PGIS's relevance, applicability and conditions in local rural development: a case study with Village Development Planning in Bach Ma National Park buffer zone, Vietnam

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by

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I certify that although I may have conferred with others in preparing for this assignment, and drawn upon a range of sources cited in this work, the content of this thesis report is my original work.
Signed …………………….

To my beloved Grandmother - "the tailor" Nguyen Thi Tinh,
who had always been telling me to learn and to live
with full of passion, courage, and hope;
who had given me the strength
to go all the way…

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List of Abbreviations and Acronyms

GIS	Geographic Information System
PGIS	Participatory Geographic Information System
PPGIS	Public Participation Geographic Information System
GIT	Geographic Information Technology
IS	Information System
P-Mapping	Participatory Mapping
MIGIS	Mobile Interactive Geographic Information System
3-D Modelling	Three-Dimension Modelling
VDP	Village Development Planning
VDF	Village Development Fund
VDB	Village Development Budget
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
PLA	Participatory Learning and Action
PAR	Participatory Action and Research
OOPP	Objective-Oriented Project Planning
SWOT Analysis	Strength Weakness Opportunity Threat Analysis
M&E	Monitoring & Evaluation
CBOs	Community-based Organisations
NGOs	Non-government Organisations
IOs	International Organisations
LAP	Land Administration and Planning Department
LSK	Local Spatial Knowledge
ODA	Overseas Development Aid
ASEAN	Association of South East Asia countries
'Dong'	Vietnamese currency unit
NTFPs	Non-timber Forest Products

Acknowledgment

Abstract

In recent years, the term participatory GIS (PGIS) has become more popular and drawn an increasing attention of GIS researchers and practitioners, particularly in its application in development context of the Southern countries.

In the same times, many critiques have been made on PGIS as being 'technology-driven' instead of being 'user-oriented'. Another debate is on how GIS – as a sophisticated technology from the Northern countries – can be introduced in the processes of working with the poor efficiently and appropriately. Questions that were emphasised are mainly about its concept and relevance in development process, its components and elements which have been remained fuzzy. There is a need for testing PGIS as a methodology in empirical research and to develop a conceptual framework of its nature and elements of the application environment that influence its success.

The overall objective of the study is to assess the relevance of PGIS and look at the conditions for PGIS in a rural developing context country in order to have a more effective and appropriate PGIS application. To arrive to the research over objective, several specific research objectives were defined as: i) understanding a practical process of PGIS application: describing a study case in application field of Village Development Planning; ii) assessing the relevance of the use of GIS in local planning process and based on this to define PGIS; iii) assessing the relevance of PGIS in rural development from which the construct a model of PGIS in rural development context; and iv) conceptualising conditions for having a relevant PGIS – toward PGIS and good practice.

The research followed some strategy on participation-oriented and participatory action research. Technical methods that were used to conduct the study included two set: PRA tools and GIS tools as a combination. Data analysis was based on the qualitative analysis of observation notes, interview data and processed maps, with support from literature.

Major findings of the study were about: i) PGIS process: necessary steps and how did people interact with GIS tools and how GIS tools influence back to local communities, ii) understanding about GIS's relevance to a local development planning in terms of: spatial dimension, relevance to local's needs, it's usefulness, its participatory levels, and how it was influenced back from local community, iii) review on PGIS as a practice/process and its economic, social institutional and political applicability in a rural development context, and iv) conditions for GIS good practice in development context

Main conclusions of study stressed on the definition of PGIS concepts: it is a continuous process which is local community's needs oriented, end-results oriented which serve to fulfil the needs of local community; and the complex relation of PGIS and rural development context.

Recommendations from this research focus mainly to more attempt on economic aspect of PGIS: cost and benefit analysis; developing more methods of quantifying participation, research on sketch maps and PGIS good practice condition framework.

1. PGIS and its problematic context

This research was motivated by an answer to my question at the beginning of the course: *"what is PGIS?"* The given answer was *"Simple! It is like when you bring a satellite image or an aerial photograph to the local community and they start to recognise their area, and tell you some things that you can not imagine, some things that you never know…"* It did not sound simple, but mysterious, and interesting; and the curiosity lead me to read more about PGIS literature works and started my research journey.

1.1. The debate and its questions toward PGIS concepts and its applications in developing countries

From 1990s, with the wide spread of participatory planning approaches and the diffusion of technology in many developing countries, there have been many queries and concerns about the use of PGIS. These concerns critically questioned about the nature of PGIS's concepts and practices in terms of the following points:

As GIS was invented and highly controlled in first-world countries, is it an appropriate technology to apply in developing countries? Who should benefit, what issues should it address and who will decide upon those? The argument on its appropriate application was many of GIS applications were to answer for *"the need of technology that is looking for its users"(Jordan 2002)*. Instead of being a rather technology-driven process, GIS application in developing countries should be user-oriented(Yapa 1991; Perera and Tateishi 1995; Jordan 2002).

If PGIS is claimed to address the problems that are more relevant to the needs of local communities and hence becoming more user-oriented, there is a doubt in combining Participatory and GIS. More specifically, GIS is a central-control technology which requires professional expertise and knowledge on computer (hardware and software) and on geo-information, whilst participatory processes involve people from different backgrounds including the poor, many of whom are non-literate people(Dunn, Atkins et al. 1997; Abbot, Chambers et al. 1998).

Moreover, the question of how participatory should a PGIS be and can be is also raised. As improper participatory GIS may bear a risk to 'extract' valuable knowledge from local communities and therefore it is *"taking power away from the people"(Jordan 2002)*. Accessing geo-information and make best use of it by local communities should be at the core of participation purposes. Hence, there should be more attempts to address issues of ownership and legitimacy in PGIS's output for local community. Yet, the question is how to ensure the access to geo-information for local communities as a source of wealth and power in order to make GIS become a tool to empower the communities, particularly to those are marginalised(Harris, Weiner et al. 1995; Harris and Weiner 1998; Weiner, Harris et al. 2002; Jankowski and Nyerges 2003; Onsrud, Craglia et al. 2003).

From individual concerns, many workshops was organised to exchange, share and discuss about the real use of PGIS and its nature. This made PGIS collective fora to find out more about the answer of

the raised question: ***can PGIS be applied in development process, why to bring it up and how to make it work in developing context***? This question is indeed about PGIS's relevance issues, the

However, PGIS researches are more empirical ones which are field-based and the evidence to prove for its methodologies are not sufficient for researchers to find a common framework which points out PGIS's opportunities and constrains. Therefore, *"there are considerable opportunities for empirical research to help develop a geographic information sciences of PGIS use"(Jankowski and Nyerges 2003)*.

1.2.   Specific situation in the study area in Bach Ma National Park buffer zone and Village Development Planning

As other typical rural areas in Vietnam, the main issue in Loc Tri commune is the poverty situation. More than 50% of the households in the commune are living under the 'medium' living standard. There are many reasons for this poverty, and one of them is the misuse and lack of access to natural resources.

Resulted from the current land management policies, land use planning process in the area is rather top-down and bureaucratic. The weak planning process does not involve farmers in the villages but is decided at the district level. Therefore, farmers in villages have little benefit and stand in the new land-use plan or they think that some areas are forgotten or inappropriate used. There is a need for developing a more grass-root planning approaches, which VDP appears to be fit to the requirement of local people and authorities.

Moreover, a large unused land area is not in planning process as the authorities said that they lack of capability (human power and equipment) to carry out the process. Also it is very costly in terms of time and money to carry the planning process in the traditional manually measuring way.

Many attempts were made by governments, aid agencies and the National Park to improve the situation. Many small projects targeting to different sectors of rural development and natural conservation were undertaken. However, these activities are scattered in time and lack of coordination. There is a need for a common forum/medium of detailed land-use situation of the area to discuss and plan on which lead to common understanding between different involved parties. Spatial information and maps are able to bring fulfil this arose need, but issue of using geo-information and mapping in participatory manner is very new and not yet experienced in the area.

1.3. Conceptual framework

Sustainable Development

Conditions for PGIS good practice

PGIS relevance & applicabilities

PGIS experiences & lessons

PGIS Concept

Feedback

Exploring

Contributing to

Learning Process

Rural development context

Culture

Technology

PGIS Process

Development problems

Community needs

Community participation

GIS supports

Addressing

Local planning process

Planning

Implementation

Monitoring & Evaluation

Development Outcomes

Communication Negotiation Decision-making

Politics

Economics

PGIS products (maps, data sets)

Institutions

The Conceptual Framework above show the circle of learning in this study. It started from the point of understanding PGIS concept, recognising problem and on-field exploration by applying PGIS tools in a rural development context in order to understand the 'truth in PGIS'. This, in return, refined the concept of PGIS at the beginning point and contributed to experiences and lessons about PGIS, and provided some insights about PGIS's relevance, applicability and conditions in rural development context, which in turn contributed to PGIS good practice guideline for sustainable development activities.

1.4.   In this study:

1.4.1. Main concepts and terms

It would be well-facilitated, at this stage, to provide the readers some brief insights of the key concepts and terms of this study in order to have a clear understanding of what were meant by these concepts/terms.

PGIS

It is an acronym of the term 'participatory geographical information system', well-recognised as participatory GIS' or 'P-GIS' or 'public participation GIS' (PPGIS). Other similar terms of this concept could be 'community-integrated GIS' (CiGIS) or 'community-based GIS'. This concept implies the involvement of public/local community in the design and/or development of GIS application.

Village Development Planning (VDP)

This is an approach of participatory development planning at grass-root level for empowering people on issues related to their organisational development, economic development, and resource management toward sustainable development. In other cases, it could be called as "Village Development Fund" (VDF) or "Village Development Budget" (VDB).

Guidelines of this process often introduce the process as a circle of development planning/management with preparation phase, planning phase (including assessment, PRA and meetings etc.), approval, implementation, monitoring and evaluation phase(MRDP-Sida 2000; SFDP Song Da 2003).

A summary of toolkit used in VDP by (Kerstan 1994) provided a comprehensive list and review of tool sets used in VDP such as RRA, PRA, Gender analysis, OOPP, SWOT analysis etc. In general, VDP is close to PRA practice but with a more local-based organisational system to ensure the implementation of the plan that is made from PRA.

Relevance

According the Longman dictionary, 'relevance' is the degree to which something is related or useful to what is happening or being talked about. In this study, criteria to identify 'relevance' will be given before assessing GIS application's relevance in participatory spatial planning.

Applicability

It means the possibility of PGIS being applied in relation to a certain aspect of the practical context. For example: economic applicability emphasis on how economic elements affect the process of PGIS.

PGIS good practice

This term means the appropriateness of PGIS on the practice ground, and the "how it should be done" to ensure not only its effectiveness and success, but also its intentions of aiming to support and empower people at the grass-root level. Its synonym could be 'PGIS sound practice'.

1.4.2. The structure of the study

In Chapter 2, the research conceptual problems are defined as the core starting points, based on which an overall objectives and specific objectives were found and justified.

Chapter 3 provides a review on some literature works that relate to and/or support the analysis and argument in this research.

Chapter 4 describe the methods of the study, including research strategy, applied tools, and research process.

In Chapter 5, findings of the research are presented, explained and analysed. There are linkages among these findings which where found based on the on-field experiences as well as literature-available lessons.

Chapter 6 makes a further analysis and explanation on the findings. It also compiles scatter-seemingly details into a connection which facilitate the lead to conclusions and recommendations of the research stated in Chapter 7.

2. Research Problem and Objectives

This chapter describes the defined research problems which were formulated based on the problematic context, what this research is aimed for to address those problems as well as questions about it, and justification for carrying out this research.

2.1. Research conceptual problems

Based on the problematic contexts described above, within a limit of an MSc research, specific research problems were identified as the following:

> *Concept that defines PGIS is unclear* while its diffusion is growing in developing countries. This leads to problem of mistaking the concepts and could it be taken for granted in many project proposals and researches.

> As PGIS is at intersection of social science and GI Science (Craig, Harris et al. 1999), *elements and implications that influence its relevance* and effectiveness in rural developing context are complex and fuzzy. There is a need of PGIS researching which emphasis more on those elements.

> Research on a participatory GIS application is an empirical study whose evidences are arrived from field experiences. Therefore, *'PGIS methodologies need to be field-tested' (Jankowski and Nyerges 2003)* and there is a need for *a conceptual framework/model* to connect those complex elements in PGIS concept and its practice in development process.

2.2. Research Objectives and Questions

This section describes the overall objectives, given the problem definition above. In order to achieve this overall objective, several specific objectives were identified, given the interest and limited resources (time, equipments, study-area background etc.) of the study.

2.2.1. Overall objective

The overall aim of this research is through a case study in Village Development Planning to assess the relevance of PGIS for development process at local level and look at conditions for PGIS in a rural developing context country in order to have a more effective and appropriate PGIS application (good practice of PGIS).

2.2.2. Specific objectives & Research questions

(1) To understand a practical process of PGIS: describing a study case in application field of Village Development Planning, to identify its sequence and interaction between local community's participation and GIS technology.

> 🖉 In what steps did the process happen?

   ✏ What GIS tools were using in each step of the process: outcomes and obstacles?

   ✏ How did local people interact with GIS?

(2) Assessing the (internal) relevance of the use of GIS in local planning, in particular; from which review the nature of PGIS and define what a PGIS process is. This assessment seeks to understand the concept of PGIS and the mutual impacts of its components.

   ✏ What are the criteria for GIS's relevance assessment in a participatory process?

   ✏ How participatory it was?

   ✏ What are the relationship of GIS and participatory process?

   ✏ What is PGIS in this particular application?

(3) Assessing the applicability of PGIS in rural development in general, given the complexity of socio-political characters of this particular context, in order to understand the influence to PGIS from external environment.

   ✏ What are the main socio-political factors/components of the development context that define PGIS applicability?

   ✏ How these factors/components relate to PGIS and influence its applicability?

(4) Conceptualising conditions for having a relevant PGIS in development at local level based on the empirical experiences of failure and success from the research, which contribute to a guideline of PGIS good practice in general.

   ✏ What are the main groups of conditions?

   ✏ What are linkages of those conditions to PGIS practice: from theory to practice and vice versa?

2.3. Justification

This section explains the process of formulating this study and why its concepts are brought up and focused.

Firstly, at the stage of study proposal, the research was aimed to look at a PGIS in its application for livelihoods analysis which mapping natural capital and risk mapping were a major part. Through this process, it was expected that conditions for starting up a PGIS in developing rural context would be seen. However, during the fieldwork period, the actual interest from local authorities and the need from local communities were for making a development plan of the villages in order to improve the poverty situation. Therefore, the research was turned from its in-intention field of application - livelihoods analysis - to village development plan in order to ensure the usefulness of the research and to prior the benefit of the local communities, having the fact that changing the application field does not change the major purpose of the study which was to find out conditions for application of PGIS in a particular rural developing context. Hence, the study is not only beneficial to the researcher and the research institute, but also benefits local people, which is a crucial point of a participation process and in its turn attracts more and real participation from local people.

Secondly, from the scientific point of view, a research on PGIS – as an empirical research – is field-based. In other words, it is on the case-by-case based. Participatory processes contain certain ele-

ments which are rather at locality characteristic such as culture, politics and ethnicity. This study is expected to provide an empirical evidence of the combination between applying a "muscular" technology as GIS and an art way of dealing with people in participation process, including their commonalities and the compliments

3. PGIS – a literature review

This chapter provides a review on the available literatures about PGIS concept, practices in developing countries. The chapter includes three main parts: 1) a concept of PGIS which was found before the research was carried out on the field and indicated the starting point of understanding PGIS of this research; 2) a summary of most outstanding experiences on PGIS in developing countries, focusing on the learned lessons and how they related to defining PGIS; and 3) relevant discussions, review and analysis upon PGIS's non-technical aspects, which closely linked to the focus of this research.

3.1.   PGIS concept:

What is PGIS?

Since 1990s, GIS has been claimed as a magic tool in Natural Resource Management as "it is ultimate in GIS – the perfect answer to each and every resource problem" (Heit and Shortreid 1991).

However, GIS and GIT applications are not always effective or successful, thus creating lose of resources. There has been criticises that *"GIS is an elite technology whose adoption provides a tool for the rich and powerful groups in society to entrench their power and extend their dominance over the poor majority"* (Jordan 2002)

Besides, experiences at the field-level have discovered that the poor majority can bring great value into GIS's successfulness and effectiveness by contributing their local spatial knowledge and making use of the technology to address their real needs. From these experiences, the concept of participatory GIS (PGIS) has been generated to emphasis on the crucial role of local community/public's participation in GIS application at all stages (design, implementation and monitoring).

(Minang 2003) has summarised some different concepts of PGIS as either "*an attempt to utilise GIS technology in the context of the needs and capabilities of communities*" or an approach that "*incorporating community participation onto a GIS, the social-behavioural implications of GIS and broadly the inter-relationship between GIS and society*", or just simply is "*the use of GIS in a participatory context*".

However, (Harris and Weiner 2003) stressed on the participation side of PGIS and defined that: PGIS emphasises the participatory approaches used in introduction of GIS tools which are a combination of digital mapping activities, and local sketch mapping, GPS transect walk, remotely –sensed data interpretation, and geo-visualisation. In PGIS, participation can be taken in many forms.

The linkage of participatory approaches and GIS comes from the complimentary trade-off between the weaknesses of participatory approaches. Sketch maps and models from PRA have very low accuracy and therefore they have little legal status and are hardly accepted at the higher level. Besides, GIS has been criticised as a luxurious technique which is more favourable for more powerful people and tends to take away the decision-making process from local people (Kwaku Kyem 1999).

PGIS and its values

With application of GIS, participatory processes have gotten significant added values that make participatory GIS become an effective tool for natural resource management.

High accuracy
Participatory GIS helps to produce maps with reliable accuracy, in particular within the context of forest management, by using GPS and geomatic technology. An example of simple participatory GIS is moving through the territory with local people, establishing boundaries and identifying key plots using GPS and GIS. This is possible to produce much more accurate maps than the traditional sketch ones (Carter 1996).

Legitimacy
(Minang 2003) study has shown that participation of local people helps institutionalise the outputs at local level and provide a legitimacy value to them. He also stressed that ownership of PGIS outcomes should be given to local people for possible uses in future. This, together with the involvement of them in learning and decision making process, will be an important contribution to empower local people in sustainable forest management.

An effective communication and learning tool
Participatory 3-dimension modelling tool is a highly effective visualization tool in comparison to 2-dimension paper maps. Particularly to people who are not familiar with reading ordinary maps, this tool facilitates the comprehensive view of the entire landscape as people are given a bird-eye view over it. In context of areas where multi-ethno linguistic situation exits, it is very easy for people from different groups to communicate on issues related to spatial dimension within the area. Therefore, it is highly useful for negotiation situation in which spatial conflicts are involved (Rambaldi, Bugna et al. 2002).

Besides, value that participatory approach have added to the technology-driven GIS application is

Value of indigenous knowledge and a linkage bridge
A research of (Gonzalez 2000) based on a study with Ifugao people in the Philippines, has brought up an essential issue of participatory GIS value use of local knowledge in resource management. She concludes that *"participatory approach in the development GIS helps develop local knowledge processes"*. Through the participatory process, for example recognizing the boundaries, join-interpretation of images, the value of the area and its history are learnt by all stakeholders. This learning process creates a "channel of cooperation and coordination" between local people and higher-level authorities. Again, the issue of connecting stakeholders at different level, which was discussed through theoretical analysis of (Gibson, Ostrom et al. 2000), is again proved at the practical experience.

Practical experiences have proved that there are cases that local people can participate in GIS with high value of knowledge and success. These practices have been documented as participatory GIS (PGIS) as they involve the participation of public/local people in data collection, analysis and feedback.

PGIS and its use
in natural resource management and development are reviewed by (McCall 2003a) are below:

- *Claiming "our land"*: including demarcating traditional boundaries of lands and other natural resource, and support gaining legal recognition of customary land rights.

- *'Knowing and using resources means mapping resources'*: including identifying, locating, and analysing specific natural resources (in livelihood analysis, this application is highly relevant), and managing traditionally-held lands and land resources systems.

- *Managing conflicts:* including managing internal conflicts and mitigating conflicts between a community and the outside. Though this study does not focus in conflict management, this application would be linked to the communication process which may be useful for such type of conflict, if any, once it's occurs.

- *Mapping equity:* equity in terms of environment, socio-economy, gender, other social issues and integrated problem.

- *Building the community:* including promoting community awareness, institutional strengthening, and empowerment. This study would contribute to this application in researching the PGIS's effectiveness and required conditions for its success in terms of "building the community".

Yet, there was argument that even with PGIS, *"GIS has not been view as a tool in participatory process, but as a technology in its own right, looking for an application"*. This means that PGIS should be applied if there is a need for it, not because of the demand of outsiders and this should be carefully consider from the early stage (Jordan 2002)

3.2. Brief summary of PGIS/P-mapping and its application in developing countries: experiences and learned lessons

This section is not aimed of making abstract on the summarised studies; rather it presented selective relevant points from those studies in order to give support for the findings and discussion of the study later on.

An investigation of land cover change in Mafugautsi forest - Zimbabwe, using GIS and participatory mapping (Mapedza, Wright et al. 2003)

This study was aimed to use GIS and participatory mapping in land cover changes detection in and around the Mafungautsi Forest Reserve in Zimbabwe. Methods used were PRA, semi-structured interview using aerial photographs, analysis of historical aerial photography (scale 1: 50 000) within GIS, analysis of secondary data, and other follow-up interviews.

In this study, participation was involved by having semi-structured interviews combined with participatory mapping using photo-mosaics. The advantages of this technique were that it produced land use maps that could be easily geo-referenced and connected to remote-sensing data, whilst being sufficiently flexible to explore unknown themes that arose during interviews. Therefore, it represented a promising additional to the range of interview techniques available for exploring land use and land cover change. In the interviews which were based around aerial photographs, all respondents were able to interpret the photograph, but it was apparent that their perceptions of change varied. One way of revolving such differences may be to use discussion based around aerial photographs as a tool for planning future natural resources use.

The study results showed that participatory mapping revealed greater detail about the timing and the causes of land cover change than aerial photo analysis alone. This connected to local knowledge which belongs to indigenous people. However, one difficulty with the participatory mapping technique in a developing country context lie in distinguishing the relative impact of discussion group

composition versus geographical location on interview results. This combination of technical and participatory methods empowers local people to share their understanding and having a dialogue about their environment.

Participatory GIS-based natural resource management: experiences from a country of the South (Zurayk 2003)

This research was about using PGIS to support natural resource management– an indigenous agroecological zoning project in Lebanon. Methods were used including participatory tools (maps, sketches, diagrams rankings), using satellite image delineate boundaries of its different agroecological zones based on local people's recognition of the terrain, having ground truthed survey and transformed sketch data into geo-data using GPS, and other computer-based map processing tasks.

Main results were two kinds of products: hand-drawn maps and GIS maps, with recognition that PGIS approach led to a set of maps that faithfully represented the study areas and that were readily recognised and adopted by the local community.

It was learned that PGIS proved to be a useful, practical and cost-effective tool with accurate geo-referenced information that is recognised and readily adopted by the local communities and other stakeholders. This leads to legitimacy issues of local map in decision-making process.

It was also recognised that PGIS facilitated research process by enhancing trust-building. When their value of knowledge is appreciated by researchers, their commitment is increased. Besides, other important stressed points were about the ownership of PGIS products, true participation, PGIS transferring and the required linkage between researchers and local community, the use of PGIS products by local people.

A strong point was made about impacts of PGIS on people's livelihoods that would be the return from their contribution of valuable information. The issue is to avoid abusing the trust of the community by being the sole beneficiaries of the research process, whilst local people remain poor and feel used.

Integrating participatory resource mapping and geographic information systems in forest conservation and natural resources management in Cameroon: a methodological guide (Mbile, DeGrande et al. 2003)

This research is aimed to illustrate a method of integrating participatory resource mapping and geographic information systems in forest conservation and management. GI tools that were applied including participatory resource mapping, ground-truthing by transect walk and GPS, and processing data processing which acquired from participatory process into a GIS for analysis.

A significant part of the research's achievement was: GIS-enhanced participatory resources maps of human use zones inside and within a buffer zone which were stored and managed in a GIS were not only being used by the Koup National Park Management but also created a strong advocacy value to local participants, which reflected a learning process and empowerment.

Promoting local community participation in forest management through GIS application: a PPGIS experience in Southern Ghana (Kwaku Kyem 2002)

This research emphasised on the use of GIS in a participatory forest management process in Ashanti Region of Ghana. Local people were involved in mapping and the interpretation of maps produced

with GIS. PRA and resource mapping strategies were adopted to guide participants produce resource and land use maps.

Majority of participants became satisfied with the role GIS played to ensure successful collaboration amongst the group and were particularly impressed with data gathering, data analysis and decision support capabilities of the system.

In this study case, GIS not only became communication tool among forester and local forest user groups in the area, but also helped to identify hidden conflicts among members of the local forest committees. The adoption of the PPGIS methods resulted in a democratic decision making process, with relatively equal participation occurring among participants, which linked to empowerment of local people.

An interesting finding of the study was about factors that have impact on success of PGIS project in collaborative forest management including: power, gender and PGIS, trust for GIS specialist and the commitment to local participation, commitment of GIS specialist to grassroots empowerment, cultural and institutional obstacles to PGIS practice etc.

It was concluded that for more effective and appropriate uses of the technology, the use of local resource including human resource and local knowledge was counted on. Local capacity must be built as only local people would understand local problems and would be better placed to initiate programs that might reform GIS application from within their respective culture.

A PGIS for community forest user groups in Nepal: putting people before the technology (Jordan 2002)

This research had paid a strong attention to the participation side of application GIS-related technology in community forest management. It was initiated with aim of assessing the applicability and relevance of a PGIS. The PGIS tool was participatory aerial photo mapping and with participatory data analysis, assimilation, organisation and evaluation.

Lessons learned through the process were that the maps developed from participatory work are highly political and hence PGIS can easily become part of a power struggle or village dispute.

The author suggested that PGIS should be a process; it starts with the public participation procedure and intrinsically involves feedback to, and from the Forest User Group (FUG) which made PGIS become a systems-based process whose focus is on participation. Although the system will vary from situation to situation, it should be based around identifying user information needs.

Another important finding was that PGIS can serve as a decision support tool for local people and hence bring back the decision making process to them. This made PGIS a people-oriented process. Also technical performance of the GIS: spatial accuracy and quality of output are all secondary to the need for a participatory approach.

It was concluded that PGIS is an appropriate and advantageous tool for community forestry in Nepal and should have much wider applications in participatory development work. It can empower the FUG by involving them in the decision-making process; effectively combine quantitative and qualitative approaches to community forestry and rural development; spatial data can be given to FUG to aid with their decision-making and negotiations; information can easily collated, analysed and returned to stakeholders with respect for right and ownership. However, GIS can also disempower disadvan-

taged groups and further distance them from the decision-making process. The emphasis had to be firmly on participation father than technical issues.

Integration of local participatory and regional planning for resources management using Remote Sensing and GIS (Sedogo 2002)

This research was aimed to understand the use of GIS in resource management, conflict management, and spatial planning in Burkina Faso. Its methods were using bottom-up approach for land use planning (PRA, RRA) and participatory mapping by photo interpretation to construct a system of maps on land use conflict risk maps which would be used for land use planning process.

