 2002).

3.4. Conclusions - satisfying the requirements of PGIS

How do we know if GIS/2 and neogeography with its array of tools and gadgets is successfully addressing the needs of PGIS? Does GIS/2 give satisfaction?

Practitioners point out that PGIS has or may have greater value in facilitating and promoting progressive changes (towards equity, empowerment, etc.) - not through the output products, but through the drawn-out process of creating the PGIS, using the PGIS within and as part of the participatory inclusion of ‘multiple forms of knowledge’. Elwood calls this ‘qualified GIS’, and emphasizes cartographic spatial narratives with the visual as a form of communication. This issue is significant in the well-grounded debate on understanding ‘participation’ as being both process and position. In practical application of thousands of “participatory projects” in rural or community development, there has always been tension between the concrete outputs of the project, and gains made in terms of participants’ capacities, confidence, and empowerment. Table 6 shows some new tools for practitioners linked with the established criteria for good practice of a PGIS.

Tools	**Examples**	***Space***	***People***	***Community***
Accessible Geospatial Information Sources. Ease of Access to base / patrimonial geodata				
Virtual Globes	Google Earth; Virtual Earth; OpenStreetMap			
Participatory creation of new geospatial data				
Volunteered Geographic Information.	Flikr; Wikimapia; OpenStreetMap; Google My Maps; Green Maps; dedicated WWW sites			
Human Sensor Webs	HSW: organized subset of VGI (e.g. Noise Tube)			
Geotagging	GPS coordinating; Geotagging			
Mobile GIS	iPaqs with GPS (e.g. ArcPad); CyberTracker			
P3DM	(manual)			
Participatory Video	VideoCam; Cellular phone			

Soundscapes, Smellscapes	Noise Tube; Gawker			
Participatory (Spatial) Analysis				
P3DM, P. video, Mobile GIS, etc.	MIGIS; VideoCam; Cellular phone; 3DMap			
Effective Presentation and Delivery				
Visualization	Graphics software: Adobe Photoshop; Corel Paint shop			
P3DM, P. video etc.	3Dmap; Video tape			
Geotagging on websites	GE Tag			
Interactive websites (with feedback)	GE; HSW			

Table 6 - Tools and some applications from Neogeography - GIS/2: Addressing PGIS criteria.

What people may call a 'successful' situation to a PGIS project is itself debatable. Some actors in a community PGIS activity may be pleased with the outcome, perhaps they get employment from it, or they get access to external resources, or they exploit it to monopolize internal resources ('elite capture'), whereas other actors may be unhappy because their priorities and preferences may be excluded in the final maps (cf. Minang & McCall, 2006; Fox et al., 2006).

This question is of course a subset of the universal discourse on what is 'community'? Who belongs? And why? How are they selected? Whilst others are not? What must they be, or do, to remain in the community? Individuals belong to multiple communities geographical-spatial, social-cultural, age, interest or problem or functional groups. The whole thrust of Web 2.0 and the VGI etc. off-shoots is that anyone's community does not need to be a coterminous geographical unit. Nor is it static, people shift in and out of real and virtual communities as they change lifestyles and change interests. Facebook and other social networking sites are a definite part of the reality of communities, though not the only part.

We cannot and should not define very concretely what is a 'successful' conclusion to a PGIS or a community mapping process, but we can identify key widely accepted criteria related to participatory approaches generally (as in Table 1). As with all participatory processes, there are criteria based on developing a satisfactory outcome - these are maps and spatial displays such as GIS which represent people's alternative spatial realities in the PGIS case; and, equally important, the criteria which are related to the processes of working in a participatory, collaborative manner – that is, creating respect for people and empowering communities. A PGIS or participatory mapping activity, which achieves (most of) these objectives, we can agree, is 'successful'.

List of figures and tables

Definitions and list of acronyms

Barangay – Purok – Sitio
: In the Philippines, municipalities and cities are composed of barangays. A barangay is the smallest administrative division in the Philippines. Barangays are subdivided into Puroks. A sitio is a territorial enclave inside a barangay, especially in rural areas.

AI	Assessment Index
AVL	Allah Valley Landscape
AVLDA	Allah Valley Landscape Development Alliance
BHW	Barangay Health Workers
CBFM	Community-based Forest Management program
CBNA	Community Basic Needs Assessment
CBO	Community Based Organization
CLUP	Comprehensive Land Use Plan
CRM	Community Resource Mapping
CUD	Commission Universitaire pour le Développement
DENR	Department of Environment and Natural Resources
EA	East Asia
ERDAS	Earth Resources Data Analysis Systems
ESRI	Environmental Systems Research Institute
ESSC	Environmental Sciences for Social Change
FGD	Focus Group of Discussion
FUCID	Fondation Universitaire pour la Cooperation au Développement
FUNDP	Facultés Universitaires Notre Dame de la Paix
FUSAGx	Facultés Universitaires en Sciences Agronomiques de Gembloux
GE	Google Earth
GEOTEACH CENSOPHIL	GEOmatic Technology as an Empowering tool for Academic institutions in Community participatory development and Human resource mobilization in the CENtral and SOuthern PHILippines
GIS	Geographical Information System
GIT	Geospatial/Geographical Information Technologies
GRASS	Geographic Resources Analysis Support System
HDI	Human Development Index
HS	Human Sensors
IDI	Interest Density Indicator
ILWIS	Integrated Land and Water Information System
IND	Institute for Negros Development
IP	Indigenous Peoples
ISFP	Integrated Social Forestry Program
IT	Information Technologies
ITK	Indigenous Technical Knowledge
LCM	Linear Combination Method
LGU	Local Government Unit

LSK	Local and indigenous Spatial Knowledge
MI	Marginality Index
MOA	Memorandum Of Agreement
NAMRIA	National Mapping Resource Information Authority
NGO	Non Governmental Organization
PC	Participative Cartography
PCA	Principal Component Analysis
PCAM	Principal Component Analysis Method
PGIS	Participatory Geographical Information System
PLA	Participatory Learning and Action
PMO	Project Management Office
PO	People's Organizations
PRA	Participatory Rural Appraisal
PVO	Private Volunteer Organization
P3DM	Participatory 3-D Model
RRA	Rapid Rural Appraisal
PWA	Philippine Working Group
SPOT	Système Probatoire d'Observation de la Terre
SSC	Swedish Space Corporation
SSI	Social Survey Indicator
TLA	Timber License Agreement
TWG	Technical Working Group
UCL	Université Catholique de Louvain
U&PuA	Urban and Peri-urban Agriculture
URC	University Research Center (of USLS)
USLS	University of Saint La Salle
VGI	Volunteered Geographic Information
2D	Two Dimensions
3D	Three Dimensions

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Cover Page : Merch Ignacio
Editing : Jean Lee Patindol

http://www.fundp.ac.be/asbl/pun
August, 2011