Results of the research proved that participatory tools have fully demonstrated its ability to bridge the local knowledge with a GIS environment. Participation-integrated GIS can provide the regional policy-makers and decision-makers with critical and relevant planning information which reflects the true opinions and perceptions of local people. However, participatory mapping could face the risk of bringing hidden conflicts into open.

Using GIS to produce community-based maps to promote collaborative natural resource management, in China (McConchie and McKinnon 2002)

This experience is aimed to test using Mobile Interactive GIS (MIGIS) to facilitate the negotiation and bottom-up solutions in the context of deforestation with Hani farmers of Luchun County, Yunnan in southwest China. MIGIS is the combination of GIS tools in conjunction with Participatory Learning Action (PLA). It proved to bring the best of indigenous knowledge and scientific information together to provide common ground upon which farmers and governmental actors could arrive to common understanding on their environment.

The value-added of GIS into a PLA were that data are credible and quantifiable, easily updated, providing baseline supportive data to intervention evaluation, reflecting physical, social, and economic constraints, assisting to monitoring, easy to access, and is used for test scenarios which helps to address potential conflicts.

It was proved that MIGIS is a powerful set of tool to assist and refine development activities and initiatives which are well-appreciated, accepted and adopted by local people. Hence, it increased the chance of successful intervention.

Platforms and terraces: Bridging participation and GIS in joint-learning for watershed management with the Ifugaos of the Philippines – (Gonzalez 2000)

This research was testing PGIS in supporting the watershed management of a marginalised community – the Ifugaos – in the Philippines with an attempt to determine the relevance of PGIS in rural context, and the capacity of poor farmers in designing of a GIS. This formed a joint-learning process about their problematic situation in natural resources management.

Main findings of the studies about PGIS process were that PGIS was a bridge to connect effort between local and higher level of NRM actors. And though the rural setting limited farmers' participation in manipulating the computer, they played an active part in the spatial dialogue, data processing and analysis. Combination of participatory methods and GIS techniques among people with no computer literacy through:

- o Data acquisition (sketches, interview GPS measurement)
- o Data processing and analysis (photo and satellite image interpretation)

- o Data display (communication/sharing perspective)

It was a satisfactory result of the research that participatory approach in designing a GIS can provide tools to facilitate collective thinking, multi-stakeholders communication and negotiation, which indeed was a joint-learning process.

Community-integrated GIS for land reform in South Africa (Weiner and Harris 1999)

In this study case, the intention of the research was to find out how the implementation of PGIS actually proceeds by applying a community-integrated GIS to support of land and agrarian reform in South Africa. It attempted to obtain local qualitative knowledge from communities and incorporate it into GIS database. Community workshops were organised with several groups divided by age, gender and power position in order to differentiate the knowledge of each group. A participatory mapping exercise was held which yielded to local 'mental maps'. These mental maps were digitised attributed and integrated into a GIS database.

Results mental maps showed a few small areas of changing in area where the black and white farmers used to stay and removed later. The mental maps from elders were interesting because of the deep knowledge of historical landscape and ability to broadly geo-reference their experiences and memories. However, it was a problem of overlapping claims in mental map comparison.

The research proved that PGIS can reveal local people's view, usage and management upon their physical resources. PGIS applications are active and ongoing and it is important to maintain a faithful corporation from the research team and community participants because map-making and map analysis needs to involve community participants regularly.

Explorations of Participatory GIS in Three Andea Watersheds in Peru (Ficenec Date unknown)

This study's focus was on PGIS to a community-based natural resource management in order to learn about how GIS data can be created to facilitate a participatory development process. It has given an empirical evidence of GIS performance in rural participatory resource management, particularly in developing countries limited in educational, administrative, communications and spatial data infrastructure. The used PGIS tools were participatory resource mapping, sketch mapping, large scale aerial photographs provide a means for linking GIS and PRM. Enlarged aerial photographs are presented in village meetings, ground control points from topo-sheet and using GPS.

The results of the process showed that delineation of features over aerial photos proved to be much more time-efficient than walking along the features with a GPS receiver, however, digitising information from aerial photographs is much more challenging than uploading GPS data. However, it was also learned that significant barriers remain for the successful application of GIS by existing institutions in a setting such as the Peruvian Andes. The mapping exercises at the village level allowed stakeholders to express the local spatial knowledge explicitly while stimulating interest and fostering community dialogue for collective resource management. The process ad its preparation was time-demanding, especially for first-time GIS users and was influenced by technical constraints and social and political context in which technology is applied.

3.3. GIS's related issues

3.3.1. Some criteria for assessment of participation in PGIS

According (McCall 2003f), participation is viewed by dimensions of "intensities" – the degrees of participation and by "purposes" – the intension/objectives of participation.

Four intensities can be distinguished, from the least, to the most, 'participatory' level.

1. Information Sharing: implies one- or two-way communication between outsiders and local communities

2. Consultation: The outsiders refer certain issues to local stakeholders, for further details, or refinement, or e.g. for prioritising. External agents pre-define the salient problems, before consultation; thus most of the analysis is controlled by outside.

3. Involvement in Decision-making by all actors: Internal (local) and external actors jointly engage in setting the development agenda, identifying priorities, analysing current status, assessing and selecting alternative 'solutions, implementation, and etc. "Participation is seen as a right, not just the means to achieve project goals".

   A 'weaker' version of this degree of intensity is that at least local people are involved in key areas of decision-making or policy-setting.

4. Initiating Actions: Independent Initiatives from, and 'owned' by, local people who are empowered. E.g. the self-mobilisation of people to perform community activities – this is completely different from simply implementation with their own labour inputs.

5. Sharing of Benefits is sometimes also considered as a form of participation. Participation which results in receiving material goods & services, e.g. 'food-for-work', as incentives. Further, they may not be only material goods, but also political clout or power

Purposes of Promoting 'Participation'

FACILITATION: "Participation" is promoted in order to make it easier to introduce an outside project/ programme:

       for the FACILITATION of "external" projects.

       To improve external project efficiency

       To facilitate & lubricate outside interventions

       To co-opt communities into supporting an outside project

       To pass (a share of) the burden of costs onto the "beneficiaries"

MEDIATION: "Participation" is promoted in order to make links between outside projects and local people and their priorities:

       in order to MEDIATE between "external" purpose and "internal" demands.

       To increase project/programme effectiveness

       For co-production

       To build up capacity of local beneficiaries

       To modify, guide or redirect outside interventions towards local needs, aspirations,   resources.

EMPOWERMENT: Participation is promoted in order to encourage and reinforce local decision-making and local responsibilities:

to lead towards eventual EMPOWERMENT of local peoples.

As moves towards more equitable social redistribution.

To empower weak groups in access to, and control over, resources

To promote people's initiative

(Carver 2003) used the public participation ladder to evaluate a participatory process. He followed the scheme of public participation assessment as hat of a ladder; the base of which represents zero opportunity to participate with successively higher rungs representing increased levels of participation and greater public empowerments in the decision-making process.

Figure 3.1 The public participation ladder (after Aernstan, 1969; Widemann and Femers, 1993, (Carver 2003)
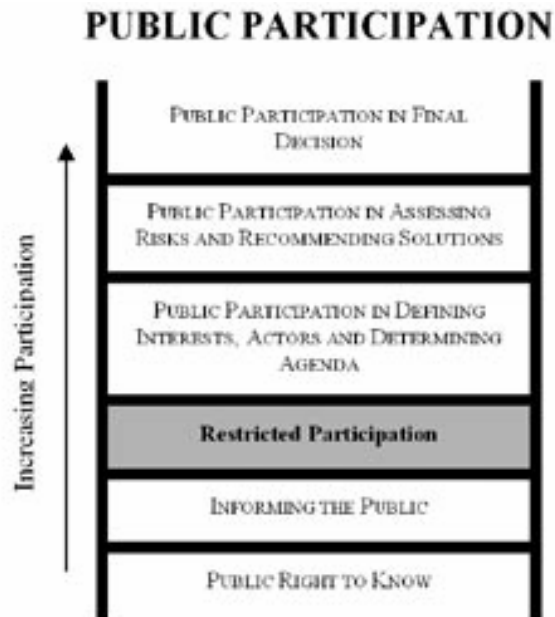
(Laituri 2003) have provide a complex set of criteria and indicators for evaluating PGIS including sets of components and coninuum which showing the degree of the components.

Figure 3.2 Component and continuums of for evaluating PGIS (Laituri 2003)

Components	Continuums of Key Words
1. Context: a. Purpose	Simple → Complex project Day-to-day decisions → Strategic outcomes
b. Stakeholders	Marginal → Mainstream → Elite
c. Linkages	Single → Multiple agencies No trust → Trust
d. Unit of Analysis	Local → Regional → Global
2. Connectivity: a. Policies	Donations → Grants → Funding
b. Infrastructure	Urban → Rural No technology → Best technology
3. Capabilities: a. Basic literacy	Less educated → More educated
b. Computer literacy	Novice → Training → Education
c. Spatial literacy	Novice → Training → Education
4. Content: a. Data availability	Information rich → Information poor
b. Data types	Public data → Sensitive data New data → Inherited or existing data Qualitative data → Quantitative data

However, these sets of criteria belong to different way of measurement and are hard to merge into one standard set of criteria for assessing PGIS.

3.3.2. Cultural aspects

"Culture cannot be precisely defined, for it is something that is perceived, something felt". (Bodley 1994 quoted in (Olutimayin 2002)). The concept of culture in this analysis would simply is "the ways of life" which people were born, grown up and develop in its norms and values.

Culture influence people's behaviour and attitude and hence, to PGIS, as it *"frames the collective mind set of a social group, provides values and norm to the group, and acts as the 'hidden agenda' behind the responses of society to the incoming technology"*. (De Man and van de Toorn 2002) after some exploration of the linkage of culture and effective PGIS has concluded that PGIS and its tech-nology depends heavily to the specific cultural conditions of the environment where the technology is adopted and diffused. It explains at deep-rooted level the persistence or welcome when introducing the technology. The explanations are resulted from understanding of two linked processes: "cultural

desirability" and "cultural feasibility", which support GIS at different stages. The combination of "desirability" and "feasibility" influence the adoption and sustainability of GIS in a certain condition. Suggestion of carrying further operationalisation and empirical studying should be useful and challenging (De Man and van de Toorn 2002).

Besides, Hofstede (1986 in (Olutimayin 2002)) has provided a framework of four dimensions to describe and examine culture as: Power Distance, Uncertainty Avoidance, Masculinity/Femininity, and Individualism/Collectivism.

3.3.3. Power, Empowerment and Political relation

Much literature mentioned the important role of politics, power and other social factor in PGIS as they them to have great influence on (P)GIS's success/failure in reality (Miller 1995; Barndt 1998).

Because geo-information relates closely to power, PGIS has the potential of marginalising and empowering. These processes are occurring simultaneously and are context dependent. Empowering groups through GIS technology can also simultaneously disempower historical leader of that community who are uncomfortable with computer technology. The nature of the technology cannot be split from the politics and social relations associated with its use. Therefore, empowering communities through the use of GIS will therefore require innovative partnerships between GIS users and grassroots community organisation(Harris and Weiner 1998).

3.3.4. PGIS and its relevance/appropriateness (good practice)

From its complex concept, question for PGIS relevance and appropriateness on practice ground has been raised, especially for (P)GIS being applied in developing countries. An analysis of the diffusion of GIS-related technology for development in poorer countries as well as of technology transfer, technical issue, data, and organisational issues which have influences on the success/failure of GIS application of (Dunn, Atkins et al. 1997) has concluded that . GIS technology in some ways may be more useful to poor countries since many issues of poverty relate to large scale problems requiring integration of large spatial dataset; however under appropriate control and with informed use, GIS have the potential to contribute positively. Local knowledge, local control should be incorporated, which emphasised on PGIS as it should never be used as a 'quick fix' strategy; rather its introduction should b slow, with long-term or medium-term training programmes and the design should be relevant to local conditions. Lastly, the authors stressed that GIS should be come a tool in the service of the poor rather than a further technological instrument for their control.

(McCall 2003c; McCall, Dunn et al. 2004a) have summarised that PGIS would meet 'its claims' as a tool for good practice only when if can meet accountability, legitimacy, ownership, with respect for right, equity and competence. A guideline of consequence in PGIS implementation was provided which aimed to help PGIS practitioners be well-prepared for its implementation (McCall 2004b).

3.4. PGIS as and some PGIS-related frameworks

A framework for the use of GI in participatory community planning and development(Rugg 2002) This research suggested a "Spoleto framework" emphasizes the intermediary role of geographic information and its interpretation in processes that basically involve policy makers addressing problems affecting individuals living in communities. In this framework, GI Infrastructure and GI

facilitator play role of channelling information about problems of communities to decision makers. This framework view PGIS as a communication medium between communities and policy makers.

Figure 3.3 Draft Framework for Participatory GIS (Rugg 2002)
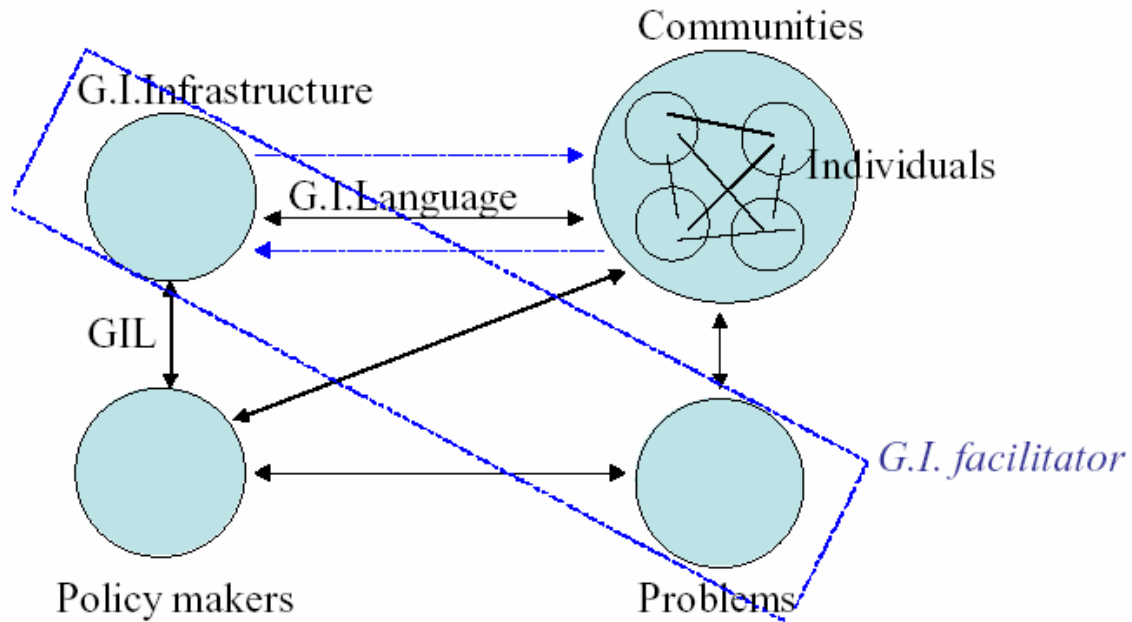
A framework for research on GI-supported participatory decision-making (Jankowski and Nyerges 2003) has suggested a EAST-2 model of interaction process in decision-making with support from geo-information. Components and element of the model were grouped into eight constructs detailed in terms of five aspects (the elements of the conceptual domain) that describe significant issues for characterizing group decision-making. The seven premises of EAST-2 describe the relations among the eight constructs.

- o Construct 1: Social-Institutional Influence
- o Construct 2: Group Participant Influence
- o Construct 3: Participatory GIS influence
- o Construct 4: Appropriation
- o Construct 5: Group process
- o Construct 6: Emergent Influence
- o Construct 7: Task Outcomes
- o Construct 8: Social Outcomes.

Though this model does not describe a process of PGIS, in provide a good overview on the relation of GIS among social context and its contents.

Figure 3.4 EAST-2 framework consisting of convening, process, and outcome constructs (including example aspects) plus the respective premises provides a conceptual map for understanding a participatory decision process (Janowski and Nyerges 2003)
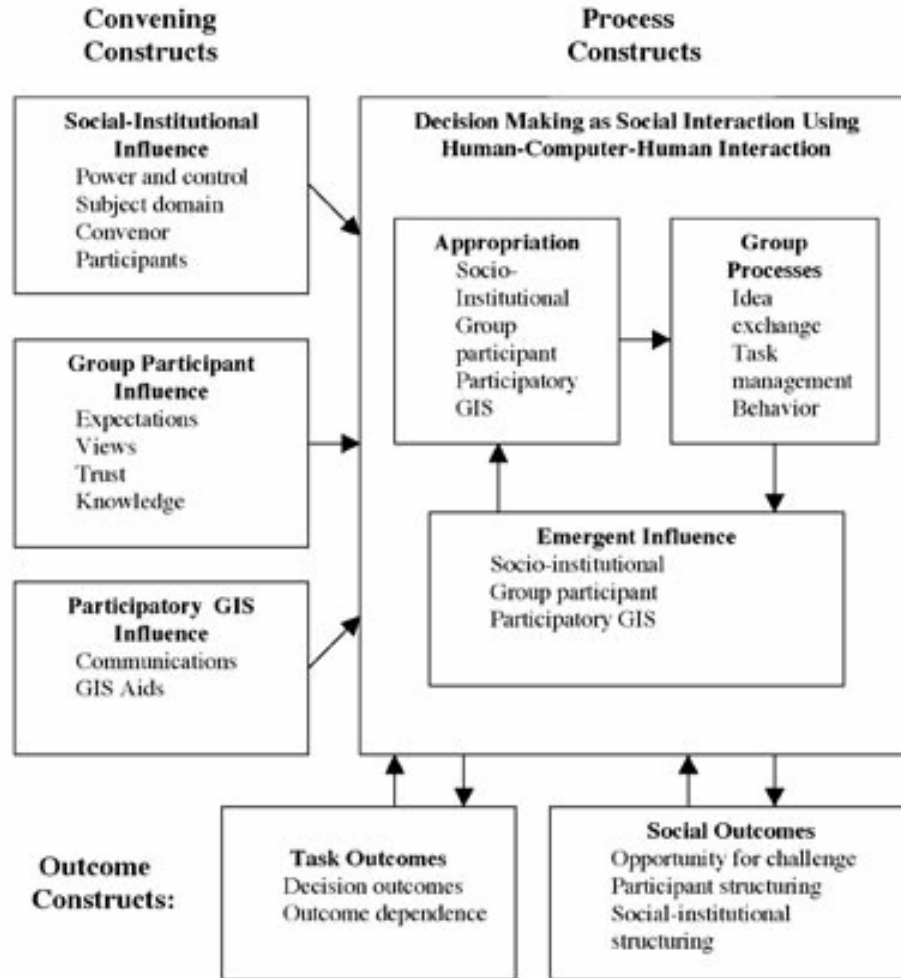
These frameworks provide some visualisation of GIS/PGIS in the relation with social factors, communities, decision-makers and how PGIS can influence society and be influenced back.

4. Bringing PGIS to the field: methods

This chapter describes the research strategies and methods. It was carried out in as a form of a qualitative participatory action research. The '*action*' was involved by a case study on PGIS applied in village development planning for a forest-dependent community in Central part of Vietnam. *'Action'* also meant the researcher actively involved as one actor in the development process. The *'research'* of the study was the observation, note-taking and interview which served as analysis tools towards all details happening during the process of the study case. It also indicates that the research was extended further by looking into other experiences and lessons learnt from other cases.

This chapter will provide some description about: the study area – Loc Tri commune, Phu Loc district, Thua Thien – Hue province, Viet Nam, further details of the research strategies, the important technical processes and major used material and equipments.

It is noticed that though the whole research process could be divided into three main periods: 'before fieldwork', 'during fieldwork' and 'after fieldwork', the chapter will focus on explaining for the two later periods because they provide major steps of arriving to the research outcomes due to the participation-oriented nature of the research. Before fieldwork, the preparation was mainly for building up the research concepts, problems, strategies and a sketched research agenda, as well as for practical preparation of the fieldwork.

An overview of the whole research procedures is presented in the 'Research methods framework' as in Figure 4.1

Figure 4.1 Overview of research process and methods
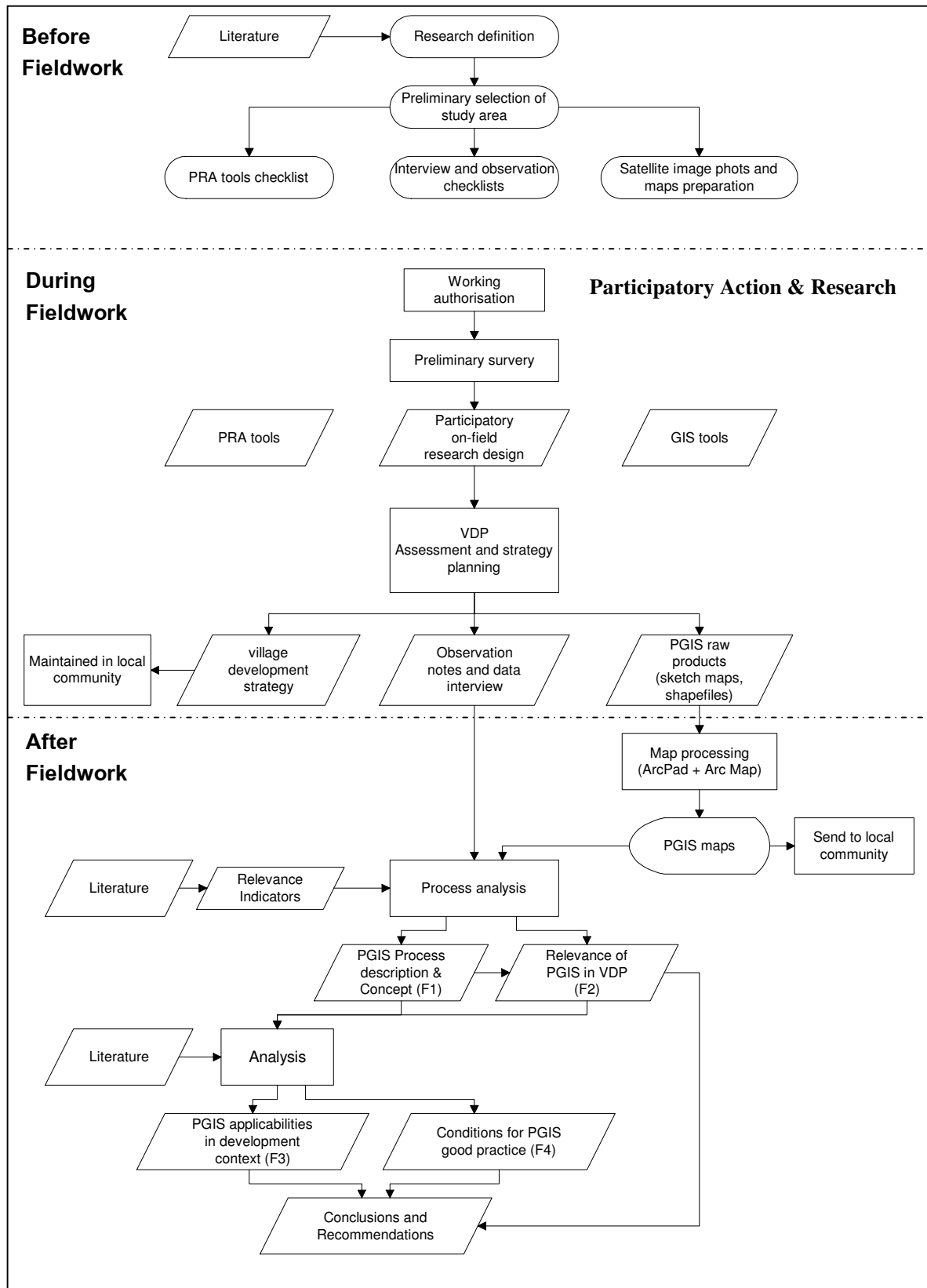
4.1. Loc Tri commune – looking for prosperousness

Loc Tri – unlike as its name means "the remained prosperousness" – is one of the less prosperous communes of Phu Loc district. Although located closely to rich natural resources of "golden forest, silver sea", the commune still has to face certain stormy dilemmas which lie behind the peaceful look of the beautiful nature.

4.1.1. Natural characteristics

Geographical location
The commune is located in the buffer zone of Bach Ma National Park. It's the only commune that has a part of it located within the park and this particular characteristic makes Loc Tri a focusing target in planning process for development activities. It borders to other communes - Loc Dien, Huong Loc, Hoa Bac, Loc Binh - and Phu Loc town in the land territory, and shares the lagoon area with Vinh Hien, Loc Binh communes and also with Phu Loc town. The commune has its location spreading long from forest area into the lagoon which is connected to the East China Sea.

Natural Resources

The most major natural characteristic of the commune is about its richness in the diverse natural resources: it has forest resources, sea and lagoon resources, beautiful landscape, and is surrounded by Cau Hai River and Rui River. The commune total area is 6294 ha, with 3060 ha of forest land, 357 ha of agricultural land. However, 51% of the total commune area belongs to the management of the National Park.

Rainfall is another problem in the areas. It is located in one of the most humid places in Vietnam with approximately 8000 mm rainfall each year, unevenly distributed in the year. Most of the heavy rainfall is between September and December, which quickly bring the water from the high Bach Ma mounts down to the basin of the two rivers and causing domestic flooding to many villages such as Trung Phuoc and Hoa Mau villages many times in every year. March and April are the driest months but even during that time humidity is rarely lower than 75 percent.

Agricultural land is constrained as the total agricultural area is 357 ha of which only 80% is rice field. However not all of this rice field areas can give two crops per year because of irrigation problem.

4.1.2. Socio-economic situation

According to the most recent inventory data from the commune's administration, its total population is 1573 households with 8779 heads which leads to density of the whole commune as 140 people/km[1]. Among 1573 households, 11% of them are listed in the lowest wealth ranking category, 71% are under poor to medium category, and 18% are in better-off category. Yet, these numbers do not reflect much about poverty situation, because the big gap between those in the very poor group those in the better-off situation. Also there is not clear cut among the majority of population, which mistaken the poor household into the same group with those are at medium economic status.

General economic situation is in a critical time because of raising needs and constrained resource access. Unlike many other poor areas, Loc Tri is a gifted commune by the richness of natural resources for having: forest, sea, and a great area of water bodies. However, since the National Park is officially

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[1] Source: Loc Tri commune, Administrative Office, collected date: 28 September 2003

founded in 1984, access to forest has become limited and illegal. The central-control land-use and land-titling policies leave only bare and degraded areas accessible to farmers. In order to make use of them, farmers need either the information on different possible schemes/models or money to convert the fallow area into forestation or both of them. At the forest side, many villagers living just next to the sea but they do not know how to make profit from fishery as most of them are farmers who originally live on water-paddy rice cultivation. Though the lagoon is close but investment for prawn cultivation field is expensive and most of farmers can not have the ability to afford for building this prawn cultivation field as well as investing on prawn breeds etc. On the other hand, all farmers here are highly depend on both forest and sea products for their daily consumption: foods, fuel-wood, housing, fishing-boats etc. This situation creates a big constrain in accessing to forest, land and sea resources and thus consequently leads to poor income and low-living standard of the people in the area.

Income generation activities are mainly rice production, husbandry, small enterprise, local services and forest products collection (fuel wood, NTFPs etc.). In some villages, a new form of income generation has been activated as "eco-tourism" at some tourist spots of the National Park, as in Khe Xu village for example.

Fast growing population, non-growing land, reduced resource access, these lead to a common problem in all villages – vast unused labour. Every year, about 150-200 people migrate to other provinces to work as construction workers, carpenters etc (for men) and garment workers and house-maids (for women/young girls).

Health care is at the basic level as in other rural area: there is one commune health care centre with basic equipments and one health worker. The commune has two kinder garden schools and one primary school with 27 teachers, which serve more than 1000 pupils. There is a proportion of children who do not go to school, which mainly resulted from economic constrain of the family.

Figure 4.2 Location of Bach Ma National Park and Loc Tri commune[2]

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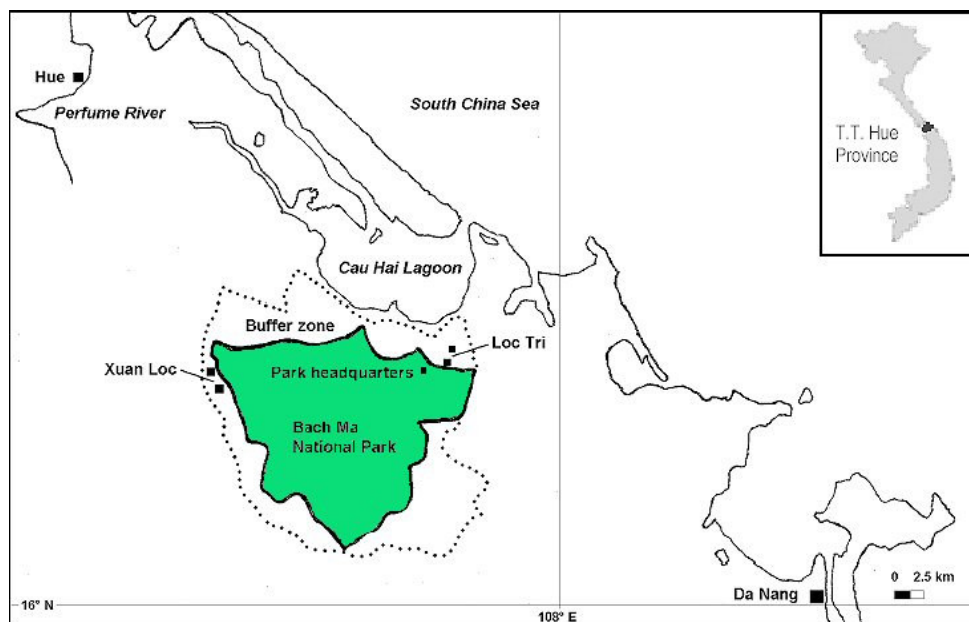
[2] Source: Tropenbos's website: www.tropenbos.nl

Figure 4.3 Bach Ma National Park: core zone and buffer zone[3]
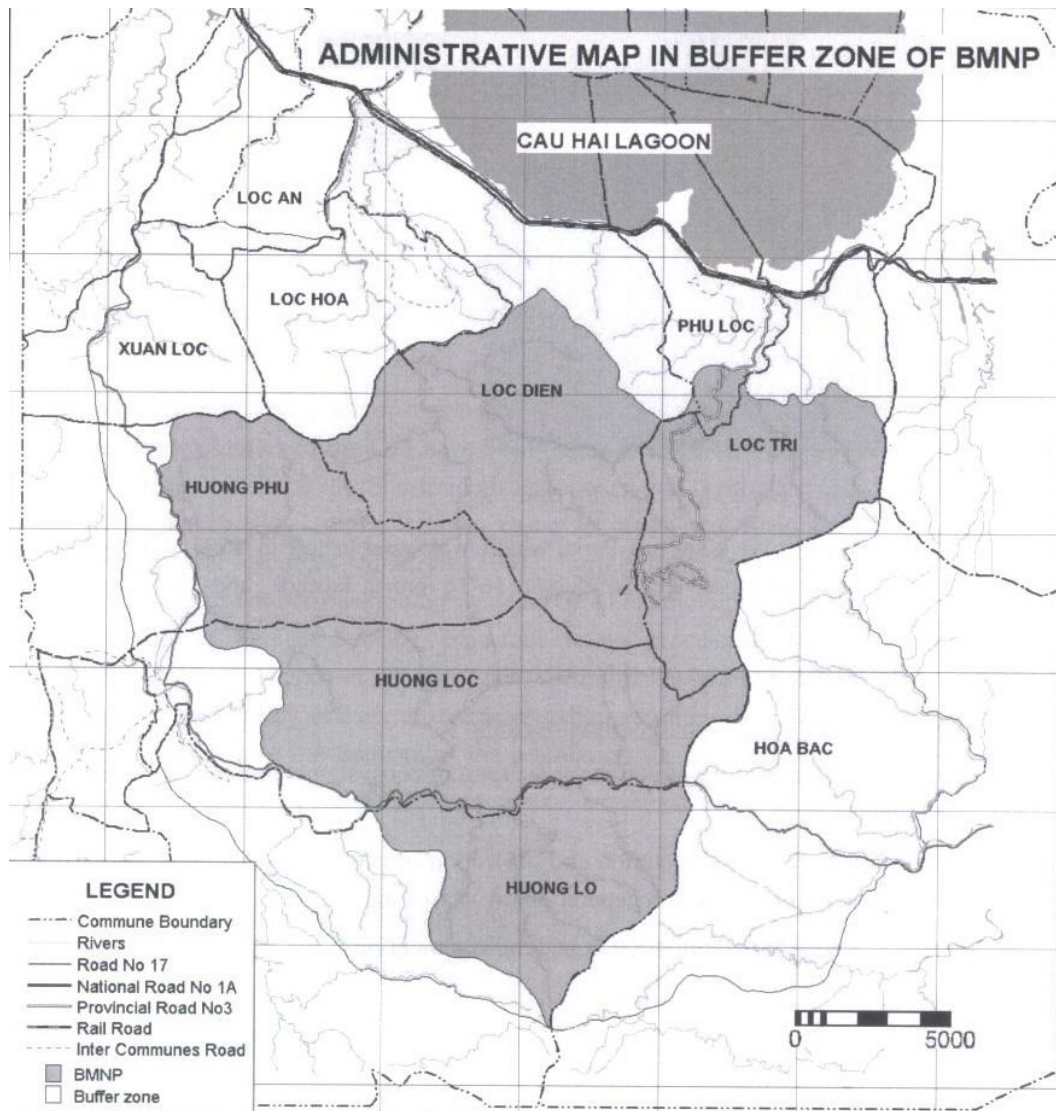
4.2. Research strategies – a focus on participatory action research (PAR)

Because focus of this research is on the social aspects of technology application in grass-root processes, main research strategies are: participation-oriented, qualitative participatory action and research, and using experiences inheriting from literature resources.

Participation-oriented research – toward a mutual learning process

This strategy is aimed to ensure participatory nature of the research as has defined: "participatory research is a process through which members of an oppressed group or community identify a problem, collect and analyse information, and act upon the problem in order to find solutions".

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[3] Source: Vu Tien Dien (2004). Susceptibility to Forest Degradation: a case study of the application of Remote Sensing & GIS in Bach Ma National Park, Thua Thien Hue province - Vietnam - Unpublished MSc thesis. <u>Natural Resources Management</u>. Enschede, ITC**:** 71.

This participatory manner of researching matches well with the approaches of grass-root development activities that have become popularised in rural areas – Participatory Rural Appraisal whose one stressed distinguishable principle is about sharing knowledge between outsiders and insiders(Chambers 1994).

Following this strategy, the research was designed in a loose form. Flexibility and open-mindedness were stressed from the beginning of the fieldwork to ensure rooms for participation. A proper learning attitude towards local people and authorities was appropriately maintained. Though local communities did not participate in designing the research, their needs and interests were set as priorities in deciding the content of PGIS exercises, and hence the research could benefit both the researcher and local communities. However, finding a good compromise for a win-win situation was not easy. This mutual learning process could be well expressed as the quote:

> "We both know some things; neither of us know everything. Working together, we will know more, and we will both learn more about how to know" (Maguire in(Selener 1997)).

Qualitative research

This research is an exploration research which based on a case study of a participatory local planning exercise. The researched was not about a 'fixed' object for implicit measurement, but about a process of dealing with people, which was very dynamic, explicit and hard to measure in quantitative scale. Therefore, its measurement, and sets criteria and indicators are qualitative and explicit.

For example: measurement based on observation, interviewee's opinions, measurement of participation with active participation, intensive participation; measurement of empowerment: ability of making choices and influencing decision-making process.

A double role

An important aspect of a participatory action and research is the combination of 'acting' and 'researching'. In this research, I had to act as a 'consultant' in village development planning and GIS application in order to facilitate the process, and at the same time to play the role of a researcher by keeping a constant observation to all details, memorising connected issues and events, questioning and finding answers etc. This was a hard work because it required very strong conscious about every details happening during the process as well as a conscious of true mixing with local communities. It is true to say that acting tests our idea, and by acting with an interest based on thinking and feeling, we could achieve very fruitful way of learning, which indeed coincide with the purpose of scientific research. (Selener 1997)

Practical experience plus literature support

However, as it was a participation-oriented research, the case study faced many uncertainties and therefore led to many changes in the research details. In additional with almost zero availability of secondary information on the study area before fieldwork, this approach limits the possibility of doing a case study with best preparation. Moreover, within the scale of a MSc research, time and resources were limited to carry a long standard participatory research, it was not possible to provide insight to understand all social aspects of PGIS which was an important main objective of the research. A combination of practical experience and literature records was used to compliment each other: contributing the new findings and inheriting experiences and lessons that have been concludes by other authors in the same field and in similar context (which is rural development in this particular research)

4.3. A combination of Participatory Village Development Planning (VDP) & GIS tools application

The research was conducted on the field with two main set of tools: PRA tools which are used for a Participatory Village Development Planning workshop, and GIS tools. They are used in a combination which was purposely organised from the preparation period of the research to compliment the strength and weakness of each other.

4.3.1. Participatory Village Development Planning:

This planning approach has been applied in several forms in Vietnam during the last five years. However, within the limited scale of time and resource of this research, it was not possible to conduct a lengthy sophisticated Village Development Planning process which would require much longer time, material and institutional support. Moreover, the topic was adopted into the research only on the study site when not much methodology preparation could be made, and it was very new form of development activity as there had been no village development planning in the area before, as well as GIS application at village level. These constrains forced the participatory planning process to be as simple, yet efficient as it could be.

The PVDP in each village was conducted in four main sessions:

i) **A preparation meeting** to explain the purpose and content of the study, to discuss on practical issues e.g. time and timing, venue and participants.

ii) **Problem identification and analysis**: to particularly assess the problems in the village and analyse their relation among each other.

iii) **Solution identification and analysis**: to look for opportunities and possible solutions for problem solving based on the strength and weakness of the area.

iv) **Strategy planning**: to decide on the sequence of possible interventions by giving priority to each solution. This was done on the basis of the problem analysis in combination with a on-site analysis and discussion during the transect.

Basic traditional tools of PRA were used including: brain-storming, making problem tree, sketch mapping, transect walk, solution analysis, priority ranking and semi-structure discussion/interview. (See Appendix 5 and (McCall 2002))

4.3.2. Main used GIS tools

Criteria to select GIS tools for supporting VDP are: the device should be portable, compact, and mobile e.g. i-paq, GPS; the materials should be available in at local condition e.g. participatory mapping on transparencies; a reasonable medium for interactive participation of a group such as the laptop screen.

i) **Mobile GIS**: a system of a GPS connected to an i-paq, using a Mr.SID file and ArcPad software to recognise the area and to record points, polylines and polygons on the field and directly have data stored as a form of GIS. Functions of mobile GIS could be much more advanced, however, in this research it was used for purpose of: location orientation at the beginning stage, and record the location and area of problematic sites in the village which also closely linked to the development activities. Recorded data were under forms of points, polylines and polygons. This tool was 'technically tested' during preparatory

phase to give location orientation of the village and used in combination with the transect walk.

ii) **Participatory mapping**: this tool was applied in two ways: mapping on the laptop screen and mapping on transparencies. It includes an interpretation of a satellite image photo of the area and marking main categories of land-use types in the area, and recognising the location for development interventions. This tool was used in combination with the strategy planning step.

iii) **Sketch mapping**: though it was not a computerised tool and is counted as a PRA tool, it was considered as an important step to learn about local mental map before they were exposed to the mapping exercise with satellite image photo.

Secondary data collection

Social-economic information about study areas were collected as secondary data from two sources: the commune centre and the Community Forestry Department in Bach Ma National Park. This information was mainly used to describe about the study area in the earlier part.

Literature was an important source of qualitative opinion support. The searching on internet and from the library of ITC provides numerous amounts of literature that were useful for this research.

In this research, several maps were used as coming from source: Mr. Vu Tien Dien – staff of Vietnam Forest Inventory and Planning Institute.

4.4. Data analysis

Process analysis

The analysis was based on 'process analysis': analysis of consequences of the steps and events happened along to understand the cause-effect relationship among researching elements, then arrive to the first finding.

Because there is no available set of criteria for assessing PGIS's relevance to development context, a selection of criteria was made based on findings and suggestions from literatures including (Quan, Oudwater et al. 2001; Minang 2003; McCall, Dunn et al. 2004a). Justification/criteria of indicators are based on a guideline of criteria and indicators from (Dopheide, Verplanke et al. 2002).

Observation notes and interview data were analysis in a form of content analysis: coding key terms and concepts. However, no quantitative analysis of these terms was made. The analysis was done in as a qualitative analysis. For some factors, analysis was made based on a combination of both quantified and qualitative indicators: the learning attitude of local people was analysis by observation on qualitative interaction "interested" "doubtful" and "not interested", however with the number of people fall into each category can be quantified easily. This methods is well-supported by Chamber (2002).

Map processing and analysis

The map process and analysis was done based on two set of collected geo-information data sets: 1) data collected from mobile-GIS and data collected from mobile GIS (on paper and computerised files). Several steps were taken before these two map sets were merge and combined as it is shown in Figure4.4 below:

Figure 4.4 Process of PGIS mapping and analysis
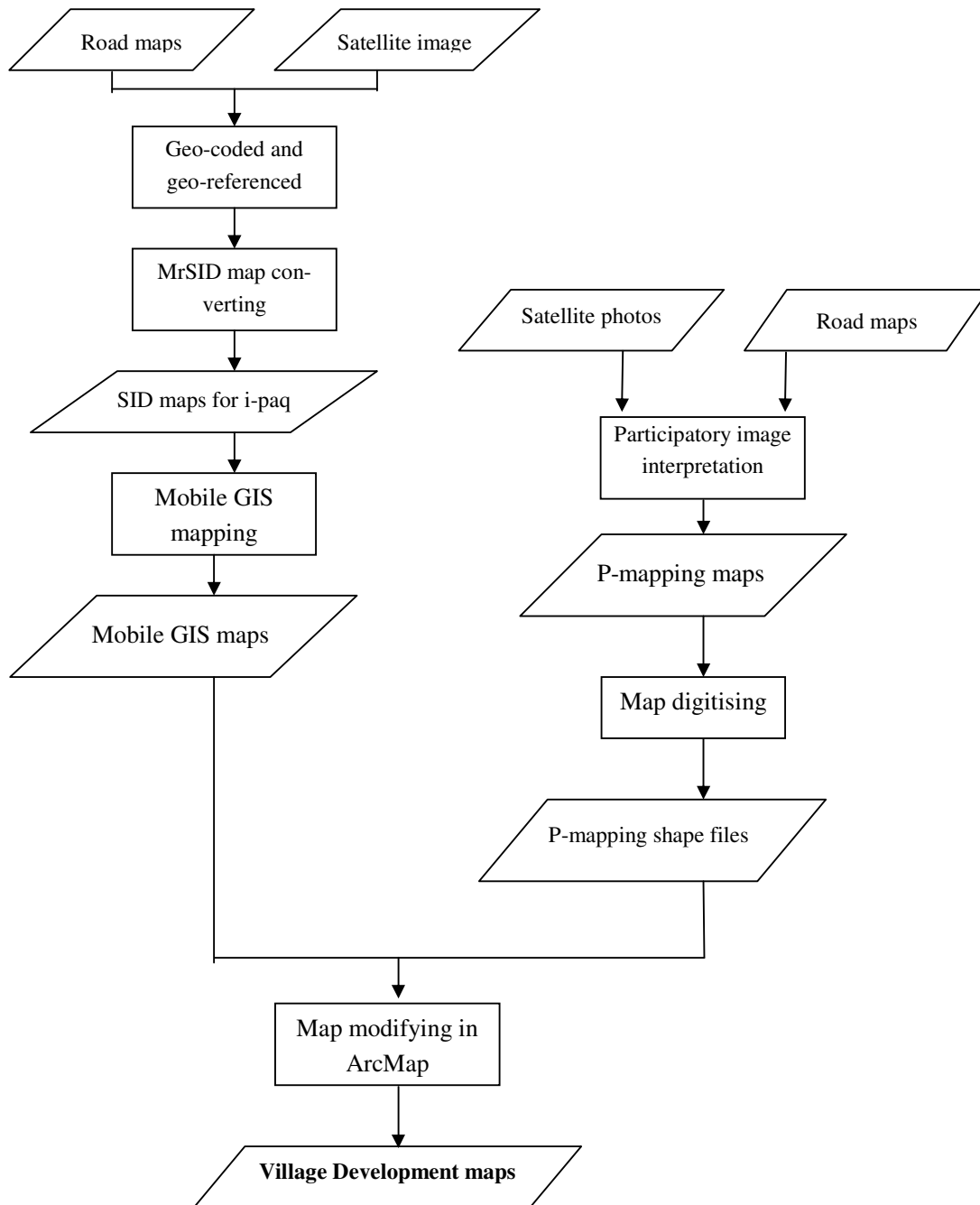
4.5. Materials and equipments

a.   Materials

- o   Satellite image: Landsat7-ETM+, image acquired on 21 April, 2003, processed in ERDAS imagine 8.6 (geometric correction and colour composition). Printed copies to field at scale of 1:50,000.
- o   Road map: shapefile format, source: informatics department, Bach Ma National Park

b.   Equipments and software

- o   01 Laptop , ArcPad
- o   01 GPS set + I-pad
- o   Digital camera
- o   Other stationeries for participatory exercises.
- o   Post fieldwork map processing in AcrMap/ArcGIS

4.6. Limitations in this study

,This study was constrained by a number of factors during the whole research process due to the limited scale of a MSc and unexpected events that happened.

In preparation period

- Very little information about the study area was found during research preparation period. The lack of basis information on study area: social conditions, social needs etc. have brought many unanswerable questions before the fieldwork.

- The research strategy of participatory-orientation requires an extent of courage to deal with uncertainties and changes during fieldwork. This was reflected by the changing focus of GIS application and led to lack of proper preparation to the new topic.

On site period:

- As the study was carried out as a field test of a research topic, yet the on-field activities require a team-work corporation in participatory process as well as real PGIS practice.
- The time for on-field activities were too limited for a PGIS test.
- The study area size is small and data of interview is not large enough for making a quantitative measure/statistical test
- Weather season during field work was not favourable: rain was continue for whole week and caused flooding in some village, hence caused delay and cancellation of PGIS sessions in Hoa Mau and Khe Xu villages.
- Technical reliability of used equipment was not high. I-paq/GPS cable connector often broke up.

Processing period:

- Analysis observations and interview data was mainly based on qualitative opinion. Because of small size of collected data sets, and lack of methodology preparation before fieldwork, no quantitative analysis for social science was possible to apply. Therefore, conclusions of the research are more subjective than those drawn from a statistical analysis.

5. The facts and truth: some findings about PGIS process

In this chapter, outcomes of the research are presented including the planning process of itself and the plans that had been made at the extent of their practical possibility because the focus of this research is not in the output of a complete village development plan, but to test the application of PGIS in the process. Literature evidences that have come only after the fieldwork period will be used to support the weakness of research which caused by time and resource limitation.

5.1. Participatory Village Development Planning using GIS – the case study in Loc Tri commune, Bach Ma National Park buffer zone (for objective 1)

Because the focus of this research is not in the output of a complete village development plan, but to test the application of PGIS in the process, outcomes of the research are counted as the process of planning and the plans that had been made at the extent of their practical possibility.

The process of local planning using GIS was carried out in main three phases: the preparatory phase, assessment phase and action phase. In each phase, beside the classical PRA tools of VDP process, GIS tools applied as a form of attachment in participatory tools. In Table 5.1 below, the 'grey-shaded' boxes imply the differences of using GIS tools in VDP from a normal classical PRA work-shop.

Details of analysing the process were about the purpose, applied tools, and interactions of participation and technology in each step.

Due to limitation of the study, not a full VDP could be followed up. The Action phase of the VDP including the steps such as 'plan approval' or 'activities implementation' requires much longer time and more resources to be carried out. Therefore, the 'yellow-shaded' boxes in Table 5.1 show the later steps of VDP that could not be held in this study, yet they likely receive certain impacts from PGIS's support.

Table 5.1Summary of the process of PVDP using GIS

		Steps	**Tools used**	**Outcomes**
Participatory Village Development Planning using GIS	*Preparatory phase*	Working authorisation	Social skills	Authorised paper to work in villages Getting in contact with village leaders
		Preliminary survey	Observation	Selected target villages
			Informal interview	
			Mobile GIS	Point maps showing location of all villages
	Assessment phase	Preparation meeting	Ice-breaking	Motivation to participate
			SI reading exercise	Working agenda
		Problem analysis	Current situation analysis	Advantages and disadvantages of the village
			Problem tree analysis	Village Problem Tree
			Sketch map	Village Sketch Map
		Solution analysis	Solution finding	A set of solutions
			Transect walk	Point maps, Polylines and Polygones maps showing positions of different development solutions
			Mobile GIS	
	Action phase	Strategic Planning	Solution priority ranking	Solutions ranked at their priorities
			Participatory mapping on paper/screen	A map showing location of development plans
		Plan Approving	Use of map to support decision-making process	
		Implementation of Plans	Use of map for activity implementation	
		Monitoring and Evaluation (M&E)	Use of map for participatory M&E	

From Table 5.2, we could see that there was involvement of GIS using in all phases of the planning process in parallel with fundamental PRA tools. Each phase will be described in details about its process and how local people interacted with GIS technology.

5.1.1. Preparatory phase

The preparatory phase was aimed for two main purposes: a) reaching the villages including getting authorised get into the villages and to explore their geographical, social, cultural conditions, people and in turn to get myself being known by the local communities including the authorities and the villagers; and b) carrying out a preliminary survey for target selection.

a) Reaching the villages

In order to get into the villages, a permission letter must be issued by the commune authorities. This means my research and I must be recognised by the commune authorities. The conditions for being at this stage were: being introduced officially by a higher level of authorities, in this case, the introduction letter was provided by the National Park, and having a clear presentation of the study's purposes and activities to the commune authorities.

It was difficult for me to be introducing myself to the local authorities as a young woman who comes from the capital city and asking them for a meeting while so many events were happening in the areas e.g. meetings, visits, reports. I had to contact the Women's Union as the first step in approach the commune authorities, with three reasons: a) the commune authorities were too busy and did not have time to give me an appointment, b) I feel more comfortable and confident in working with the women due to my experiences of working with women group at grass-root level, and c) the women organisation is more available, warm-welcoming and easy to approach.

The meeting with the Chairperson of the Commune Women's Union – Mrs Thi – were very productive. She helped me to make an appointment with Commune Management and provided me basic information about all villages in the commune including approximate geographical location, general socio-economic situation, contact persons and the way to reach the villages.

The process of approaching the villages is summarised as below:

Figure 5.1 Process of approaching grass-root level
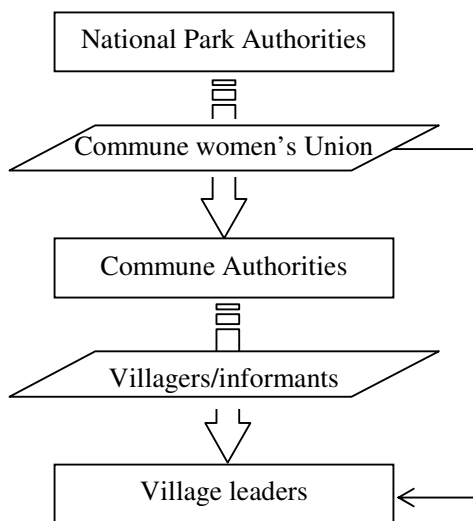
Figure 5.1 shows two main types of organisations that exist in the formality procedure process: formal institutions as the 'hard structure' that I had to get through: from higher level of authorities to lower one; and informal institutions 'soft structure' that 'channelled me through the process and helped me

to reach/approach the 'hard structure' more smoothly. In my particular case of the research, this informal institution is the Commune Women's Union. However, in generalised context of rural developing countries, they can be other organisations such as CBOs/civil organisation (Farmer Association, Youth Union etc.), or a connector organisation such as Project Office, NGOs, liaised contacts depending on the topic or professional area of the GIS's application process

b) Preliminary survey

The preliminary survey was carried out to select the target villages. Certain criteria to for target villages were mainly based on the geographical identities in relation to forest and the friendliness of the village authorities. More detailed of the criteria and survey results are presented in Appendix1.

Due to the initial intention of doing a livelihoods analysis applying PGIS which was still available till this stage of the study and because in livelihoods study in a National Park buffer zone, the research target was on forest-dependent groups. Therefore, criteria for selecting the villages were based on the relation of the population to forest area and its extent of forest-dependence

Participation in this period was very low. It was possible to discuss about village selection with only one technical staff of the National Park. Participation from commune authorities was almost impossible because of the relational distance between the researcher and local authorities in this beginning stage.

Four out of eight villages in the commune were selected as target villages:

Khe Xu village was selected because it is a very unique village as it is the only village located within the area of National Park. Though administrative area of the village is large, most of this land belong to the Park and therefore is not under the management of local people and they don't have legal access to make use of this land. Village population is small but is the only village doing ecological tourism scheme (receiving foreign tourists to stay within the village). The Head of village was very hospitable, open and active and this promised a good collaboration.

Hoa Mau village was selected because of its close distance to forest, medium hospitality from the village leader, and various activities on income-generated activities e.g. carpenter, ecological tourism, NTFPs collection.

Phuoc Tuong village was selected because of close location to forest, its unique location which is near to both sea and forest, and very warm hospitality from the village leaders.

Though *Trung Phuoc village*'s leader did not give a very warm welcome to the researcher's offer for participating in the research, it was selected because the village is at large area, with big population and close location to forest area.

5.1.2. Assessment phase

This phase was taken place in many small steps: preparation meeting, problem analysis, solution analysis and strategic planning. Details on purposes, used tools, outcomes, obstacles and interaction of people with GIS tools in each step are described as below.

Preparation meeting (ice-breaking) step

The purpose of this step is to create a good person-to-person understanding for me and the village representatives who are going to take part in the coming up sessions. I also needed to make a clear ex-

planation about the contents of the exercise, main concepts and tools that will be used. For example: explaining about concepts of participatory approach in planning, bottom-up process and GIS. It was noted that explaining about GIS to farmers/villagers was not always easy.

The tools were used in this step were ice-breaking introduction, interactive discussion, and a simple satellite photo interpretation on the image of the area.

At the end of this step, the local representative should be clear, well prepared and motivated for what they are going to do the in next coming three days. A detailed working agenda for the following days/sessions should be made which fit in the schedule of all/most participants so they can arrange their time and family activities.

In this step, the difficulties for me was to 'break' the wall in getting to know people, to remember their names, to address them with proper word in local language, and to understand and start using some local dialect in our conversations.

It was interesting to see the reactions of people in the satellite image reading.   Two main criteria of attitudes happened in this exercise were about showing some extent of interest and showing some extent of understanding. Observation combined with interview results showed number of people who participated in preparation meetings in three villages (with total number of 24 people) fell in each category as in Table 5.2.

Table 5.2 Interaction of participants to satellite image reading

	Understand	Half-understand	"Have no idea"	Total 1
Interested	4	2	7	13
Doubtful-looking	0	4	4	8
Not interested	0	0	3	3
Total 2	4	6	14	24

The figures in the table above show that the number of people who were interested in the exercise dominant the total of people who were doubtful and not interested. At the same time, most of them did not understand the image at the first place, some half-recognise and some could recognise different areas and objects very quickly. Those who "had no idea" of the satellite image reading consequently became doubtful or losing interest in the session, yet half of them remained as very interested. When answering the question "*why you were interested?*" in the interview, they said that because they were curious to know what it is. In my observation, people who recognised the area would explain to others and they were very excited. This shows a community of learning through a process of working together.

The interview analysis gave several reasons for most of villagers did not understand the satellite image. They were confused by the small scale of the image and its false colours. What would make them to recognise the map more quickly were to show them the overlay of the image with other map such as road map, or to give them some hints on an typical object and on one colour of a land cover type e.g. cyan line shows the national road, dark blue line is river, or brown colour is forest. The interview answers also pointed out that the villagers were interested and impressed with this exercise because it was a very modern technology - something totally new that they had never seen before. In

Phuoc Tuong village, it was even seen as *"a great fun – a good entertainment"*. They also admitted that the image reflected very closely their area and they really admired it. All people who were not interested said that it was because they did not understand the image and the computer.

This new, mysterious and colourful-looking satellite photo created curiosity and motivation in villagers who were very keen to learn about the modern technology to participate in the next sessions. Through this learning process, I also got closer to the villagers because of the interaction and a certain level of gained trust/respect.

Problem analysis step

This step is aimed for both local people and the outsider to review the overall situation in the area to identify their opportunities, problems and the relations among them. It was noted that the whole exercise was to focus to village development and local planning; hence issues concerning natural resources management e.g. agricultural land use, forest management were more stressed at and further discussed than issues of social problems. However, it was aware that there could be a linkage among them e.g. the shortage of agricultural land and lack of access to forest resources resulted to large proportion of jobless population, which consequently yielded to labour immigration to big cities such as Da Nang or Ho Chi Minh city[4].

The step was carried out by having group discussion, brainstorming on current situation, problems and opportunities. The problem tree analysis tool was used to review the problems in their cause-effect relations, and a sketch mapping exercise was done to visualise the problems in their spatial relations.

Problem analysis in Trung Phuoc village

Trung Phuoc is one of the villages located adjacent to forest are of Bach Ma National Park. The village has 156 households among which only 6 live on prawn cultivation and the rest is dependent on water-rice cultivation. The village has advantages of its location which is close to both forest and sea (lagoon) areas and a large area of unused shrub land near the forest.

However, there are more problems in Trung Phuoc village than its advantages. The most concerned problem is in agricultural land. The total area of rice field in the village is 31.6 ha. Average area for each household (with average of five heads per household) is 0.2 ha. Yet, many areas of the rice fields are unusable because of being 'salty' by the invading flooding from the lagoon every year. Water management for the rice production is not under farmer's ability and irrigation service is not sufficient as some irrigation dams and dikes are not made from stable material and therefore need to be rebuilt every year. These difficulties lead to low rice productivity which is only two tons per hectare per year. Forest is the second important natural resource in the village. Forest land for home garden in each household is very scattered. Though the villagers are responsible for forest fire protection and illegal logging but they do not have the rights to make benefit from forest. Yet, the villagers are heavily dependent on forest resources - which have been strictly restricted - for fuel wood, timber and non-timber forest products (NTFPs). This leads to low income level and jobless situation. Consequently, many people have to immigrate to big cities for jobs e.g. being industrial garment workers, building workers, and house-keepers. Because of shortage of fuel wood, villagers are looking for solutions of alternative energy. Other natural resource such as drinking water is also in constrain as water most of the wells in the village is sour and need some processing. Infrastructure system of the village is very

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[4] Source: PRA data from Phuoc Tuong village, date 8 September 2003

weak: there is no electricity line, domestic roads are in bad conditions. Especially, the women's union stressed on the need of having a kinder-garden school in the village.

Below is the problem tree showing the relations among the problems.

Figure 5.2 Problem tree in Trung Phuoc village's PRA
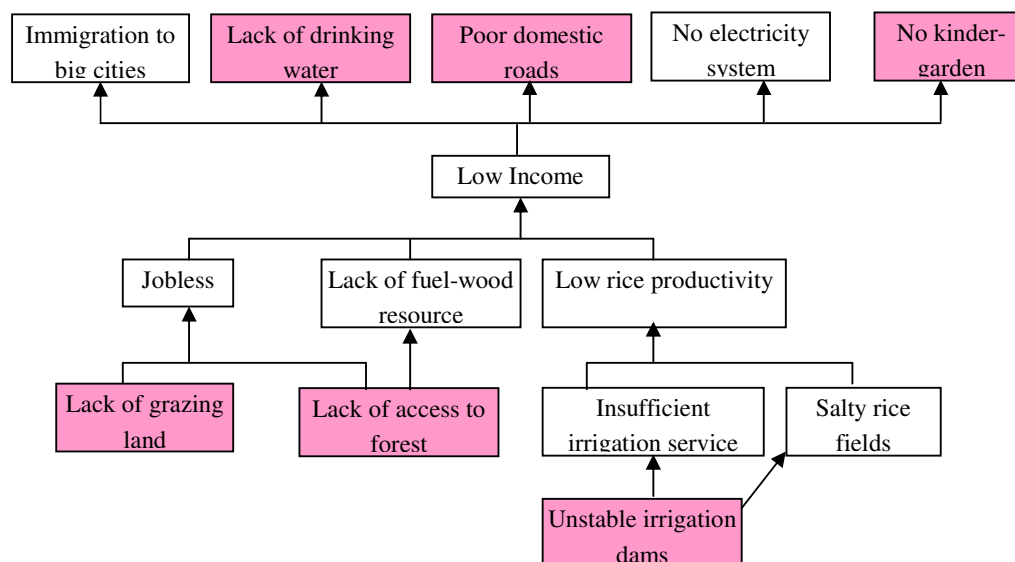
It was observed that the men were giving more emphasis on issues of grazing land, roads and irrigation whilst the women emphasised on the importance of kinder garden school and the poor drinking water supply which closely related to health issue.

The main obstacle in this step is the power holding way of meeting in the villages. Village authorities are more suspicious when discussing about problems in the village. In Phuoc Tuong village, village authorities refused to have brainstorming on the problems of villagers. The suspicion could be resulted from lack of trust and understanding which was partly due to poor explanation of the facilitator. Timing was an important issue because in all villages, farmers could not spend too many hours for a session of PRA. For example: meeting time in Phuoc Tuong village started from 7.30 am and not exceeded lunch time while or meeting time in Trung Phuoc village started mostly from 2.30 pm and could last until evening. However, because there was no electricity in the village, working in evening with oil-lamps were not productive and distracted.

In this step, interactions of villagers with GIS tools happened during sketch mapping exercise. Observation in all three villages showed that participation in sketch mapping was not always even. In Phuoc Tuong and Trung Phuoc villages, all participants actively involved and contributed to sketch map while in Khe Xu villages, only the Head of village took charge of making sketch map. However, the sketch map in Phuoc Tuong village was not as detailed as the one in Khe Xu village. This was explained by the degree of 'being serious' in participating in the exercise of the participants. Specifically, the sketch map in Phuoc Tuong village was made at the end of the morning, very close to lunch time when people were distracted to go home, so they rushed finishing the work, while in Khe Xu village, the Head of village took more time in the afternoon to carefully make the sketch map in details.

From the interviews, all participants said that making sketch map was both easy and difficult. It was easy because "the map is always in our mind" and they could easily work with pen and papers. But it

was also difficult because they did not know the exact shape of the areas. However, it was useful to have the sketch map in their analysis because it represented the problems in visualisation and showed the geographical/spatial relations among them. With the sketch map, villagers could clearly explain and demonstrate their problems with more confidence. Interview data also pointed out that sketch mapping was an important preparation step for participatory mapping as it provided hints and orientation for villagers before they could map on computer or on the satellite image photo. Through the process of making sketch map, participants including both local people and outsider learned about current situation in the village and the approximate spatial location of each issue. For example in Trung Phuoc village, many people who live nearer to forest did not know about the areas of salt-invaded rice field; participants also learned about the boundary of their village through discussion with village authorities.

In the sketch map presentation, local people decided themselves upon what symbols and in what colours they want to present certain subjects. Categories of mapped subjects were also decided by them, which later on were explained in the legend of sketch map.

Figure 5.3 Sketch map of Trung Phuoc village
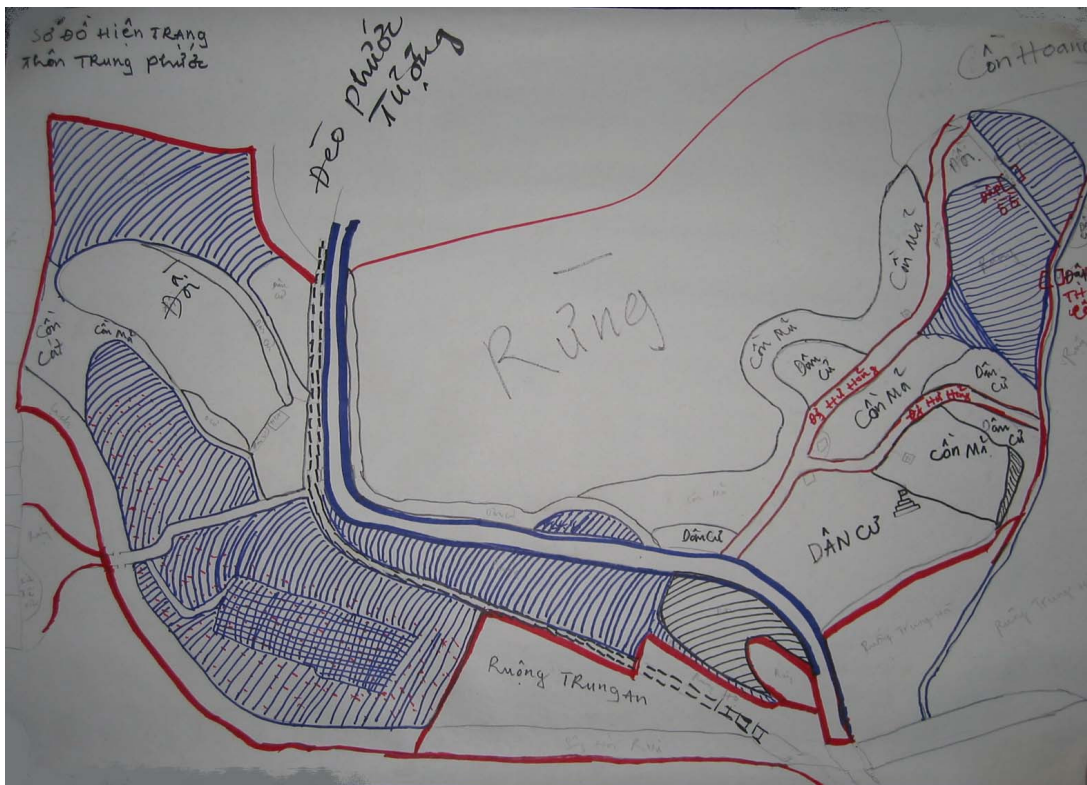
Solution analysis step

By using solution-oriented approach, the purpose of this step is seeking for solution based on available resources to overcome problems which were scanned in the previous step.

Through discussion and based on the village problem tree, a set of solutions were identified making it a solution tree. A transect walk were made afterward to give all participants a review on the overall situation of the village: its available resources, locations and current status of problematic sites and

their potential solutions. The mobile GIS was used in this step to record different sites into maps and make on-site measurement e.g. area of a potential farm, the length of the very bad quality village road that needed to be fixed.

Because of the out door session - transect walk, interaction of people in this step was more active. However, local people did not ask or pay much attention to mobile GIS on how GPS and i-paq work but were more concentrated to practical issues: which way to go to have a more comprehensive view of the village, what potential in each on-stop site. After the transect walk, local people said that they learned a lot about their own village: the village boundary, village potential for long term development etc. They were highly impressed by how mobile GIS can give very accurate calculation of the field or the road. This also brought much of trust in this first-time-ever-seen technology to them.

Mobile GIS combined with transect walk made a productive and well-informed analysis process. It combines both advantages of spatial accurate calculation and local knowledge. The equipments are fairly compact and easy to carry along. However, several problems might occur and needed to pay much attention such as the battery of i-paq and GPS, the connection of the cables that connect GPS to i-paq. It was noted that any technical problem, even just a small one, may result to big delay for the whole transect walk which would have negative impact on the participation, bring up frustration from waiting time, and subsequently would lead to losing trust.

5.1.3. Action phase

Strategic Planning step

The purpose of this step is to filter the identified solutions to focal activities based on critical needs of the villagers and available resources. These make a foundation for the village development plan whose development activities are presented on a map.

From the set of all solutions identified in solution analysis step, focus activities will be selected based on the needs (discussed in the problem analysis step) and the potential (discussed and reviewed in solution analysis step) of the village. A priority ranking sheet was made in order identify the extent of importance of each activity, which would contribute to decision-making process from the funding agencies. Since it was made in purpose that only spatial-related development activities were focused in, these activities later on were mapped on the base of the satellite photo either on paper or on the laptop screen. These participatory mapping exercises resulted to a map showing location of the focus activities of village development.

Development activities in Trung Phuoc village and their priority rank

Activities	Priority
Building concrete irrigation dam	1
Developing farming systems	2
Building a kinder-garden	3
Improving domestic roads	4
Building a gravity system of water supply from forest	4

There could be many obstacles in this step. From the participation perspective, many villagers did not have enough patience to continue attending the workshop. A continuous programme in three or four days was very long for farmers who must take care of many household activities. In Trung Phuoc village, it was very difficult to fix a day in agenda that would fit the schedule of all participants who wanted to continue the workshop. From GIS technical perspective, the most common problem was no electricity in the village and therefore the laptop was not able to be used. Delineating village boundary was not always clear because local people were afraid of making conflict by putting the boundary into their neighbour village.

Interaction of people in this step was very active because they have to give their own opinions for solution priority ranking and defend them to the others. For example, in Trung Phuoc village, the representative of Women's Union convinced all the men about the importance of having a kinder garden which would support women's participation in more socio-economic activities. They were very excited to do the mapping exercise in both cases of mapping on laptop screen and of mapping on transparencies and satellite paper photo.

As it was mentioned earlier, due to the conditions and limitation of this research in time and resources, the steps for plan approval, implementation, monitoring and evaluation were not able to be followed up. However, it was attempted to predict a in a certain extent of how PGIS products will influence decision-making process by map displaying on computer/i-paq to the authorities. However, the limited options in presenting maps in ArcPad had not fully expressed the strength of these visualisation products as the properly processed ones could do.

Figure 5.4 A resulted map from Village Development Planning using PGIS tools

Trung Phuoc Village Land Use Planning for Development

Legend

<all other values>

LANDUSE

Village road: to be improved

Trung Phuoc land use planning

<all other values>

LANDUSE

Con hoang, nghia dia (FL, Cemetary)

Dat dan cu (residental land)

Dat rung (forest land)

PT trang trai (farm dev.)

Ruong 1vu (1 crop ricefield)

Ruong 2vu (2 crop ricefield)

Ruong nhiem man (SA ricefield)

Trong cao su (RT plantation)

<all other values>

TYPE_

Quoc lo 1A (National road)

Duong lien xa (Commune road)

Duong mon (Village road)

Duong sat (Railway)

N

0 125 250   500   750   1,000
                                Meters

1:20,000

FL: Fallow land
SA: Salt-affected
RT: Rubber trees

5.2. Assessing the relevance of PGIS in a VDP (for objective 2)

"Relevance is a direct connection of something to a subject or a problem being discussed or considered". This connection can be seen from different perspectives such as connection by process/time, connection by nature, connection by necessaries, and connection by impact and effectiveness.

(Quan, Oudwater et al. 2001) have mentioned some criteria of GIS application's relevance as below:
  - ➢ The **relevance of spatial dimension** analysis (connection by nature – from technical aspect)
  - ➢ **Demand/need** for the application of GIS (connection by necessaries of GIS)
  - ➢ **Value/use of** results from **using GIS** (connection by impact/effectiveness of GIS)

However, all these criteria were merely focus on the technology side of GIS application in general, not particularly on PGIS. Therefore, additional criteria were added to emphasis on the participatory aspect of PGIS as below:
  - ➢ The **level of participation** (connection by nature from participatory aspect)
  - ➢ The **value of participation** in GIS application (connection by impact/effectiveness of participation)

5.2.1. VDP and spatial dimension in planning

Village Development Planning in its nature is a planning process of solving development problem at local level. The development problems that it aimed to tackle could be economic problem, social problem, infrastructure problem which somehow may directly or indirectly link to their livelihoods and the natural resources in the area. The spatial dimension in this planning process can be visualised as below

Figure 5.5 The links of Village Development Planning to spatial dimension
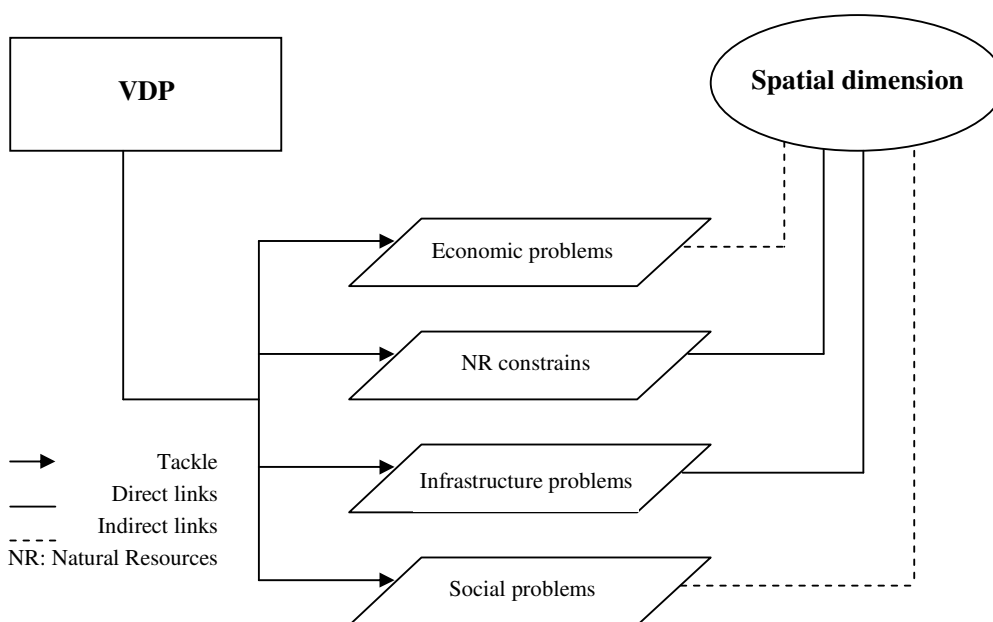
In the particular case of Bach Ma National Park, the land use situation in buffer zone was in great constrains in terms of shortage of agriculture land, lack of access to forest land whilst a large area of unused land is not efficiently planned. Figure5.4 shows non-forest land as in 'light pink' colour. Most of these areas are listed as unused land in the land use classification.

Figure 5.6 Land use situation in Bach Ma National Park: core zone and buffer zone[5]
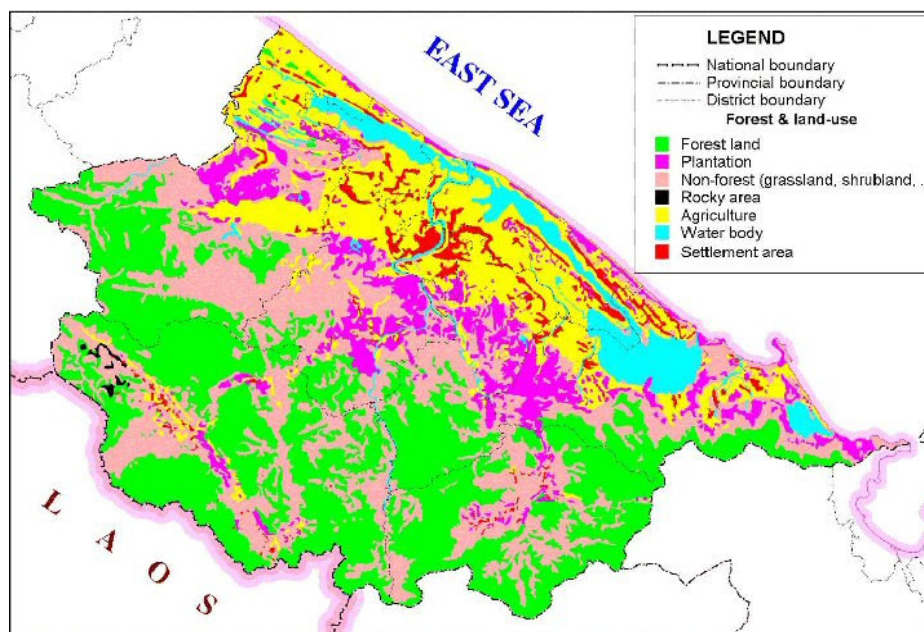
Figure 5.7 Loc Tri commune: land use situation and related land-use as sources of income

| a) Land use situation | b) Related land use as sources of income |
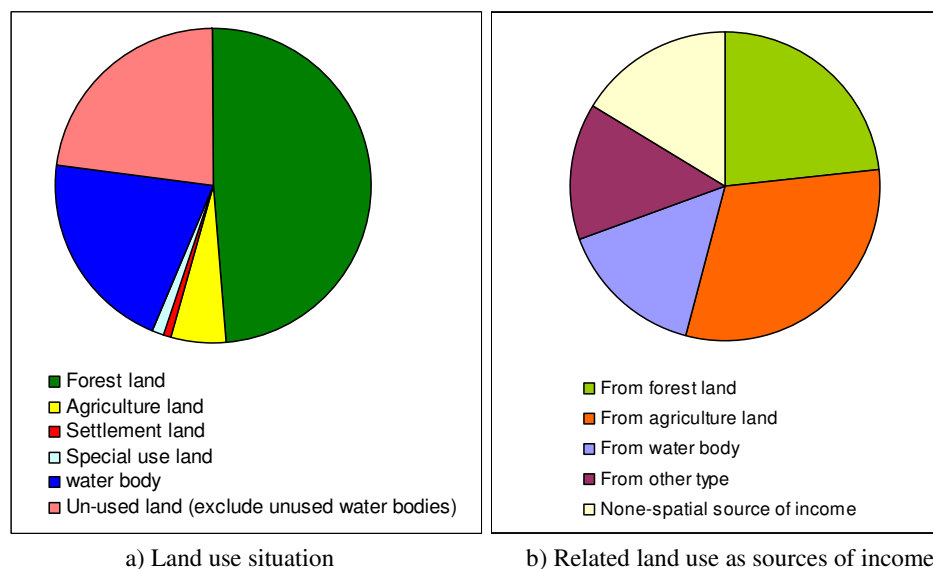
In Loc Tri commune, the land use classification data (see figure5.8) shows that about 40% of total
area is 'unused', among which about 20% is water bodies and 20% is shrub/grass land. Whilst in-
come that comes from these land types takes only 15% and mainly comes from using the lagoon for
prawn cultivation. Agriculture land occupies a small proportion of the area but take the largest contri-
bution to income generation for local people. Though forest area takes approximately 50% of the to-
tal area, in generate only about 25% of the income amount. When discussion about increasing income
level, local people recognised that alternatives are to increase access to the use of forest resources,
converting unused land into plantation or farming system (cattle raising in combination with agrofor-

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[5] Source: Tropenbos International website: www.tropenbos.nl

estry models), and converting one-crop rice field into two-crop rice fields. However, location and the scale of these development activities were not in any plan and this is the direct link of VDP to the application of GIS/PGIS.

5.2.2. GIS and local spatial planning related needs

In order to assess the relevance of GIS to information-related needs in VDP, the current system of local planning and approval is presented in the following paragraph. Main stakeholders and their needs are also summarised. Based on this summary and analysis of information-related needs for planning process, connection to PGIS will be assessed.

Process of planning and approval for VDP

The main flow of local planning in the study area is based on the top-down target assignment system. Every year, certain amount of funds is assigned from provincial level to district level, communal level and reaching the village level. These funds are usually to accomplish a physical target of activities.

A less formal process of planning goes from the village level to commune and district level through making proposals of development activities: road construction, electricity network construction etc. Usually these proposals are made due to critical situation in the village such as broken rice field dam/dyke, difficult access to village hampers living and economic activities of villagers. There are a certain number of village meetings being organised in a year, often before the rice season start. These village meetings may combine different purposes: discussion and information delivery on timing and technical issues of the coming rice season, domestic community issue, and discussion on villagers' suggestions to higher level. The suggestions will be voted by the villagers and then recorded in a minute with signatures of key people in the village: village leaders, head of CBOs etc. This paper is send to Commune People's Committee, from where it's being filtered to send to district level for funding as a part of commune's proposal for funding. However, the process of approval for these proposals often take many years to be done because often they are not matched with the Government plans which are assigned from higher level. For example some proposals on make dams for rice fields have been proposed for eight years and still not being approved, and the villagers do not understand the reasons of that.

Since Bach Ma National Park was formed which considers Loc Tri commune as a commune of buffer zone, another line of planning has been setup in parallel with the government administrative system. The Park has its own fund and connections of funding to support activities in buffer zone, with aims of reducing the economic pressure on forest in core zone. The Community Forestry bureau acts as facilitator for launching community-based projects in buffer zone communes in combination with available funding programmes and local needs.

Expressed needs of involved actors in those planning process were summarised as in Table5.3 with analysis of their relations to PGIS's implementation.

Table 5.4 The needs/targets of different actors in local spatial planning process

Actors		Needs/targets		Related to PGIS?
Village level:	Communities	- Improve their livings - Improve their production and income	} Development need	Direct
		- Get more projects approved	External funding need	Indirect
		- Channelling their wishes to higher levels	Information transfer-ring need	Direct
Commune level:	Commune Management	- Complete the tasked assigned from district levels	Mandate completion	N.A
		- Funds for small projects in communes	External funding need	Indirect
	Land Administration and Planning (LAP) cadre	- Funds to implement a proper land use planning within commune	External funding need	Indirect
		- Well-trained technician in land administration and equipments for land use planning	Technical support need	Direct
	Forest Rangers	- Fund for forest fire prevention	External funding need	N.A
		- Human resource strengthening	Learning need	Indirect
National Park:	Bach Ma National Park Management Board	- Human Resource Development	Learning need	Direct
		- Technical support in Public/International Relation and information management	Technical support	Indirect
		- Being confident to trust the reported information	Information need	Direct
	Community Development Department	- Sustain the self-sufficiency mechanism in forest protection by developing eco-tourism in certain parts of the Park and developing community forestry	Development need	Indirect
		- Information about villages in buffer zone to seeks for causes of problems (forest en-croachment and illegal cutting) and create dialogue, negotiation and solutions	Grass-root information need	Direct
		- Capacity building for staff	Learning need	Direct
	Forest Rangers	- Fulfil their main target: to protect entirely more than 22,000 ha of forest and the flora and fauna in it.	Mandate completion	N.A
		- Develop the forest and forest cover by increasing plantation areas, forest rehabilita-tion	Mandate completion	Indirect
District	District Management	- Fulfil the targets assigned from District level	Mandate completion	N.A

level:	LAP line-department	- Human resource strengthening	Learning need	Indirect
	Forest Rangers	- Fulfil their assigned target in forest protection	Mandate completion	Indirect
Provincial level:	LAP Department	- Tools for land use conflict resolution among different sectors in the province	Technical support need	Direct
		- Develop policy land titling to communities	Policy development	Indirect
		- Develop a comprehensive data base and digitise existing land administration data	Information management need	Direct
	Informatics Centre	- Update their software and hardware to manage the GIS database of the whole province	Technical support	Direct
		- Exploring on Remote Sensing expertise	Learning need	Direct
		- Coordinate with international/national partners to conduct quality training courses	Mandate completion	Indirect
Donors:	NGOs, University etc.	- Getting appropriate projects finalised and implemented	Grass-root information need	Direct
		- Research and learning process	Learning need	Direct

N.A = Non Applicable

Direct = Direct relation to PGIS application

Indirect = Indirect relation to PGIS application

Judgement on PGIS application's relation to the needs of different actors involved in local is made at three levels: direct relation – the application of PGIS would be useful to make the need fulfilled; indirect relation – application of PGIS would consequently/partially lead to the need fulfilment; and not applicable – the actor thinks that without application of PGIS at all they would still fulfil their need/target.

Table5.3 shows that PGIS application would fit in the needs of different actors at all levels: village, communal, district, National Park authorities and provincial levels. It was interesting to see that PGIS is more closely related to the needs at grass-root level and the higher levels of administration system such as the National Park authorities, provincial level, and donor institutes. This could be explained by the information gap from grass-root level to those institutions as far 'outsiders'. The commune and district authorities are considered as knowing the local areas fairly well.

The information gap from grass-root level to higher levels (district/province/donors/National Park) was expressed in two aspects:

- The need for 'matching' the information gap between local communities to higher levels, in order to facilitate access to external funding resources.

- The need for information transferring in order to multiply and replicate successful experiences in one local area to others.

In both cases, PGIS is expected to play a role as tools for information presentation and communication (Gonzalez 2000; Rambaldi and Callosa-Tarr 2001).

It was also noticed that the needs of different actors at different levels may fit each other or may contradict each other. The need of 'sending through' the information on local development to higher levels and funding agencies matched well with the needs of getting information at grass-root level for having appropriate projects of the National Park/donors. However, the development needs of local people in which increasing access to the use of forest resources may have a conflict with the target of forest protection from the forest rangers. In this sensitive case, PGIS may act as a conflict resolution but it may also deepen this conflict and hence its application should be well considered.

5.2.3. Assessing the usefulness of each GIS tool in participatory spatial planning:

The circle of VDP/local spatial planning and PGIS application

Figure 5.9 Participatory Development Planning (SFDP Song Da 2003)
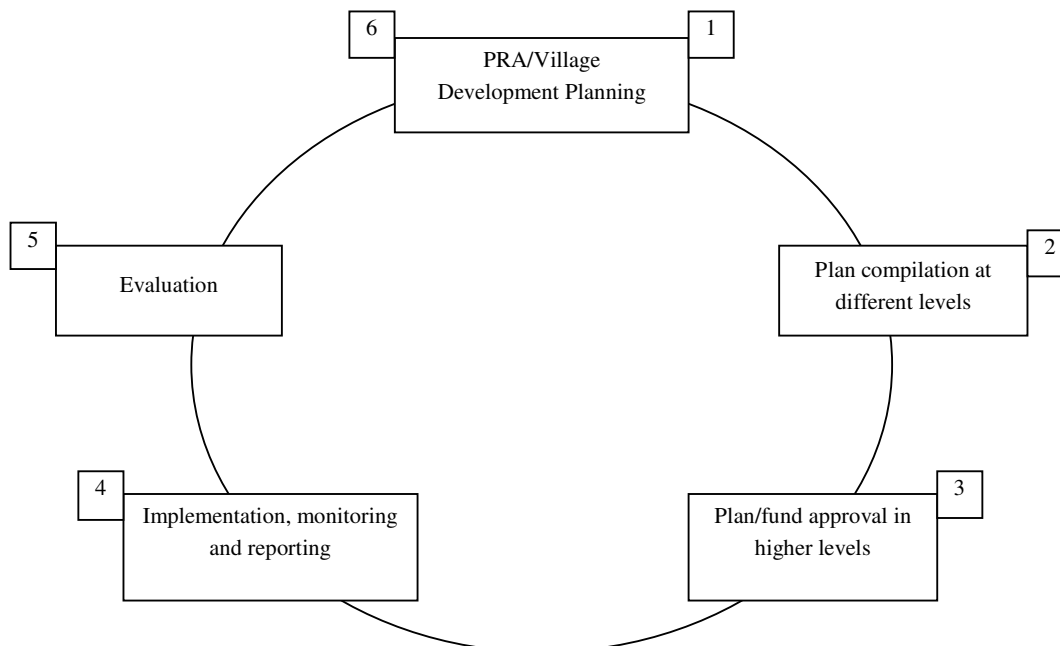
According to Table5.1, the steps of VDP can be standardised with the 3-phase local spatial planning process as below:

Step 1:   = Preparation and assessment phases
Step 2 & 3 = Action phase (strategic planning)
Step 4 & 5 = Action phase (implementation and M&E)
The assessment of the usefulness of GIS tools is based on details that happened within this process.

Assessing the usefulness of GIS tools in a participatory spatial planning process:

Technical Preparation

Though this was a step for preparatory phase, but not an assessment/action tool, it was very important, particularly in PGIS, for having other steps happening more smoothly as:

➢ It helped the GIS operators to be re-assured about the functional status of all equipments. Even with experienced experts, being in new areas with different climate/weather conditions and after long journey, it would be always useful to have this check.

➢ It helped local authorities and communities to have an early exposure to the technology. This created curiosity, interest and transparency.

Mobile GIS

Mobile GIS is a system consist two components: the Global Positioning System (GPS) and an i-paq which in general is a compact pocket computer and is handy for field work. These two components could be in separate from each other and then be connected through cables and connectors. New models of mobile GIS has the GPS integrated within the i-paq body.

In Loc Tri commune, this tool was used for recording location of each village in the map. Because the smallest official administrative unit in Vietnam is commune, there is no boundary of villages on the maps, and sometimes their location and names could be missed. Another use of mobile GIS was to record the transect walk routine, record important areas and site related to development plan and even measure on site a representative area for investment estimation.

Mobile GIS was applied in a participatory tool – transect walk – so it has the value from participation that individual application of mobile GIS do not have: recording local spatial knowledge. These values will be assessed in more details in the next part: PGIS and participation

When it works smoothly without any problem, mobile GIS showed high technical efficiency. It helped to record many points/items in a short time.

Figure 5.10 Transect walk and data collection using mobile GIS in three villages
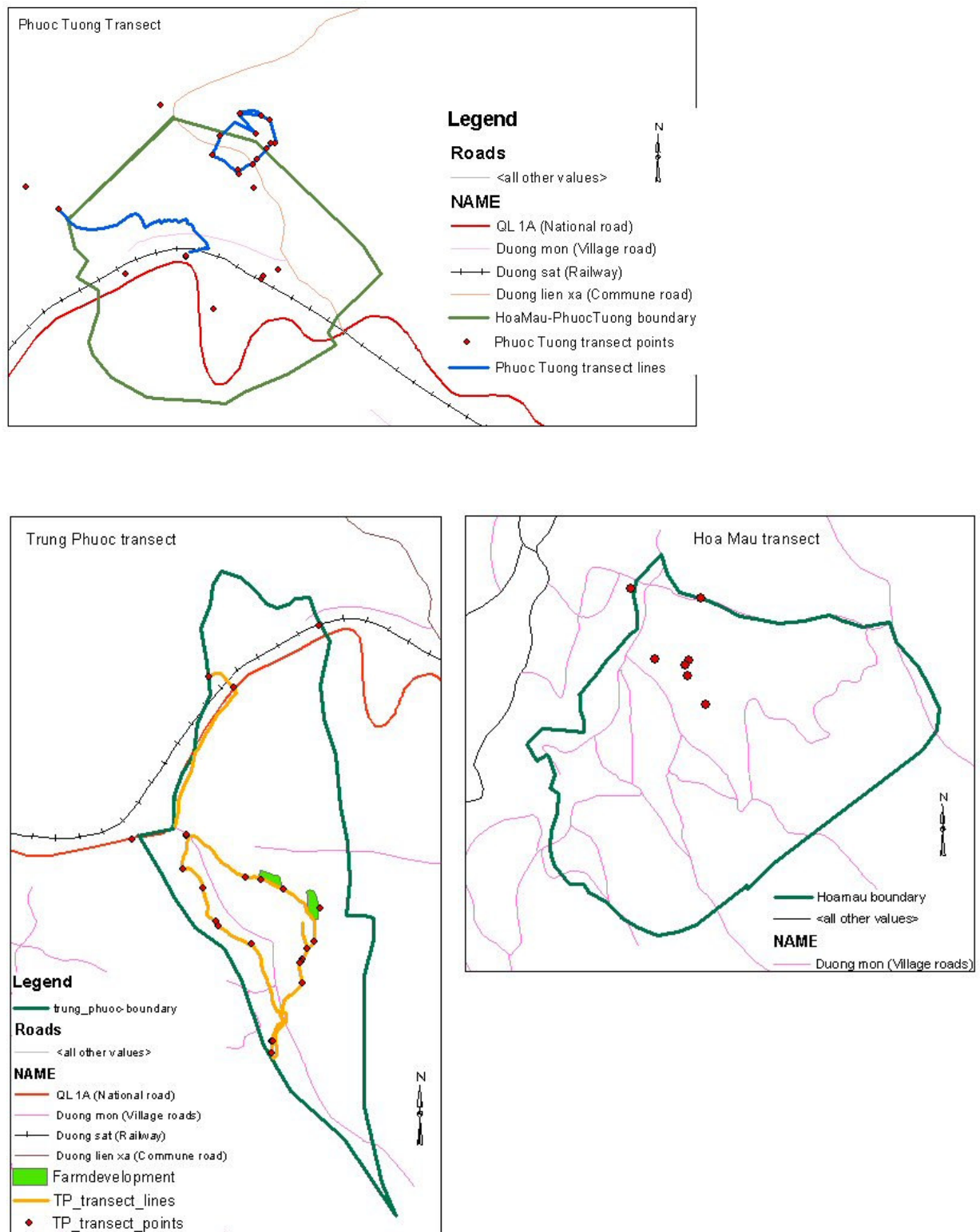
In Hoa Mau village, the i-paq was not working due some technical problem and only GPS was working and hence mapping process during transect walk had to be done by manually recording the points' geo-reference into note sheet. Comparing to using mobile-GIS, this conventional way of ground-truthing was much less productive in GIS data record and frustrated to participants.

However, mobile GIS is also a very fragile tool which may have many technical problems. The hardware problems were about battery, connection cable between i-paq and GPS (if they are separate), and the often meet 'hang up' status of the i-paq/GPS. This may cause to data losing, time consuming and effort wasting. The software problem were about GPS receiving, choosing geo-reference system, local datum and data recording/storing in safe place (memory card) or down load data every day after coming back from the field. Even though the risk of losing data during the fieldwork if the i-paq went off was high and in a participatory process, which was difficult to repeat, this could create unnecessary interruption.

Sketch mapping

It is one of the classical PRA tools. It was used for visualising the overall situation of the village: its natural resources, their geographical relation and problems. It was also to 'draft' the village boundaries to other areas/villages, so participants could be aware of the spatial limits of their village.

It was found out that sketch mapping was an important step before carrying out more sophisticated GIT mapping such as mapping based on satellite image. This step allowed local participants to express their knowledge and understanding on their own area relatively freely with a broad white paper and colour pens, like one participant from Trung Phuoc village said "*I can put the boundary wherever I want as far as my paper allows me to*". This product later on was integrated into participatory mapping with satellite image. In Hoa Mau village where sketch maps was not made, the mapping exercise based on satellite image took much longer time and participants were distracted by the satellite image too much.

The important step in sketch mapping is to establish the legends. Local participants had to identify those types of resources/objects that they want to map and how to present them. However, basic guidance should be given to them to avoid confusions such as the items on the map should be relevant to their problematic situation, particularly to spatial planning. For example: the problem of unemployed labour should only be analysed on problem tree but not necessary to express in the sketch map, otherwise it would be too 'busy'. Symbols for presenting mapped items were decided based on creativity of villagers. In many cases, they would prefer just to put its label in the mapping unit. This was because this area have high rate of literacy and people use the national language commonly. In areas where ethnic minorities live, this could be expressed in their own languages or be symbolised by themselves.

Participatory mapping on the base of satellite image

In this exercise, participants not only involved in data collection on field (through transect walk and using mobile GIS) but also identified areas and delineated village boundaries, areas or location of developments activities. The aim of this tool was to have a participatory map which reflects local development needs and plan. This visualisation tool was expected to serve the communication process between local people and the outsiders. It was done either by mapping on a computer/laptop screen or on transparencies putting on top of the satellite photo.

However, the experience in Loc Tri commune showed that by doing this exercise, local people had gained more than a product – the map. Interview data showed that local people found this as a good learning of their own resources (shape, size, location and comparative status to other resources) which were truly reflected through the satellite image. In both Trung Phuoc and Hoa Mau villages, participants were surprised by how much of unused land which mainly was shrub land did they have in their village territory. Because of the immigration, many new families had been settled in the village during the past ten years and these people, by the convenience of staying at the edge of the village, had never been to other remote sides of the village. Therefore, not all individuals of the communities owned the same local spatial knowledge and that was how participatory mapping exercise could act as a social learning process. In this process, it was the learning process not only among local people and outsiders, but also among community members.

However, the risk of having conflicts in this exercise was higher than in the normal sketch mapping. Particularly, with satellite image at scale of 1:50,000 it was not always easy to delineate boundary between villages. In some case, the groups tended to '*move*' their boundary back into their territory to avoid this problem other territory, especially to forest areas which are under State Forest Enterprise or the National Park.

Figure 5.11 Conflict in village boundary participatory mapping based on satellite image

Legend
Village_boundary_mapping
Village name
— HoaMau
— PhuocTuong
— TrungPhuoc
— transect_phuoc_tuong
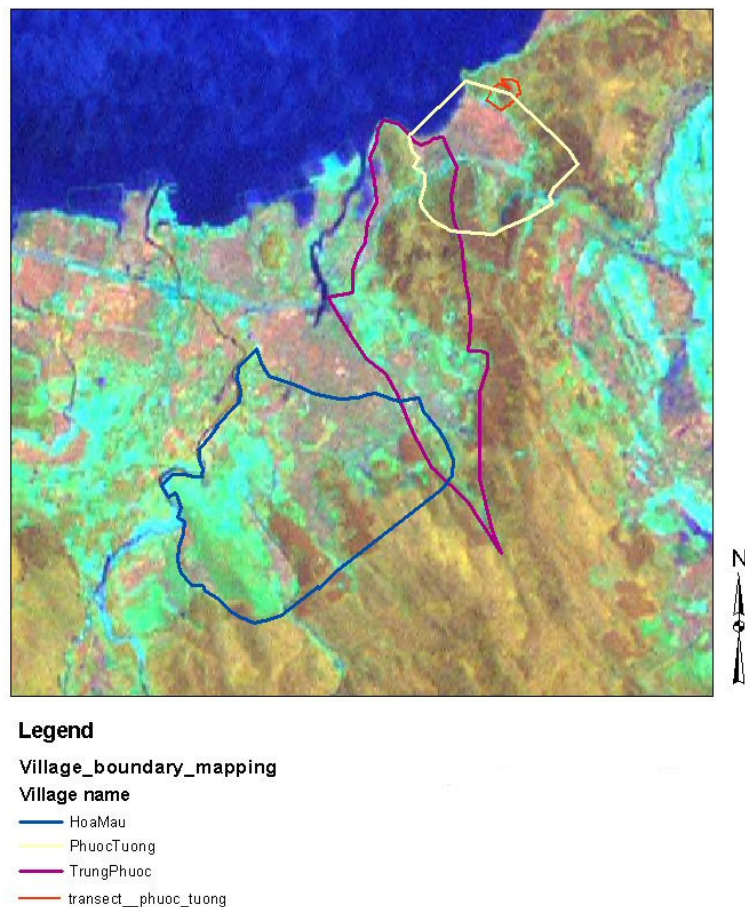
Figure 5.13 shows the conflict from boundary mapping among three villages. However, if the mapping process were done with participation of representatives from all villages, this conflict could be negotiated during the work. On the other hand, the 'red' boundary shows the areas during transect walk, which imply the true extent area of the village, while during mapping process, the village leaders wanted to shift the boundary back because they thought that forest areas should belong to the State Forest Enterprise.

PGIS Maps

They are visualised products processed from the raw participatory mapping data for supporting the communication process of local people and outsiders. Most of interviewees said that they do not need the map for themselves because they know the location well, but it would be useful for authorities at district or province level whom they would want to send their proposal of development activities to.

Authorities at Bach Ma National Park also acknowledged the use of having those development maps for them as the maps provide the first impression on geographical location of the development activities/areas during their proposal scanning and in activity plan compiling.

Summary

Table 5.4 summarised the advantages and disadvantages of using GIS tools in a participatory spatial planning process – its influences to participation (both positive and negative ones).

Table 5.5 Advantage and disadvantages of GIS tools in a PVDP process

Planning phases	GIS tools	Advantages/usefulness	Disadvantages
Preparatory phase	Mobile GIS (1)	- Getting to know the spatial location of the area more quickly - Attraction participation - Creating interest and trust	- If introduction about the technology is not made properly, misunderstanding and suspicion may occur, particularly in sensitive areas (border areas, conflicted areas etc.)
Assessment phase	Sketch mapping	- Easier to make than mapping on computer or photos because the map is always in villagers' mind - It gives orientation for image interpretation and digital mapping. - There is a joy of being an amateur painter in it - Flexibility: can do anywhere: on large paper or on ground, well-adapted to rural conditions	- It takes long time - If information is drawn wrongly, mistakenly, the map has to be done again from the beginning. - It is highly distorted and have no accuracy - It is not considered at district level
	Mobile GIS (2)	- Produce accurate map of development plan in the area - Safe time and effort for large area planning and mapping - Impressive and attractive to participants - Highly accurate calculation of planning areas	- Slowing down the transect walk for recording points and record information - Require high competency from the technology operator - More vulnerable to technical problem: batteries, memories, cables and wires connections etc. - It is a 'must' to have special attention on technical issue such as making reparation making a SID file small enough (in the preparation period) or choosing a correct local datum, matching with GPS, GPS connection etc. (on the field site)

Planning phases	GIS tools		Advantages/usefulness	Disadvantages
Action phase	Participatory mapping based on satellite image	Using paper photos and transparencies	- Closer to doing a normal sketch map and therefore is more familiar to villagers - Improved accuracy in comparison to normal sketch map - Easily do in village conditions which has no electricity for computer	- Require large scale photos - False colours has to be well-explained to avoid confusion - More complication for map processing with digitising step: error propagation
		On computer	- Impressive technology and therefore is attractive to participants - More powerful visualisation tool because of zoom in and overlay maps function	- High dependency on electricity - More risk of confusion to villagers, hence a proper explanation is necessary - More risk of putting a distance to pessimistic farmers who have never exposed to modern technology e.g. computers
	Using (P)GIS results (maps, database etc.)		- Visualisation of spatial plans for communication with higher levels -	

In summary, the linkages of GIS tools in a participatory rural spatial planning process were summarised as in Figure 5.12.

Figure 5.13 Summary of application of PGIS in a participatory process
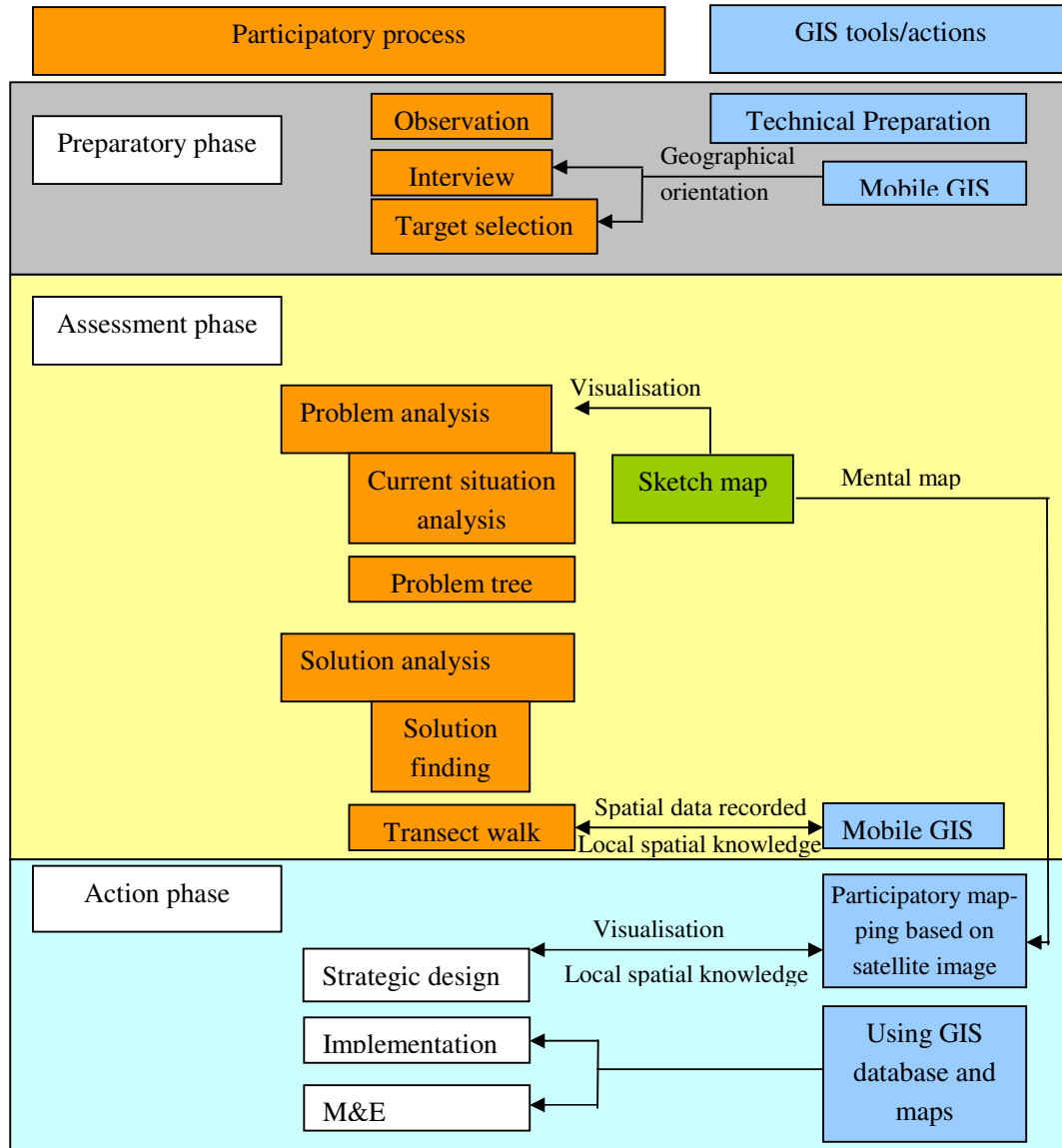
From this summary image, we could see that PGIS, even reflected through a simple case study, already has been shown to be more complicated than just a use of tools related to computerised geo-information system. It is a process of using GIS in a participatory manner, coming out from the needs of solving common problems, and serving as a set of supportive tools to solve those problems.

5.2.4. Assessing the participatory level of PGIS in VDP

Participation in the process

Due to the limitation of this research, expected number of participants in each village was not exceeding 7 people who were representatives for different groups of the communities including village authorities, representatives of village Farmer Association, Women's Union, Youth Union, Elderly Union and Veteran Association.   Participants attended the exercises with full motivation coming from their interest because there was no monetary compensation for their time.

Table 5.6 shows the number of attendants during different steps of the VDP in all villages including the number of women participated.

Table 5.7 Total people/women participated in different steps in VDP of different villages

	Introduction	Problem analysis	Solution analysis	Strategy planning
Phuoc Tuong	16/1	5/0	5/0	5/0
Trung Phuoc	5/1	5/1	6/1	5/1
Hoa Mau	2/0	2/0	2/0	2/0
Khe Xu	2/1	5/2	3/0	0

From the table above, Phuoc Tuong and Trung Phuoc villages had reached much closer to the expected number of participated people than Hoa Mau and Khe Xu villages. In fact, some key members in the village could play more than a single role in the community structure. The signnificant difference in number of participants on the first day in Phuoc Tuong village was because the introduction step of VDP was carried out in integration with a meeting of the village Farmer's Association. After the regular programme of the meeting, most of participants decided to stay for the "*special programme*". This was considered a good opportunity to get local people informed about the plan and contents of VDP. However, in the next day only key members of the village attended the next step.

The participation in term of quantity in Trung Phuoc village stayed at the most stable and satisfactory level. An observation showed that after the VDP exercises were done in Phuoc Tuong village, the information about these activities was quickly spread to Trung Phuoc village due to their close and easy geographical location. In case people were satisfied and excited after the process, this '*information channel*' offered the best help in participation mobilisation. In the next Result section, this issue will be discussed in more details.

Women participation was low in number in all villages mainly because of the 'framed' focus group of the society. This is the disadvantage of having representative/key member of village's civil groups, particularly in a society in which men are much more power dominant and women were not commonly found in many leading positions.

Reasons for having less participants in Hoa Mau village were: i) people were not well-informed about the activities because of their livelihood activity schedule (the village had more people living on forest resources, which required long and far trips to deep forest areas), ii) there were heavy rains during the week which caused domestic floods in the village (due to its close location to forest and river at the same time, run-off water from Bach Ma ranges often raised very quickly in the basin of the its river). In Khe Xu village, though people were highly motivated because they are more experienced in

working with participatory approaches and development thinking, an unexpected event was happening as there was a group of tourist are coming to the village under a 'eco-tourism' programme. These eco-tours had played an important role in the villagers' livelihoods recently and often was unpredictably happened, therefore it was the first priority at the instance to the villagers. The exercise was dropped before all steps could finish.

On the other hand, reasons for people to participate in the exercise were: i) the need for development planning in the village and solving their problems in the village, and ii) the curiosity of new technology and the need of learning/ acquiring more information, which was considered as a part of their 'spiritual life' in quiet rural areas

True participation

To a deeper analysis of participation, the quantity of participation did not promise a successful process. It depended on how actively the participants contribute their opinions and knowledge to the process. Observation notes in Phuoc Tuong village showed that the discussion and analysis tasks were not spreading evenly among all participants. To raise problems and opinions, often the village authorities controlled and dominated, while to work on technical tasks such as drawing the sketch map, a man with no position in the village structure was attaining. In other villages, there were also people who attended the exercises with much silence during the whole process without any *power control*. This reflected of the degree of active participation of a participatory process.

Another level of participation analysis was to identify the intensity of participation as: information sharing, consultation, decision-making, and initiating action suggested by (McCall 2003b). The table below showed the assessment of how intensive participation in VDP was.

Table 5.8 Participation intensity analysis in VDP in Loc Tri commune (adopted from McCall 2003d)

When	Who	What	How	Why[6]			
				IS	Cn	DM	IA
Pre-paratory	Communities	Needs expressing	Discussion	√			
	Higher authorities	Problem scanning	Discussion	√			
	Expert	Problem scanning	Discussion	√			
Assess-ment	Expert	Analysis local situation with communities	Learning, observing, explaining about GIS	√			
	Communities	Sharing idea, problem analysis, solution analysis,	Critical thinking on problems and advantages of the area		√		
Action	Communities	Prioritising, planning, proposing, Plan implementation and M&E	Strategy thinking on solutions, Using PGIS outcomes,			√	√
	Higher authorities	Compiling plan, approval, M&E	Using PGIS outcomes/ products			√	
	Experts	Support map making	Support technical skills		√		

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[6] Information's Sharing (IS), Consultation (Cn), Decision-making (DM); and Initiating Action (IA)

5.2.5. Assessing the contribution of participation to PGIS

Local spatial knowledge:

Although technical exploration was not a focus of this research, it was interesting to see how local spatial knowledge was revealed and reflected during through participating in a PGIS process.

One interesting finding on local spatial knowledge was related to a problem of land use classification using satellite images. Most of maps for Bach Ma National Park focused on the classification of the core zone, buffer zone areas often mapped as one class. It was not only because of the strong focus on forest area from the perspective of Forest Rangers and the National Park authorities, but also because of the complicated problem for supervising classification in buffer zone. Often these are mixed by many segmental land use types such as: houses, garden, rice fields and home forest. An expert on remote sensing data and map classification explained to me that he prefer to map the forest because they are much more homogenous and can be clearly delineated. "I put all area of buffer zone in "Others" categories" – said he. Review of data collected from a transect walk through different land use types in Phuoc Tuong village surprisingly revealed a recognisable tones on the colour image photo which could differentiate one-crop rice fields and two-crop ones. We were walking through the area of one-crop rice fields in the transect walk because this area was slightly higher and hence drier than the two-crop rice fields. The satellite image was taken in April which was the ending time of the second rice crop in the year (the Winter-spring crop season, see Appendix 3). This season is usually drier and colder; therefore only rice field with favourable conditions of elevation for getting water from irrigation system can be used. From May till September, the (Summer-autumn crop season), the summer rains in June and July provide best water supply to the rice fields and farmers can cultivate rice on both land use types. Figure 5.12 showed the different tones of one-crop rice fields and two-crop rice fields.

Figure 5.14 Local knowledge on land use analysis for satellite image interpretation

Transect walk through rice field: Phuoc Tuoc village

transect: one-crop rice field
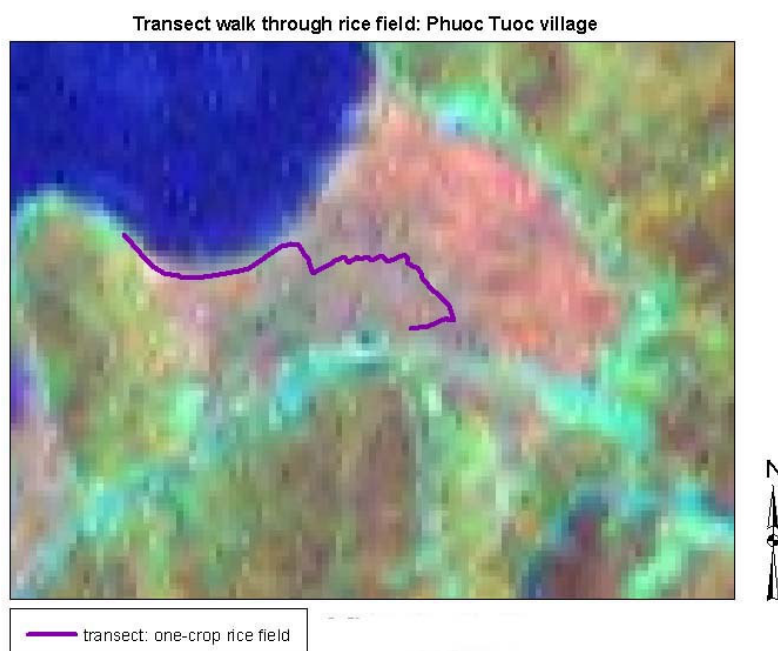
Another important finding was about the 'mental map' in local people's mind: how well-georeferenced and spatially close to a GIS map it can be. This was reflected in the sketch maps that were made by local people with neither compas nor topographic map. The sketch mapping was done by giving the participants Ao size papers and colour pen. The direction of the paper when the map was drawn is indicated by the arrow - - - - -► in Figure 5.13 as bottom-up direction. When I rotated this sketch map to a more 'geo-referenced' to the North as if it were in a GIS, according to the direction of the National road and the rail way, most of the features that were expressed in it are relatively close to the true shape of the village.

Even distortion of sketch map could be explained by several reasons. First, it was limited by the size of the paper and the table. In some PRA exercise, the sketch map could be made in a large bare soil ground so people can draw the line with much flexibility. Yet, with this method, information could not be stored for later use, but only for one discussion session. Second, distortion also comes from 'mental mind' that reflects how they perceive their village. In this case, the distortion goes with the wide of the village because local people perceive their land according to their houses, garden and rice fields. This will be discussed in more details later in Chapter 6.

Figure 5.15 Trung Phuoc's shape in local people's mind and it's relatively 'real' shape in GIS

a) Trung Phuoc sketch map   b) Trung Phuoc PGIS map
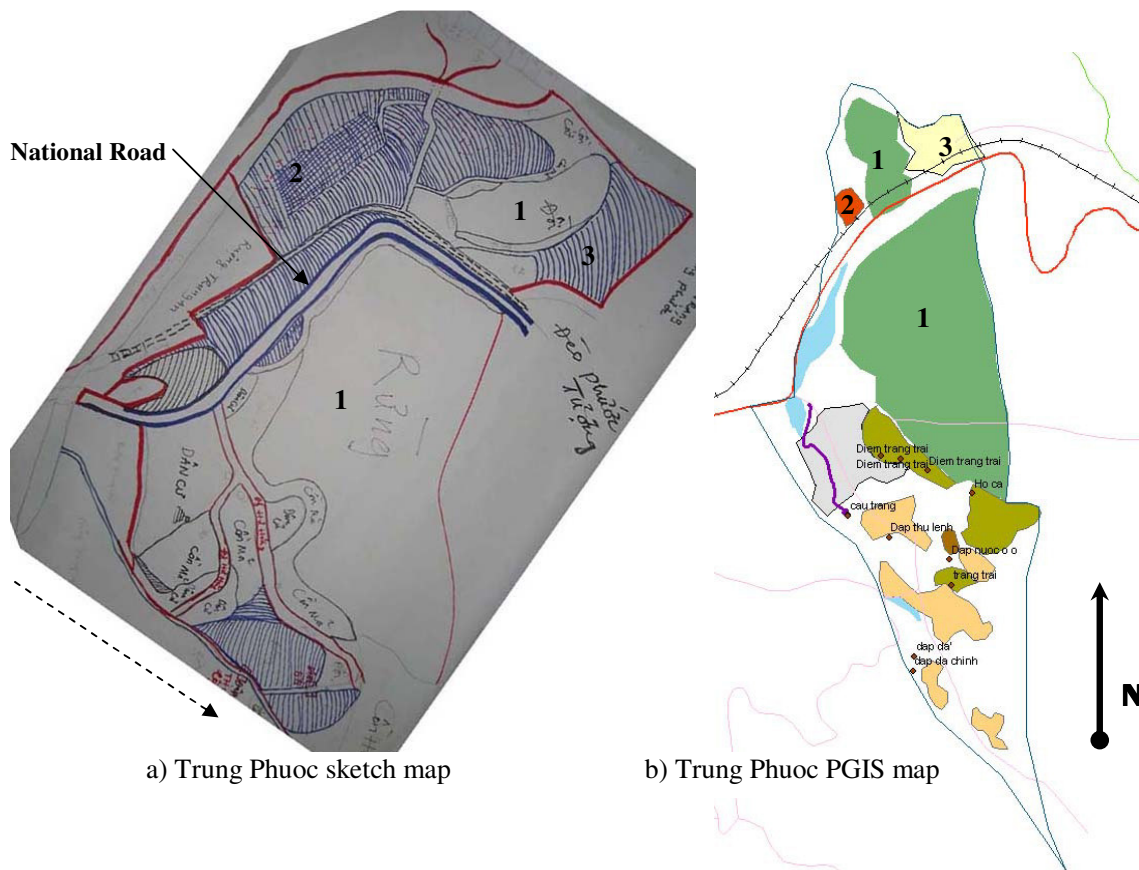
Legends

Legends that were made in different village could differ from each other because people from different villages may have different local word to mean a type of land cover or land use. For example, in Trung Phuoc village, the shrub areas were called as "*cồn mả*" which was a very unique term particu-

larly used in the area while in Hoa Mau village, it was called in normal term as *"đất hoang"* or *"đất trống"* mean "fallow land" or "bare land". The legends made in local terms were closer to local people and easier to understand or recognise than those using scientific /formal terminologies. However, when combine data from maps coming from different areas, the diversified terminologies used in legends require time and effort to compile and merge them into a common legend.

Attributes

Not only the name of the land use on the maps, local participants were encouraged to decide what attributes should be attached to each type of land use/development activity. Though this took more time to explain and facilitate the thinking process with local people, it may worth to invest on because of an advantage that might come later: when data are assimilated into a GIS, it would be a basement for developing the database which reflects local information and avoid getting unnecessary data.

Yet, because poor farmer can not interfere much in technology, and LSK, attributes etc. are not added for improving it but at first they improve the usefulness of the outcomes/products of technology (map and database) that are more relevant to grass-root level or could facilitate the use of technology in a more appropriate way/more effective use.

5.3. Review on the applicability of PGIS in local rural development context (for objective 3)

This section is an analysis based on reviewing PGIS experiences and researches that are literally available. The focus of this review is how relevant PGIS is as an approach applied to participatory spatial planning (in this specific case) and in participatory natural resources management (collective spatial-related problem solving) of rural developing context. The study case of Loc Tri commune in Bach Ma National Park buffer zone was used as an example for this analysis in combination with the use of worldwide documented experiences and analysis on PGIS as an overview of its application. These literatures could already be mentioned in Chapter 3 Literature Review, and could be the 'new' literatures that were found during analysis process which was a part of learning.

According to many researchers/PGIS practitioners issues of PGIS on socio-political implications and influences are undeniable(Aitken and Michel 1995; Miller 1995; van de Toorn and De Man 2000; Berry 2001; Weiner, Harris et al. 2002; De Man 2003). In this research, my analysis was determined in the direction of PGIS's relevance to a rural developing context in economical, social, institutional, and political aspects.

5.3.1. Economic applicability

Very few literatures and researches on cost-benefit in PGIS were found. This probably was due to the complexity of PGIS socio-political factors. A review of Rhind (2000) on funding of geospatial data infrastructure was made, though it was aimed analysis at national level, also relevant to funding for PGIS at local level. The cost-benefit analysis on PGIS in this section will be made mainly according to the main lines of this paper with adaptation to PGIS perspective.

Cost

What are the costs required in PGIS application? According to (Rhind 2000), invested costs for a system of geospatial data infrastructure including: (1) cost of raw data capture or maintenance, (2) cost

of equipments, (3) cost of human resources, and other costs which including institutional cost. Besides, the process of PGIS application would need (5) cost for data collection, compilation and maintenance; and, the (6) cost for training people who can use GIS and maintain its use should be counted. However, according to (Berry 2001), the cost for data collection, maintenance and human resource training is much greater than the cost for hardware and software.

McCall (2003f) mentioned the cost of time-consuming in PGIS which is unavoidable.

So, who can pay those costs? Rhind (2000) summarised four different funding models as:

(1) Funding by central or local government using available funds;

(2) Funding through payments made by PGIS users, collected by the private sector;

(3) Funding through payments made by PGIS users, collected by the public sector; and

(4) Funding on the basis of sponsorship, advertising or other indirect methods.

PGIS users in PGIS are mainly the local communities because PGIS is aimed to serve their problem solving process. However, poor farmers in the villages would have to spare their annual income for many years to afford a computer. Local authorities are in lack of funds and often not having efficient fund for local needs. The role of funding usually came from Government research/technical institute because they have available funds for technology and science researching (model 1). Another source of funding was the international development aid which comes from ODA budget line of first world countries (model 4). These funding resources (researching, development assistant) did not always require a cost-benefit in PGIS due to their non-profit nature. So far, the economic aspect of PGIS benefits has been 'blurred'.

How to decrease the cost of PGIS application? Assuming in a NRM project which was based on co-financing basis between the funding agencies and local community (to ensure the sense of ownership and relevance of the project), a part of cost for PGIS application should come from local community's contribution. The question was how local community could manage to get the cost at the lowest level which fit in their pocket and at the same time to remain the efficiency of the approach.

Suggestion for reducing PGIS cost could be:

Reducing cost on materials including PRA materials and GIS tools materials. A practical estimation on necessary expenses should be calculated from the beginning.

GIS equipments should be made as simple and essential as it can. Sometimes, the rural conditions are not favourable for sophisticated equipments anyway e.g. no electricity for the laptop/computer. GIS could also be 'simplified' into a set of pencils, paper and transparencies etc. as non-computer GIS.

Promoting the use of local human resources. Though training of local human resources (local people capacity building) could be expensive at the beginning, for long term of data management and maintenance, this would help to reduce cost and dependence on experts/consultants. In Loc Tri case, it was suggested to get more staff of Bach Ma National Park to be trained in GIS.

Costs for data purchasing/preparing could be reduced by photo copying (especially for participatory image interpretation) instead of printing on expensive paper.

Benefits

What can be benefits from PGIS? Measurable benefits are: time saving for doing manual technical tasks (map recording, data manipulating etc.), labour saving, and cost reducing for data collection through data sharing. Among the immeasurable benefits, the most important one is legitimacy increasing for local information, which leads to higher chances of funding approval. PGIS is a social learning process through which information of local needs spreading to outsiders either during PGIS application or by using PGIS outcomes. In Loc Tri commune, by doing this research, information on local development needs were analysed and compiled into a development strategic plan which became more comprehensible and well-organised to higher levels of authorities and other funding agencies (NGOs). Chances for funding approval and arrangement were higher. For example: the Youth Expedition Programme of Singapore International Foundation was seeking for supporting community activities in South-East Asian countries (ASEAN) was very interested in those development needs of Loc Tri communes. If one project was approved, the benefit could be up to US$ 3000 which was double the cost of the practical payment for conducting this VDP using PGIS research. Other immeasurable benefits were learning value and strengthened social capital which will be discussed in the next sub-section.

Who benefit from PGIS and who benefit more? The answers of the questions so far remained humble and painful as for rural development, little literature was made about a real impact on development process to local community resulted from their participation in PGIS. The immediate impacts that could be obtained often arrive to the outsiders e.g. researchers, consultants etc. who got their work done. (McCall 2003c) emphasised on the equity in benefit sharing which was obtained from information access, among individuals of the communities. This is because in many cases, only local elites have access to information and take advantage from 'community benefit'.

Therefore, strengthening benefits from PGIS has three aspects: i) exploring opportunity of converting geo-information into profit (through improving production, better use of natural resources), and ii) more push on benefit returning to local community, and iii) ensuring equity and benefit sharing among all community members.

However, benefit from PGIS also may arrive in a long-term time set, not as an immediate return.

Also, due to economic trends in the development, for instant the economic growth in Vietnam, and the reductive trends of international aid from first world countries, PGIS in developing countries should be moving towards the adaptation to a more business structure.

5.3.2. Social applicability

Because PGIS, as it was defined in the earlier section, is a social construction process, it is strongly influenced by many social factors of the development context. The most significant social elements of culture to PGIS that were found are:

- ➢ Culture: It is important to understand the culture where PGIS is used because each community maybe differ from others by its certain identified cultural characters. In turned, culture includes characters that are significant to PGIS as: learning attitude, information sharing, and power distance etc.

- ➢ Social capital: This could be a character belongs to the community as a whole or to its each individual. Social capital shows the connection among individuals of a community as well as

the connection of the outsiders who bringing in the intervention, which in this case is PGIS, for some changes in local community's life.

Culture

Besides, Hofstede (1986 in (Olutimayin 2002)) has provided a framework of four dimensions to describe and examine culture. They are: power distance, uncertainty avoidance, masculinity/femininity, and individualism/collectivism.

In connection to the study case, culture characters were analysed in the four dimensions as following:

Power distance

Power distance in the study area in general is great, though the extent may vary from one to another village. Vietnamese culture is greatly influenced from Confucianism theory which arrived from China long time ago. This theory emphasises on the strong power of the King/the Boss, the Teacher, and Father who are always right. In this culture, a lower level staff or the students or the son/daughter should not raise their own opinions, especially if they are different from those of the Boss's, or the Teacher's or the Father's, but being obedient to listen and follow. This is still very strong and deeply rooted in rural areas in Vietnam. It determines the very strong Power Distance, strong Masculinity in power-holding people and hence greatly limited the cultural desirability and feasibility. However, if the power-holding person is interested in the learning process, this could give a very positive chance and big advantage for the adoption of new technology.

In Phuoc Tuong village where most people are in the same big 'relatives connection', power distance was much greater. When one village leaders refused the brain-storming exercise on current problems in the village, no participants had objection and different opinion. The village leaders repeated many times in the interview to stress on the solidarity of the community as "*it is easier for us to control each other*".

In Trung Phuoc village where people have less relative bonds like in Phuoc Tuong village, the power distance among village leader and other people was less strong. All participants contributed their opinions, the women's union representative actively argued for her point of view on the importance of having a kinder garden school in the village which will help the parents feeling more at ease when they are working on the far away fields.

Uncertainty avoidance

To farmers in Vietnam, dealing with uncertainty is a part of their life because most of them live on agricultural production which relies heavily on nature, in particular the unpredictable natural disasters: flood, diseases etc. People are used to taking risk and facing failure. In Loc Tri commune, most of the population, who migrated from elsewhere to the area, originally live on rice cultivation; and now many household are changing to learn doing fishery/prawn cultivation which is a very new, cost-demanding and risky activity for them. This also true to farmers who have been trying their farm development toward the edge of forest area where they can convert shrub land into agro-forestry model: planting cassava, peanuts and other crops and livestock keeping.

To PGIS, both local community and authorities were very interested and attracted. The Authorities of the National Park expressed a strong enthusiasm to apply GIS in forest management works: monitoring forest fire, mapping wildlife and biodiversity mapping supported development activities in buffer zone communes etc.

There is no hesitation in taking the risk of adopting new activity, in particular PGIS, in this area.

Masculinity/femininity

This factor determines how strongly a community insist in achieving its target. For instance, in Loc Tri commune, this factor in its turn is determined by two elements: the communism and the *'farmer style'*. Communism ideal is very masculine in achieving the goal and target, and the '*farmer style'* is more relaxed and time-taking and is much feminine. I noticed that the 'farmer style' which has been generated from many generations is stronger than the fixed masculine communism thinking of achievement. Therefore, the general culture in the community daily life is more to femininity than to masculinity.

This was reflected very obviously in the timing in meeting. In all villages, the village/groups meetings always took place with at least half of an hour later than in the plan because of waiting for participants. Another example of this less achievement-oriented style is the 'definite' lunch break at 11.30 am to 12.00 pm even when the discussion was not finished.

GIS should be a masculine tool because it requires strict achievement in data quality and quantity, and it is about to safe time in order to reduce consultancy cost. However, PGIS is more about mobilising community participation, addressing local needs, and respecting local knowledge, than about having the technical achievement. This emphasis on the participation makes PGIS becomes a feminine approach.

Individualism/collectivism

Collective action is a strong character of rural communities in Loc Tri commune and in Vietnam in general. Beside the relative bonds, community members have to rely on each other in irrigation (sharing water supply system), disaster prevention and mitigation, information sharing on weather, markets and farming techniques, and housing/farm construction, etc.

When I asked about participation in community activities, all interviewees (including village leaders and normal villagers) said that there is no problem in mobilising the communities to work together on contribution of their labour to a development activity such as village road construction, internal-field road construction, and dam/dyke construction.

For PGIS, as it was not expected that local community participated in operating the equipments but contributing their opinions and understanding/knowledge on the area to build up the data system and analysis data, collectivism is at reasonable level. It takes different contribution from participation of both local authorities and local communities, and is used to address their needs/interests as a collective practice and benefit process.

Assessing the character of study area's culture in "four dimension of cultural framework":

If consider the extent of this dimension ranges from 0 to 1, a random estimation of standardisation for each cultural dimension of general Vietnamese rural culture is suggested as the below chart. Note

that it is only for purpose of visualisation of the cultural shape but suggesting no correlation among those four dimensions.

Figure 5.16 Assessing Vietnamese culture in four dimensions
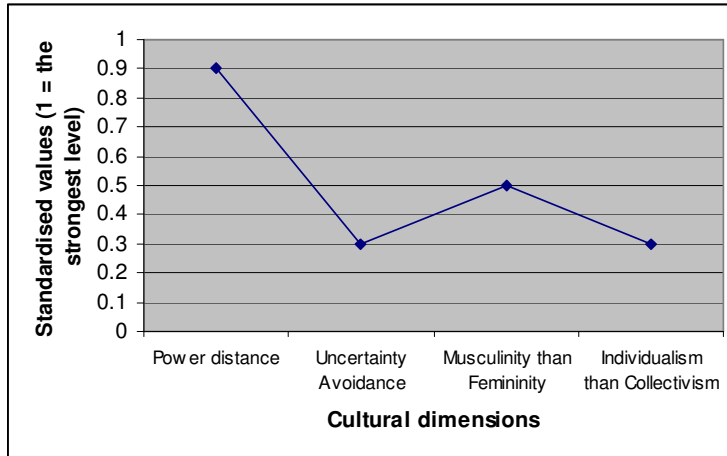
Culture in learning:

In general, Vietnamese people are very open to learn and learning is considered as a continuous process of every person. As the old says: *"One day on the road spent, one basket of wisdom gained"* emphasises on daily life learning and encourages people to expose to new ideas, areas and activities. Informal learning and learning in community is culturally very important as *"learning from teachers is not as enough but learning from friends"*. In the study case, learning was the thread going through the process: it was the motivation, the purpose for local people to attend the sessions, and also was the results as it was indicated repeatedly in their interview answers.

Learning was the purpose, motivation of all participants: the answer for why did they participate is always because they wanted to learn. Also, a farmer said that it was more excited to learn a new thing than to get twenty thousand "Dong" (and he didn't go to attend a training session in animal husbandry at the commune centre which has the stipend for participants).

Figure 5.17 Learning attitude in PGIS: "it's strange", "it's interesting", or "what is it?"

Results of learning process through PVDP using PGIS in Loc Tri commune by local communities obtained from interviews are showed in Table 5.9 as below:

Table 5.10 Community learning through PGIS process

What	How
• Participatory methods	During whole process
• "I learn a lot"	During whole process
• I learned things that are useful for myself and my communities: the difficulties of our village, sources of water, location of salt-affected fields etc.	Problem analysis
• Ranking our needs: to think of what is more important than others	Solution analysis
• The general shape of our village	Participatory mapping on satellite image
• Learn to draw a map	Sketch mapping
• Learn about poor people in the village	Transect walk
• Learn about the potential in the village	Transect walk + mobile GIS
• Learn about the areas in the village where we didn't know before	Transect walk + mobile GIS

The learning process was not only to learn from outsiders and from what technologies could show, but local people also learned from each other as a community of learning process. At the beginning, many people did not understand the satellite image or about drawing a sketch map, after discussing with other, it was getting clear and that how they learned. This process of learning from each other, among community members and between them and me, built the connection, trust, and respect among them, and also to me. It was a process of building up social capital all participants, including myself.

In short, learning attitude in rural development is high as it was expressed as a need of their live – a need of knowing new things. PGIS was proved to bring an exciting learning process to the Loc Tri communities as it was commented as "*a good entertainment*".

Culture in information sharing:

Traditionally, information about weather, agricultural production experiences are well shared among people in the same village/commune as people consider very close linkage to each other in each village/commune.

However, spatial information is more and more attached to values of economic and political benefit and therefore is harder to share. The saying that *"information is power, and power is never shared"* remained as a common banner in people's mind. And therefore, the Individualism, Uncertainty Avoidance and Power distance dimensions are very strong in this aspect. Talking about adoption and implementation of GIS using indigenous knowledge, cultural desirability is great from the poor majority and the possible resistance from those powerful minorities may create difficulties for cultural feasibility in information sharing. However, information on agricultural production is very well-shared among villager (through village meetings) and often the informal medium of information sharing is very active; informal media often are places such as on the fields, in markets, local canteens)

Because PGIS is about bring spatial information into public and collective discussion, it could confront with sensitive issues such as land value and land dispute which local people tend to hide from outsiders. This requires trust and true blending of PGIS operator in the communities to deal with this issue appropriately.

Social capital

Social capital is an element at being required from both participatory process and GIS application. This is the process that confirms that the outsider who bringing GIS has a common understanding of problem with local authorities/communities and there a mutual understanding from both sides exists or be developed, from which trust is built up. This is the only way leading to well-motivated participation of the community besides giving them some stipend for their participation. Also, to GIS this element is important to attract curiosity and obtain certain interest from authorities and local communities. This is necessary for the process of community learning about new technology in the local level.

Development is about bringing people together.

(Fukuyama 1999) defines Social capital as: *an instantiated informal norm that promotes cooperation between two or more individuals*. The norms that constitute social capital can range from a simple relation between two friends, up to very complex and elaborately articulated religion of such as Confucianism or Christianity. *"By this definition, trust, networks, civil society, and the like while have been associated with social capital are all epiphenomenal, arising as a result of social capital but not constituting social capital itself"*. In a simple way, Social capital *"refers to the collective value of all 'social networks' and the inclinations that arise from these networks to do things for each other"*

In GIS application, social capital is an important condition as it (De Man and van de Toorn 2002)

- promotes and facilitates cooperation
- resolves dilemma of collective action
- making "I" become "We"
- leads to changing in behaviour and hence facilitates knowledge sharing process which is crucial in strengthening community's performance

Three dimensions of Social capital is: Structural, Relational and Cognitive

Structural: is the system of connections or media through which members in a society can community with each other, for example: telephone, computer network, discussion room and conferences. This component refers more to the infrastructure system.

In a rural context of Vietnam, this connection is mainly by oral communication on the rice field, in village-common hall, in market etc.

Relational includes all obligations, norms, trust and identification that exist among each member of society. Obligations, norms and trust generating relate strongly to cultural background of the people. Among these elements, trust is the element that should be taken into account as a condition of designing and implementing GIS/PGIS. (Fukuyama 1999) and (Putnam 1995) both emphasise the likelihood of building trust in network among those who are closer and sharing more common values such as members of family, and neighbours. And therefore, community learning and community of practice (doing things together) would help to increase trust, and then enhance social capital.

In Vietnam, particularly in rural areas, this is very true. An outsider who wants to interfere in a local community process/activity would have to spend time and effort to understand the local cultural values, sharing their values and creating a sense of closeness in order to obtain trust. But in order to have a starting point, he/she should already have a form of initial social capital in term of trust (could be through network introduction) and common interest. Hence, it is estimated that the relationship of community of practice and social capital is not a one way of influence, but a mutual condition for each other. As a result, through participating in the process, this connection (social capital) could be strengthened or weakened.

In Loc Tri study case, social capital at the beginning has to be set up and it was much built up during the process and became a strong social capital after the process. Participatory process strengthened social capital and GIS, with its technical efficiency e.g. accuracy, effective measurement, and data manipulation, facilitate the process of building trust in social capital.

5.3.3. Institutional applicability

Legitimacy

This issue is linked to the participation in PGIS, its technical efficiency in terms of accuracy and 'how the real world is reflected' through PGIS maps, which promote the ownership of local communities to PGIS products and promise higher chances for grass-root information to be accepted at higher level authorities.

As (McCall 2003d; McCall 2003f) have reviewed, *"legitimacy demands active participation"*, here, participation means the involvement of all parties: local communities, higher level authorities and technical experts. In this participation, each party contributes a 'value' to the process which is well validated and appreciated among all participants. This combination brings up legitimacy.

However, in reality, the full participation of process maybe more complicated. Time and certain conditions to gather all parties are required. Besides, not only the meeting atmosphere would be more ceremonial than cosy as in a normal internal village meeting, the issue of 'saying the truth' from local communities may be changed when there is a government staff attending the process. In Loc Tri study case, it was not possible to invite government staff at commune level or staff from the National Park to participate because they were busy with other activities and agendas. Having government authorities' participation requires more formal invitation than just a researching task.

Though government authorities did not participate in the process, they appreciated and validated the result maps when the maps were showed to them on computer screen. Interview data showed that this appreciation and validation comes from the trust that PGIS maps give a better prove of the local situation than a normal local sketch map does. The fact that PGIS maps reflect true shape of the village and the relative locations of different development activities is not only useful for the learning process of local people but also provides better understanding to higher level authorities. This increases chances of acceptance if those maps would be enclosed to proposal for funding to them. Loc Tri commune, authorities of the National Park have confirmed that with the PGIS maps that reflects local needs, having the value of local opinion and expressed in a more accurate format of data, it will be easier for them to make decision and to use the map as attachment to the proposal for funding to higher levels or international partners/agencies.

Accountability

Accountability is about the transparency in data sharing and about the 'trust' of the shared data, or in other words it is the reliability of shared data.

In PGIS implementation, data sharing is important because one conditions for GIS application is the availability of some data set (Quan, Oudwater et al. 2001). Especially, in PGIS collected data are considered as 'bad' data. Besides, the participatory mapping session has proved that local people recognise their area better with several overlay layers. Therefore, the more information prepared and shared for PGIS, the more effective and better quality the collected data could be.

Institutionalised and institutional support

Management institutional and human resources

When looking at spatial information and rural development at local level, it was noticed that all processes that happen at local level may not make sense and sustain if they are not connected to the a higher level of institutional support. In Loc Tri commune, the exercise of PGIS at the villages may provide useful information about the needs and problems of local communities to higher level authorities. However, before these sets of information could only reach the decision-makers through a technical institutional structure, for instance the informatics bureau in Bach Ma National Park, or Provincial Informatics Centre of TT-Hue province. The department of Natural Resources and Environment, which is the most directly relevance authority to deal with land use planning and land allocation has not resources (both human resources and equipments) to GIS usage. Similar situation happens in Department of Investment and Planning of the province. This means a village development map may be sent to higher level authorities and may not be used efficiently. Data analysis and manipulation are not possible at provincial level in this moment and hence the PGIS products which reflect information at local level may not be well appreciated and best used.

Therefore, PGIS, in long term, should be institutionalised as a part of management purpose, not just as individual applications from different development project. This would only happen with a legal supportive policy of the provincial authorities and require time and cost for human resource building.

Serving community needs

A core issue of being institutionalised in PGIS is being user-oriented. It means that PGIS would be developed to meet the community needs and is influenced by society's perceptions. And if the problem-solving contribution from PGIS meets the expectation of society and in its turn has influence on social perceptions and brings up a change of collective actions and behaviours, we can say that PGIS has become institutionalised (De Man 2003).

In this study case, the study was adopted to fit in the need of local communities, a step of institutionalised itself into the community, making it become a part of community activities.

Infrastructure

The rural infrastructure system in the area where PGIS is integrated in development process may have a strong influence on the possibility of what PGIS tools should be used. For example the condition on electricity would determine if mapping on computer screen or interactive maps could be used on the site or not. Other infrastructure system

5.3.4. Political applicability

Often, political issues in PGIS in developed countries are listed as a part of the social/institutional condition. However, in developing countries, development and political power attach strongly, particularly with the centralised management mechanism. PGIS implementation, coming as a new form of development approach, would be influenced much by this factor (Olutimayin 2002).

Power and Empowerment

Politic and power goes together. In rural context of many communities in developing countries, power comes in two forms: the political power and traditional power and often the degree of power distance is high in such communities. With the strength of geo-information display and analysis, PGIS intents to involve local communities and expose them to hidden development information which the powerful elites do not want to share. This might create doubts and resistance from power-holding people to PGIS from the early stage.

According to (Mosedale 2003) empowerment is "a sense of people making decisions on matter which are important in their lives and being able to carry them out". PGIS emphasis on empowerment as it is aimed for supporting the needs of people at grass-root level whom were assumed to be forgotten, to be marginalised and not to be heard. As a subsequence, the reduction in power distance would lead to two ways of changing in power pattern: some people are empowered (for bring them information) and some are marginalised (for taking away their information and power). The change in power system might lead to political changes, which might be positive or negative to PGIS implementation.

Because this is an important criterion of PGIS good practice, indicators for assessing empowerment in PGIS should be established. (Craig, Harris et al. 1999; Mosedale 2003) suggested some indicators as: ability for decision making, ability for carrying out their plan, increased power, and in this study I suggest an indicator of the power distance measured by the degree of working together and sharing opinions/works among community members during collective process.

This links to: intensity of participation (decision-making); strengthen their capacity (learning, improving their assets, tools and efficiency) and power-distance, and social capital.

Political sensitive issues

In many countries, politics, national security and geo-information might be closely linked at its certain areas. Proposal of PGIS implementation in areas where political issues are vulnerable would be resisted. For example: areas near military camp, conflict national boundary or national restrict areas.

5.4. Conditions for PGIS applicability and good practice in a rural developing context (for objective 4)

From the case study and literature review on PGIS, the most significant for PGIS application being relevant and effective are:

5.4.1. Economic conditions

Sources of funding have to be made clear and firm to cover the expenses of GIS equipments, raw image data (aerial photos or satellite image), expertise and the whole organisational preparation for PGIS because, often, these costs are not affordable to local communities (including local authorities) in rural developing context. They could only provide material contribution in terms of time and some local logistic materials (meeting place etc.).

Although most of **benefits from PGIS** come in the non-financial forms, there should be 'feasibility' in having some benefits from its application. This is a crucial element of being relevance to the need and to the biggest concern of people in developing country: improving their living standard through increasing income level or better production. PGIS should lead to raising living standard of local communities directly or indirectly.

Also, there should be a mechanism to ensure an **equitable benefit sharing** and access to the information that were involved in PGIS. This is to make sure that not only some elites in the communities are involved and hence benefit from the process but a well-representative participation of the communities is counted for its stand in the whole process.

5.4.2. Social conditions

Because PGIS is about dealing with information system (IS), an open **culture of information sharing** is very important for its setup, implementation and maintenance. This information sharing process could be sharing among individuals of the communities, sharing among the community and the outsiders (higher authorities, technology operators etc.) and among different sectors of local authorities that involved in geographical information and development process.

Because GIT often is an 'abroad' technology to local communities and authorities, there should be willingness and openness towards **the learning attitude** from them in order to accept or to expose to the new technology. Particularly, in areas where power distance is great and the community chiefs have a strong influence in participation process, his/her attitude toward learning is very important and influencing to the whole community.

Because PGIS is a collective/social constructed process, the element of **'acting together'** in community's culture is also needed to acquire certain level of participation: people not only participate largely but also actively (doing things together) and intensively (being creative and empowered). This also requires certain strength of local social capital among individuals of the communities and among local communities and their authorities. However, during and after participation, the sense of 'acting together' and solidarity among community individuals will be built up.

A certain level of **social capital** is also required for outsiders to have a starting point in working with the community and having 'trust' and acceptance. This social capital maybe created through organisational contact such as professional network, civil societies, local NGOs or personal contacts. However, the relationship between the outsiders and local communities will also be improved and tightened during the 'working together' process. This shows a mutual relation of participatory technology application and social capital.

Power and its relation to geographical information in the areas should be open for PGIS application. The cultural tradition influence of **power distance** could be hampering to participatory process and benefit sharing.

5.4.3. Institutional conditions

The first condition for having a relevant PGIS application is the **needs** of having spatial information as a tool for problem solving in the communities. The problem they have should be spatial related, and it should be a collective process. These needs could be complement to each other, in which case PGIS will be provide tools for spatial planning and resources managing; or they could be overlap to each other, in which case PGIS will provide tools for conflict resolution and communication tools for

negotiation process. This reflects the real motivation of participation in PGIS application and makes PGIS become a part of community's activities.

A condition of **supporting institutions** including support policy, technical institutional structure e.g. technical department within Bach Ma National Park or at provincial level is required for linking information from different areas, information storage, maintenance, and development. These supporting institutions will help to channel the message that the communities want to deliver through PGIS to the decision makers.

A basic **condition of infrastructure** in local areas is required to have access to certain GIS tools such as the use of participatory mapping based on computer screen requires the place having reliable electricity network.

5.4.4. Political condition

The **aspect of right** to access to, own and benefit from PGIS products for local communities should be clear and agreed at the beginning among local communities, technology operators and the higher authorities.

Because PGIS is about geographical information which could be very **sensitive** to local **political issues** for instance in border areas of the countries, areas which are near military base or camps working with maps, high resolution satellite image might be violent to political security matters. Particularly, in areas where national conflicts exist, this issue should be well aware by all PGIS users.

5.4.5. Technical conditions

As its name indicates, a PGIS should be **addressing the needs** of local communities who are aimed to be the end-users. This is called an user-oriented approach as (Jordan 2002) have also suggested: the technology should depend on *"obtaining community needs, perceptions and ideas"*. Similarly to this line of thinking, de Man (1988) has mentioned the differences between information-system-focus vs. information utilisation-focused viewpoints. He has realised that the risk of information-system-focus is the bias in viewing reality that generates from the information system. This bias could be avoid if IS designer considers the utilisation of information as the point of starting.(D4) For example, in case of Loc Tri commune, PGIS was 'shifted' from its initial purpose of serving a livelihoods assessment to village development planning to fit in local community's development needs.

To be able to 'survive' in rural developing conditions, PGIS equipments that are used on field should have **high reliability**. In particular, the mobile GIS devices should have least vulnerability to technical problem: both GPS and i-paq are fragile gadgets – the restart of the i-paq may cause data losing; the connection between them which sometimes even made by self-created connector is also easily broken. Reliability of technology is also in data preparation such as the preparation of MrSID file to use in mobile GIS should be ensured to be smaller than 2MB (de Bee 2003). The size of the file set also affect much to the speed of image presentation and processing.

Another practical condition of PGIS application in this particular context: it should **be simple and user-friendly** in terms of being low-cost, easy to be operated and easy to be transferred. The sophisticated presentation of the software screen would create a confusing feeling to people with little formal education background and create a distance from them to the applied technology. The first implication of GIS's threat to individual in Appendix4 could well demonstrate to this point, particularly true to a rural developing community.

In order to adapt to working with local communities who do not have high computer literacy in rural conditions which could be not favourable for electric devices, PGIS and its tools should have **high flexibility**: the participatory mapping based on aerial photographs or satellite image may be able to use computer/laptop in certain areas. Paper images and transparencies are good alternatives and they have their advantages. In place where the communities have no conditions to adapt GIS on computer based, other types of GIS that are used for visualisation, analysis and communication could be used such as the 3-D model of the areas, a set of transparency overlays. This proves that GIS might not always be a computer-based system but they could exist as a non-computer based one.

5.4.6. Technology-operators

There are two main requirements of qualities in technology-operators/deliverers in PGIS: the competence in technology operation and the inter-personal and social skills in working with people at grass-root level.

The **competence** in technology of the operator(s) is required because (s)he is representing the 'magic' of GIT. This quality will create an impact of building trust and respect from local communities to the outsiders whom are called as "experts". This is not important to attract participation but also influencing the relationship between local communities and the technologies. In a way, (s)he is the bridge that connects people to technology and vice versa.

Inter-personal and social skills including:

- *Understanding of local culture and traditions*: each region/area has its own local habits/traditions such greetings habits, timing habits. They should be respected and followed.

- *Having a good attitude of learning toward local communities*: especially the learning from old people, from local authorities, from villagers who wants to share their opinions and problems.

- *Using proper language* (verbal skills): using local languages/dialect of the communities would create a feeling of 'closeness' to the expert/operator. For example, addressing to different people by their age/gender with local word or local action to show respect; or in some rural areas, it is important to remove your shoes when entering a villager's house as it is a part in their customs.

- *Respect to local conditions*: living conditions in rural area are tough and far different from city life where most of high educated experts come from e.g. the lack of some facilities (no electricity, no toilets etc.). This should be well-aware and prepared to be adapted

Figure 5.18 A local TV fixer – the savoir when the ipaq-GPS cable connector went wrong

by experts/operators. In many areas, offering their local foods and drinks to an outsider shows the house owners' hospitality and this expected to be well appreciated.

• *Properly dressing*: avoid dressing with impressive style such as complicated skirt, formal long dress, formal suits and shoes, or to another extreme, to wear too informal clothes with sleeveless shirts, shorts etc. The tips were: wearing polite, simple and comfortable clothes.

• *Show appreciation to local contribution*: thanking them for working with you, for contributing their time and idea, and sometimes even their food and hospitality.

A **team work** of operators to provide support to each other is necessary in PGIS as they will be able to answer more questions, discussing and supporting each other in difficult/unexpected situation (such as if any technical problems arose). It is preferable to have this team work as a cooperation of foreign experts and local technical staff, making it a part of capacity building step, and reducing cost on foreign experts.

A **continuous technical support** from PGIS operators should be remained and regulated during process of information processing, utilising, maintaining and managing, PGIS operators and users should aware that because of the 'participatory' characters, there is a high dependency of local communities to GIS experts/operators.

However, there is no ideal situation for PGIS application because it's aimed for solving and improving problematic situation. The point is to know the starting point to set up an appropriate step-in action. After intervention, PGIS with its good practices should have influence back to the situation as well as be able to adjust itself toward the most appropriate technology to the communities.

5.4.7. Seasonal conditions

Working in rural area is highly dependent on seasons and seasonal activities. For example: the study was conducted on fieldwork during September which is a most 'free' time of farmers from rice cultivation. It was a favourable condition to participants because rice-production dependent farmers can spare their time for participating in PGIS much more easily than during the crop season months. Knowing about local livelihoods and their seasonal activities is useful for PGIS (and also other participatory processes). Another seasonal condition is about local weather. September is also the rainy season in Hue province which also covers Loc Tri commune and its villages. The work in Hoa Mau village was delayed for many times because of the domestic floods caused by rain water coming down from Bach Ma mountain ranges.

6. A discussion on PGIS concepts and its context

6.1. PGIS as relevant technology in participatory process

The complementary combination of technology and participatory approaches

From Finding1, the interaction of participants and different tools of PGIS showed a very active mutual impact of PGIS tools and participation.

Positive impacts
- PGIS, with its power of technology coming from abroad, can attract great participation through drawing curiosity and desire of learning in local communities   - PGIS facilitates the interaction of participants during the participatory process as it provides visualisation tools for communication and discussion. Through these dialogues, local communities develop better understanding about their common problems and achieve a consensus of solutions. This could be a part of empowering process which enables local community members to express their opinions and they feel their voices are heard. This process of interaction also results to a by-product of active participation, which is the built up social capital of each community members as well as the outsider. (Rambaldi, Bugna et al. 2002)   - PGIS provides efficient technical support to participatory spatial planning and area calculation. By using mobile GIS, with accuracy of up to 5 meters, the on-site measurement for land-use planning in rural area could achieve high accuracy with much of time and cost saving in comparison with conventional survey techniques. This helps to reduce the 'length' of PRA time in participatory spatial planning which has been criticised as too time demanding.   - While local sketch maps are considered as not legitimate by government authorities (Fox, Suryanata et al. Date unknown), PGIS provides sketch maps which is based on satellite image or aerial photograph with a reasonable accuracy and are appreciated by both local community and authorities for its providing real shape of the area and approximately exact location of development plan. The distortion of sketch map can be explained by an example: while local community perceive their village space as it is larger in horizontal dimension than the true shape which includes more forest areas spreading along the vertical dimension of the territory. This is because in their mental map, the village is perceived by location of residential houses and farms. Meanwhile, forest areas, which belong to village's territory, is not open to villagers' access but is under the management of the National Park or of the State Forest Enterprise do not come into villager perception of their village's space. This reflects the difference in how local communities and higher authorities perceive a common spatial location and the reason why local maps were not well-appreciated. With PGIS maps, the higher authorities feel that they can trust the maps and give it more validation, as consequently, this brings in legiti-

macy and accountability to information that come from grass-roots level. (Mapedza, Wright et al. 2003)
▪ On the other hand, participation has its contribution and impacts on PGIS as it brings local (spatial) knowledge to PGIS data collection, analysis and processing. Although we did not do image classification in this exercise, and satellite image interpretation was aimed only for local people to recognise their area and based on that they can plan for village development, the process showed that local people can analyse remote-sensed data based on their knowledge on the area and provide valuable basement of building up a data base. This was proven when local communities established the legends and land use planning unit attributes identification (Gonzalez 2000; Rambaldi and Callosa-Tarr 2001))
Negative impacts
▪ When operating PGIS, the computer operation and technical problems will slow down participation process. Farmers could not operate the computer themselves and therefore, they were dependent on the external PGIS operator. Time of waiting for computer operation could cause frustration and distraction to participants. This is especially true when technical problems happened and people had to wait for data display recovery.
▪ PGIS may lead to conflict/dispute on boundary or in land use planning as it was showed in the participatory mapping exercise. Because village is not the administrative unit in Vietnam, the idea of village boundary is very vogue and general. Usually a significant land mark is used to identify village territory. However, in areas where forest or bare land is the majority, mapping boundary becomes more complicated.
▪ Participation requires high competency of PGIS operation. Because the process involves many stakeholders/participants, it can not be easily repeated and hence all technical operations that are carried out during participatory process have to be very reliable and firm. Mistakes and clumsiness in PGIS operation by the outsider cause distrust and lost interest in participants.
▪ With PGIS, local communities will tend to be more dependent to external agencies in operating, maintenance and updating GIS products (maps, data base etc.). In this study, the villagers are totally dependent on me (the GIS operator/researcher) for having their maps back.

It is important to have a proper consideration between positive and negative impacts of PGIS before bring it into a rural development activity. The uses and limitation of different PGIS tools are very different and therefore it should be well-considered for each PGIS tool whether or not it is wise and cost-effective to use it. For instant, the use of participatory mapping based on paper satellite image which was found to be farmer-friendly, flexible, efficient, and cost effective while the use of mobile GIS was considered to be more troublesome because of its high technical vulnerability (running out of battery, fragile connection etc.), and small size of screen which limits greatly participation. However, if the efficiency of time-saving for mapping by using mobile GIS is more counted, it may still worth to take use of the tool with more proper preparation to avoid problems.

Emphasising on participatory dimension: dimensions of the 'dimension'

From observation on participation of the process, it was found out that participation in large number did not promise a good contribution from the participants and did not guarantee a true participation.

Other more important dimensions of participation are the equal task dividing and sharing during the process and the purpose/intensive of participation.

In this study, the number of participants in Phuoc Tuong village was bigger than in the one from Hoa Mau village, the planning map from Hoa Mau village was made in more detailed and with more attention. It was because in Hoa Mau village, participants, although were few, actively participated in the mapping exercise and contributed their ideas equally to each other, while in Phuoc Tuong village, the participants were more passive and cautious of the village leaders.

Not only in PGIS, but also in other process of using participatory tools, it was not clear how to evaluate the extent of participation. Indicators for participation often are taken as number of participants: males and females, which overlooked other dimensions of participation.

Attempts to review and evaluate participation have been made. (McCall 2003f) have suggested some dimensions of participation such as: intensities and purposes of participation (see Chapter 3). However, I found that the dimension of purposes or intentions is closely linked to the one of intensities. For example, a participation process with intensity of 'information-sharing' would be classified as having 'facilitation' or could be 'mediation' but not possible to be 'empowerment'. Also, a participation process with 'initiating action' intensity must be the one with purpose of 'empowerment'.

Therefore, in combination of empirical experiences on participation and reviewing others' research, I suggest three dimensions of evaluating participation as the following:

- **Large participation**: is the number of people/stakeholders involved. This is the surface of participation.

- **Active participation**: is the extent of task sharing and working together among participants (especially when the powerless work together with the powerful). This could be a criterion to assess power distance among members of the community. The change of this power distance during the long process could prove for empowerment.

- **Intensive participation**: the intensity of participation, this will define the nature of participation in the process. This reflects the nature of participation in the process: respect to the communities, empowerment, ownership and rights.

Figure 6.1 Three dimensions of assessing the level of participation in a collective problem solving process
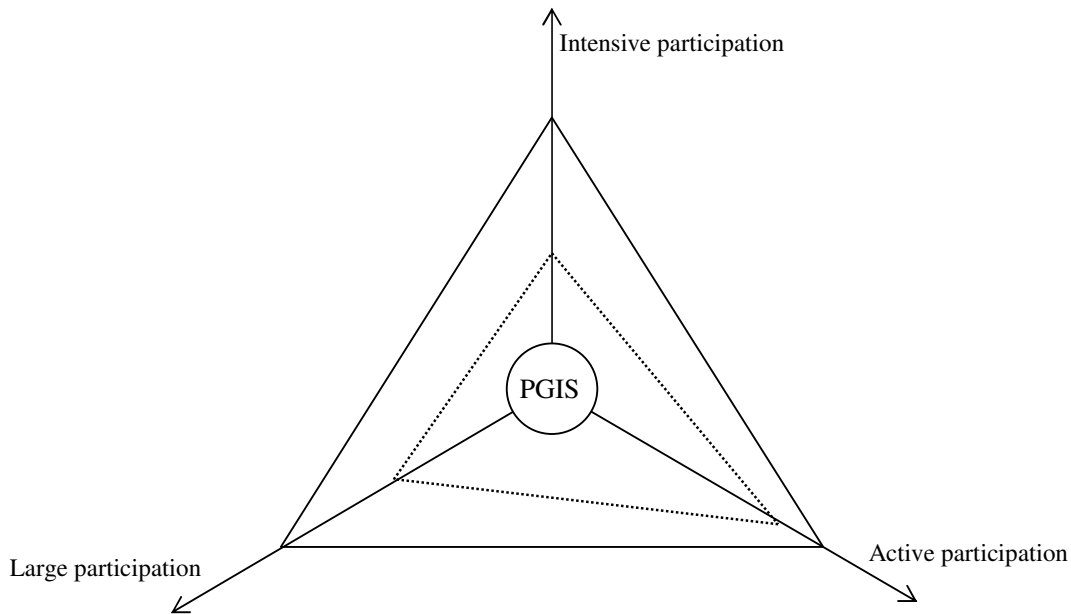
Figure 6.1 shows the three dimensions of participation and the 'shape' of the actual participation that was achieved in the process. The three points that are identified on the three axes form a facet of participation. Depending on each case, the triangle of participation will change its shape. The most ideal participation process is to have a good balance in all dimensions with: large number, actively and equally participation and deep involvement.

6.2. *'PGIS'* once more…

Up to this stage of the research, I realise that my understanding of what PGIS is have changed in comparison with those perceived before I went to fieldwork. Besides, another review of literatures on PGIS: experiences and definitions, it has become clear to me what my understanding of PGIS is so far. Outstanding points that I want to emphasis on a PGIS definition are discussed as below.

It is dynamic

I noticed that PGIS is not just a mere use of GIS in a participatory manner as Minang (2003) has summarised. More complicated than that, PGIS requires the use of GIS tools in very flexible ways which varies from one place to another and in different environment, with different technical GIS tools, applying for different application fields, having different purposes, and with different dimensions of participation.

As PGIS is about dealing with geo-information together with local people, the 'participation' requires much more complicated and proper preparation than a normal GIS application does. 'Participation' changes all the time in terms of number, personnel, and even emotions and moods of participants. Even if the same number of participants remains in the next sections, it could also because of "people leave, people come". Likely, even the same group of participants continue the work, they might be distracted by farming concerns, family worries and duty, society responsibility etc. All these changes force PGIS as well as other participatory processes to be well-adaptive, patient and highly flexible.

The dynamic aspect also comes into PGIS's practical tool. It is not necessary to interpret GIS as a computerised system geo-information. The use of non-computerised form of geo-information such as transparency overlays and 3-D models provides user-friendly and adaptive tools to geo-data analysis in rural environment. This non-computerised GIS concept does not go against the ordinary definition of GIS in geo-information science in (Chrisman 1999).

It is a process of application

Similar to other participatory approaches, PGIS is highly time-demanding and require a continuous intervention. It implementation has phases and steps which go coherently with the phases and steps of development management circle. In each phase and step, the use of PGIS tools should be considered carefully for what the purpose of using it is and what preparation should be made particularly for it in order to avoid technical failure. This is coherent with opinion of (Dunn, Atkins et al. 1997; Jordan 2002).

Its starting point

The process that defines PGIS should not be technology-driven. It must have a starting point which comes from the needs of stakeholders – from the 'what problems do they want to solve'. In Loc Tri study case, because of a strong need in having information on village development planning, I had to change the topic of the study given little information on study areas during preparation phase.

However, addressing the needs in rural development is not a simple task. The key issue is to have a common problem that is perceived by different stakeholders. For instance, the need of having information on local development planning expressed by the authorities of the National Park was in a mutual need with the practical economic development need of local communities. Though this development planning process may serve different purposes of different stakeholders, such as in this case, the authorities of National Park wish to improve economic situation in buffer zone villages in order to reduce the pressure on their protected forest areas, while to local community: income improvement and diversification is the aimed of their living.

Yet, in order to strengthen local communities' livelihoods and income, their needs could be confront with targets of higher authorities e.g. the need of having more access to forest production (NTFPs or plantation) is contradictory to the target of keeping the total protected forest area out of local community's activities.

In short, PGIS may serve a common problem in a rural development context, and addressing different needs of different stakeholders. They could be well-matched or un-matched which if it is the case; PGIS becomes a conflict resolution instrument.

It is end-result oriented

In PGIS, its outcomes/outputs should serve and be utilised by local communities. The question of evaluate if it is really a PGIS should be if its end-result really help the communities to solve the problem they want to solve. This relates to issue of local community's access and ownership to PGIS products which should be used for their communication, negotiation, planning, visualisation, monitoring etc.

If local communities do not have access to outputs of PGIS or not benefit from them, the whole process would become a mere GIS application with some involvement of participation in order to extract

information from local community. The issue of PGIS good practice is closely linked to this end-result orientation element.

Therefore, a process of applying participatory mapping with purpose of researching/studying with no access and benefits from its products is not a PGIS, but a merely community-integrated GIS practice.

The shape of PGIS

From the above discussion and analysis, PGIS is conceptualised in to a framework as in Figure 6.2.

Figure 6.2 PGIS conceptual framework in local rural development
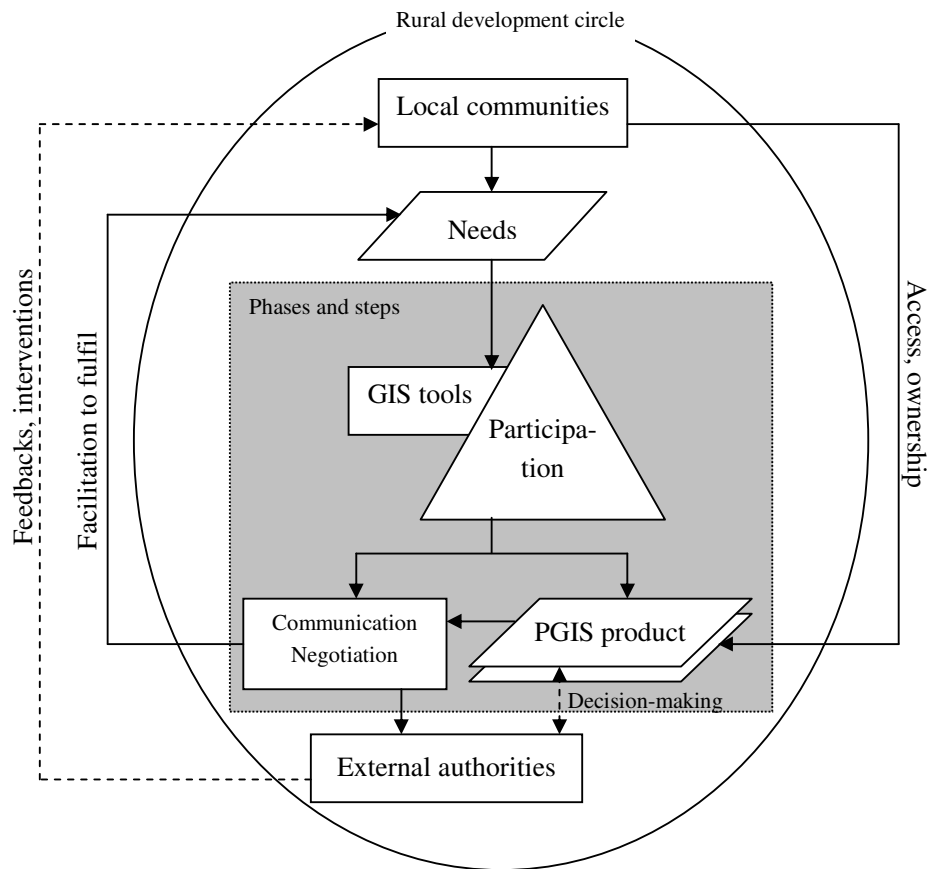
As it was discussed that PGIS is a process which has a starting point coming from local community's needs, and an end-result which should serve those needs fulfilled, PGIS in this understanding is a continuous circle of development practice. Outcomes of PGIS counted as both its GIS products e.g. maps, data sets and the communication/negotiation arose spontaneously among stake-holders/participants during the process. The GIS products (maps, data sets) could be used for decision-making process at the higher level of authorities and it is appropriate to give credit and owner-ship of those products to local communities. The use of PGIS products should facilitate to fulfil the needs of local communities' (as the first priority) and other stakeholders'. Through this process of information flow, communication and negotiation, external authorities (including other agencies e.g. NGOs, IOs) can provide feedback and intervention to support local community addressing their problem.

6.3.   A conceptual model of PGIS and its applicablity context

The model of PGIS and its application environment

As it was analysed in Part 5.3 "Review on the applicability of PGIS in local rural development context", PGIS's success and failure are influenced by groups of factors. It could be viewed as if PGIS is a practice; its 'sphere/space of play' and effectiveness are constrained and bound by those factors. This could be illustrated by Figure 6.3 as below.

Figure 6.3 PGIS in relation to its application in development context
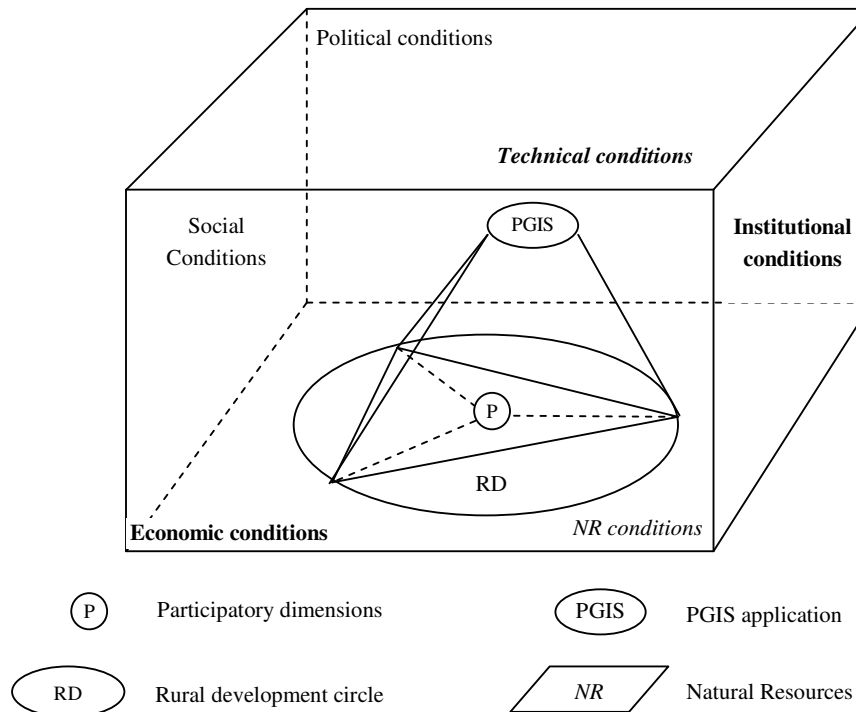
This model illustrates the relation of PGIS and its complex environment in rural development. It has two main components: PGIS in rural development process and the conditions that influence its applicability and effectiveness.

The circle of rural development has a close linkage to natural resources conditions because of the spatial dimension in development planning.

PGIS, as a set of tools coming from outsiders, has a dynamic application in all phases and steps of development process with different dimensions of participation (P)

The 'box' including the facets of natural resource, social, economic, institutional, technical and political conditions forms a 'space of play' for PGIS. These conditions may be favourable or constrained to PGIS and therefore the facets may expand or shrink.

The shape of this 'box' also may change when there are other conditions that influence PGIS applicability are found. Hence, it is a dynamic box which may change it shape in each situation, in each period of PGIS.

This model which is built from a practical experience is found to be coherent with the logic of a simplified model of GIS in relation to its use from (De Man 1988) as he defined an information utilisation system according to three layered concept: object system, information utilisation system and information, based in its environment. When comparing the 'PGIS and its application environment mode' in this discussion, it arrives to a similar structure of layers and components.

A framework of PGIS and its rural development context (at local level)

Yet, elements and factors that influence PGIS's effectiveness on the field are not completely split out from each other like 'the walls'. Rather, they are inter-linked, integrated, and mutually affect each other and these complexity in their relations has brought in the complexity of PGIS implementation.

PGIS, in its relevance to development and conditions for good practice, bears important elements as: its linkage to natural resource/spatial information, its linkage to local needs, participation levels, participatory added values, use-friendly, reliability, flexibility, and operator (competence and social skills). These elements are strongly connected to those from its implementation context.

Rural development context (at local level), in this study, is identified by four main groups of non-technical applicability conditions: economic condition, social condition, institution condition, and politic condition. Each of them contains many components/elements as it was analysed in Part 5.3 as summarised as below:

☞ Economic conditions: cost and benefits

☞ Social conditions: culture and social capital; each of these component in its turn holds other elements such as learning attitude and information-sharing culture.

☞ Institutional condition: legitimacy (policy), accountability, human resource, and institutional support etc.

☞ Political condition: Power and empowerment, and political sensitive

These components/elements come into different levels and seem to form a hierarchy tree of conditions and elements (see Figure 6.4) but they are very complicatedly linked and highly influencing to each other. This explains that if one component/element is overlooked in PGIS implementation, the whole process may face serious problems and even be threatened to failure. Figure 6.4 provides a visualisation of this complex system of PGIS and its environment.

Figure 6.4 PGIS and its context: elements and their links

PD: Power Distance   UA: Uncertainty Avoidance
M vs. F: Masculinity/Femininity

────────── PGIS-context external links

I vs. C: Individualism/Collectivism
LA: Learning attitude IS: Information Sharing
S: Structural   R: Relational
─ ─ ─ ─ ─ ─ ─ PGIS/Context: internal links

Rural Development Context (at local level)
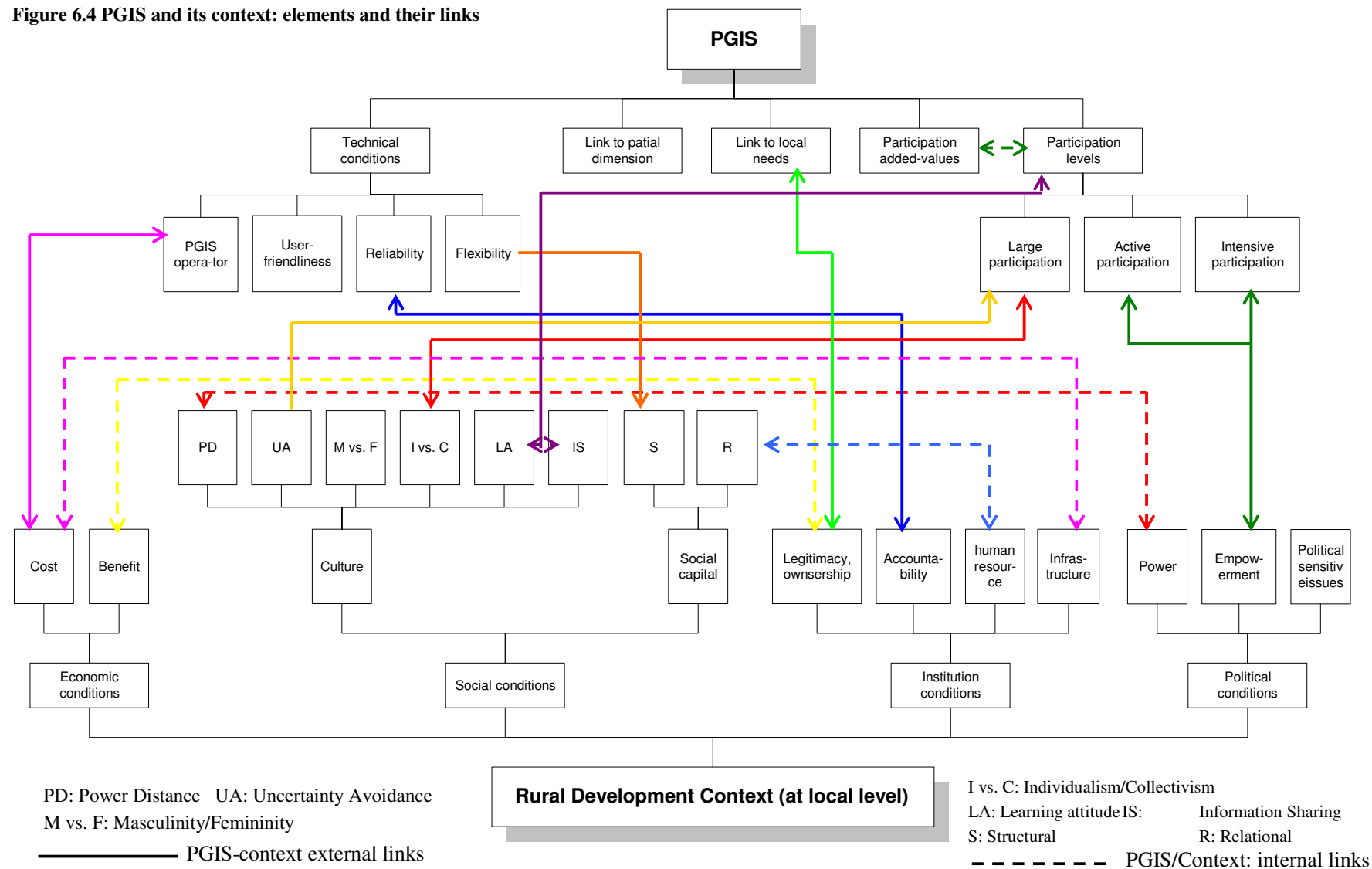
6.4.   PGIS implications for good practice

'PGIS good practice' in this study is perceived as the appropriate way of implementing/introducing PGIS in an intended context. 'Appropriate', in its turn, covers the meaning of relevance, suitability, effectiveness and sustainability.

In order to have 'PGIS good practice', it is important to answer two main questions: what it is? And how does it work? The practice of an approach depends greatly on how the people who are using it perceive its concept nature. A practice of PGIS with a purpose of serving technology's need in information acquiring would not be able to be justified for 'good practice'. The 'participation' meaning is often taken wrongly by many participatory approach practitioners/users.

Findings in Part 5.1, 5.2, and 5.3 have provided evidence and inputs for understand these two questions that PGIS good practice should first come from user's need and with true commitment of participation from all involved actors. This is well supported by many authors (Dunn, Jordan, Harries and Weiner), especially, McCall 2004 suggested some similar point of view in basic requirements for community-based natural resource management as: an initial commitment, and problem-driven.

Secondly, PGIS good practice link closely to good participation (Chambers 2002). It requires specific conditions and understanding as any other participatory approach does.

Thirdly, the issue of end-result oriented, which was mentioned with meaning of "access PGIS products" was not mentioned in other PGIS definitions, but was mentioned in terms of legitimacy, accountability and ownership (McCall, Dunn et al. 2004a).

(McCall 2004b) shared a list of guideline for PGIS good practice sequence including pre-conditions and 20-steps in process/procedures.   Though this consequence covers most of key issues in PGIS implementation, it is more in term of practical steps for the PGIS operators than considering conditions that are arriving from the local community and local conditions, for instance, local seasonal pattern as in the villages, crop seasons are very critical and important time; community activities should be carried out during the free crop months so farmers can attend the activities and not affecting their farming activities.

That guideline provides a 'vertical' list of conditions for good practice with consequences, and in this study those were seen as in a more 'horizontal' dimension with groups and clusters of conditions. (Chambers 2002) provides a short list of PRA-good practice. Combining of these conditions/checklists for a PGIS good practice guideline would bring up much clear and comprehensive view. However, it is beyond the reach of this study, given its limitation in time and other conditions.

7. Arriving to key conclusions & Recommendations - toward future research

7.1. Conclusions

PGIS process in Village Development Planning and the local community-technology interaction (for objective 1)

❖ The process of PGIS in Village Development Planning has three main phases which based on the phased of VDP process. The use of GIS does not change the consequences of participatory process, but is adapted to fit in and support to problem analysis and solution seeking.

❖ Interaction of local community and technology varies from one village to another, depending on local social, economic, political and institutional conditions of the areas.

GIS's relevance to rural development planning at local level (VDP) (for objective 2)

❖ It could be considered as a collective spatial-related problem solving with multi-stakeholders/actors involved each of whom have their own "value" to contribute in the problem solving process. Therefore, the process of applying PGIS is multiple-actor, multiple-value, and multiple-benefit.

❖ The usefulness of GIS application in local rural development planning are: its technical efficiency in time and data quality improve which lead to improvement of legitimacy and accountability in the later stage of VDP products (development proposal, map etc.); and its attraction to participation by drawing their curiosity and learning desire which links to the community learning process, empowerment and improving social capital. These impacts from geo-information technology (GIT) compliment to the weaknesses of ordinary PRA tools e.g. distorted sketch map, lack of liable and accountable and comprehensible visualisation tools for communication and negotiation.

❖ Participation in PGIS can be assessed in three dimensions: large participation – implies the quantitative aspect of participation; active participation – implies the degree of sharing opinion and working together of participants, reflecting the 'dynamic' aspect of participation; and intensive participation - also attaches to intension and purposes of participation and emphasis on the 'heart' of participation.

❖ The added-values of participation to GIS reflected by local spatial knowledge about their own areas, the mental maps which reflect hidden socio-economic/institutional situation, a comprehensible legend with symbols and language close to local communities, and a basic data design by involvement in attribute identification.

❖ In this combination, the exposure to geo-information in participatory process may lead to potential conflicts.

❖ GIS and participatory development process are mutually influencing each other and the use of GIS tools can be relevance and effective in a collective problem solving process e.g. VDP

PGIS concept (for objective 2)

❖ PGIS process is a continuous application. A single use of maps or mobile GIS is not called PGIS. It involves sets of participatory tools and GIS tool used in combination with each other, depending on its purpose and the problems it deals with.

❖ It starts from the needs of local communities, is continuously carried out under types of several tools during the phases and steps of the problem solving process.

❖ It has the end-results which should be a means to serve the communities to solve their problem and be available for them to access in an equitable and well-respected manner.

❖ An action of participatory mapping exercise which is aimed to exploit information at local level for purpose of research or management which has not relation to benefits of local people is not a PGIS application.

❖ PGIS is not necessary a computerised system but could be non-computerised: transparency overlays, 3D models etc.

PGIS and its context (for object 3)

❖ PGIS's relevance in rural developing context is shaped by economical, social, technical, and political factors of the communities.

❖ However, there is no perfectly favourable condition for PGIS application. It is useful to understand the complexity of its application environment, and hence be able to be well-prepared for each steps of the application as well as to adjust the technology into a more user-oriented direction.

❖ Dependency of local communities to external agencies in PGIS in terms of technical operation and funding sources.

Conditions of PGIS good practice in rural development context (for objective 4)

❖ Conditions of PGIS good practice in rural development context are complex and inter-linked to each other.

❖ These conditions may be grouped in categories: conditions from PGIS context which are more difficult to control and need to be well-studied before PGIS implementation; and conditions from PGIS tools and steps, on which PGIS participants can give more initiatives.

❖ PGIS good practice includes "participation" good practice, "GIS" good practice, and PGIS special value good practice (e.g. to achieve legitimacy etc.), of which each 'good practice' requires different conditions and appropriate steps . Combination of all these conditions and steps requires more effort on researching and practicing in the learning process.

7.2. Recommendations

From the process of finding results, making discussion and conclusions of this study, I have come to some suggestions for future study on PGIS as following:

 📖 **Cost-benefit study** of PGIS has been in a 'gap' in attention at both practical and research level. This is an interesting debate to find out how 'costly' or 'beneficial' PGIS is. Both empirical and literature researches on this topic would be innovative.

 📖 **Participation** has been an important criterion to evaluate sustainable development process. However, it fuzzy and complex characters challenge researchers and development practitioners in measuring it. In this research, another dimension of participation was suggested, yet not in form of **quantitative indicators**. Further researches that dig into quantifying participation should be valuable

 📖 **Sketch map** has been considered as a special PGIS tools as it could be listed as a part of both sets of PRA tools and GIS tools. Sketch map made by local community can 'tell' many stories about the area and its people through process of visualising and interpreting 'mental map'. A research on finding the relation of sketch map and GIS map in PGIS, analysing reasons behind distortion, and finding an appropriate techniques in making sketch maps that combine both strength of 'mental map' and GIS map would be challenging yet interesting.

 📖 The last suggested topic is about **PGIS good practice**. It requires more analysis and compilation on its conditions from different dimensions: from technology perspective, participation perspective and PGIS implementation's environment perspective.

7.3. Some ending notes

Now as I have come to the closing stage of the study, I would like to dedicate the final lines of this work to give credit to the people in Loc Tri commune, Thua Thien Hue province, Vietnam, who has taken a big share in designing this study and contribute many inputs about their life, areas and opinions during the field work period. My apology to them is necessary because I still feel that they have not got an equal benefit from this study though they have shared the work.

I view this example as a not yet successful case of PGIS, because it has not completed the 'return' part of PGIS products to local communities, as I am expected and plan to do.

This study is *small* in term of time and scope and is *beautiful* to me in term of what it has showed and conveyed about PGIS and for it has been such a learning process: learning by hearing, seeing, doing at the same time. The process would continue and go on for longer, but at some stage it has to be wrapping up to an ending note. Yet, at the same time, it opens a new door of knowledge for me as well as hopefully might be useful for those who are interest in PGIS.

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Appendices

Appendix 1 Criteria and results of selection of target villages in the study

Village	Number of households	Location	Distance to Forest	App. area	Main pro-fession	FPs of consumption	FPs of in-come-generation	General wealth ranking	Hospitality	Others
Khe Xu	49	Inside the park	Next to restrict area	Large	Agricul-ture	Fuel wood, mush-room	Ecological tourism	Medium-poor	Very	
Hoa Mau	280	Between for-est and main road	Very near	Very large	Agr., carpenter, etc.	Fuel wood,	Fuel wood, eco-tourism	Medium to better-off	Medium	
Dong Luu	397	Between la-goon and main road	Far	Medium large	Various	Fuel wood, wood logs for boat mak-ing	Fuel wood, wood logs	Better-off	Medium	
Le Thai Thien		Next to la-goon	Far	Medium small	Fisherman	Fuel wood, wood logs for boats, fish-ing equipments	-none-	Poor	Not so	
Dong Hai		Next to la-goon	Far	Small	Fisherman	Fuel wood, wood logs for boats, fish-ing equipments	-none-	Medium-better off	Medium	
Trung An		Between la-goon and main road	Medium	Medium	Agricul-ture	Fuel wood, housing	Fuel wood, NTFPs	Very poor	Not so	
Phuoc Tuong		Next to la-goon	Near	Large	Agricul-turefishery	Fuel wood, housing	Fuel wood	Medium	Very	
Trung Phuoc		Both side main road	Near	Large	Agricul-turefishery	Fuel wood	Fuel wood	Medium - poor	Not so	
Cao Doi Xa		Next to main road	Far	Large	Trading, agriculture	Fuel wood		Better off		Not typical

Appendix 2 Loc Tri land use and livelihoods pattern figures[7]

Land use in Loc Tri commune

Land type	Area (ha)	
Total area	6294	100%
Forest land	3060	48.6%
Agriculture land	357	5.7%
Settlement land	48.4	0.7%
Special use land	70	1.1%
Un-used land	2758.6	43.8%

Livelihoods pattern and land resources

Sources of income	Related land type	Ratio (%)
Rice	Agriculture land	17
Subsistent crops and other crops	Agriculture land	13
Garden products	Forest land	3
Live stock keeping	Settlement/special use land	14
Trading	N.A	16
Fishery farming	Water body	15
Off-farm activities (except trading)	Forest land (handicraft, carpenter)	10
Wood loggings, fuel woods and NTFPs	Forest land	10

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[7] Source: Loc Tri commune, Land Administration officer, date collected: 28 September 2003

Appendix 3 Loc Tri commune crop season calendar

Seasonal Calendar

Month	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall												
One crop land rice												
Two crop land rice												
Upland rice												
Cassava												
Sweet potato												
Green bean												
Brow ground bean												
Tobaco												
Other Vegetations												
Forest planting												
Sea product exploit ing. *Day* : Young strimp Fish *Night* : Fish, Shrimp, Crab												
Timber collecting												
Time of liverstock often get disease Pig Chicken												
Food shortage month												

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VN 0012. 01 WWF - EC project
Bach Ma National Park

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Appendix 4 Institutional and Individual Threats and responses

THE THREAT OF GIS

INSTITUTIONAL THREATS

- ➤ **ORGANIZATION** — "There's only one problem having all this sophisticated equipment... we don't have anyone sophisticated enough to use it"
- ➤ **STATUS QUO** — "If it ain't broke, don't fix it"
- ➤ **OVERLOAD** — Torture numbers and they will tell you anything"
- ➤ **STIFLING** — "Imagination is more important than information"
- ➤ **AWARENESS** — "Technobabble... that seemingly endless drone masking what would otherwise be a clear understanding of a new technology's concepts and use"

PERSONAL THREATS

- ➤ **INTIMIDATION** — "It's like new math, I'm just too old"
- ➤ **POWER** — "Experience used to be worth something, now you just dazzle them with color"
- ➤ **DEPENDENCE** — "Middle management is an endangered species... they are information brokers hooked to the computer jerk down the hall"

COPING WITH GIS THREATS

INSTITUTIONAL RESPONSE

- ➤ **GRASSROOTS SUPPORT** — "*They* don't know what *they* are doing"
- ➤ **UNDERSTANDING** — "You know, this GIS stuff isn't so bad after all"
- ➤ **PROOF-OF-CONCEPT** — "Oh, now I see, I could use something like that"
- ➤ **COMMITMENT** — "What do you mean, learn it in my spare time"
- ➤ **TOUGH LOVE** — "Like it or not, unless you have retired, your job has evolved for the better"

PERSONAL RESPONSE

- ➤ **LINGO** — "Sticks and stones my break my bones, but arcane terminology will never hurt me"
- ➤ **CONTINUING EDUCATION** — "The era of the four-year smart pill is over"
- ➤ **LEADERSHIP** — "If the boss can handle this stuff, then I guess anybody can"

Appendix 5 PRA mapping tools and transect guideline

SESSION 16a: Maps

Purpose: To introduce the importance of maps and to practice mapping.

Time: Two hours

Materials: Chart 16a.1: What Are Maps Used For?
Chart 16a.2: Drawing Maps
Handout 16a.3: Example of a Map
Chart 16a.4: Participatory Mapping
Chart 16a.5: Exercise: Mapping of the PRA Site
Maps or aerial photographs of the PRA site

Activities: Trainers ask participants why maps are important, what maps can be used for, and introduce the steps of mapping. Participants map the proposed PRA site(s) using available maps and/or aerial photographs as a basis for the outline map. The map is completed based on the participants' knowledge of the site and on available secondary sources.

If community members take part in this exercise, they should take the lead role in mapping their community. It is preferable not to use existing maps in this case as this could inhibit the community members' creativity. If existing maps of the community are available, compare them afterwards, and make any necessary changes.

Notes for Trainers: Be sure that participants understand why maps are an important part of a PRA, and that the choice of maps depends on the purpose and topic of the PRA. Maps can indicate areas with inadequate infrastructure, or highlight differences in socioeconomic level, religion, or ethnicity. In an agriculturally-focused PRA it is important to distinguish areas by soil type and plant cover. Be sure that participants understand how maps can help the PRA team understand a situation, and, potentially, make decisions.

Obtain maps of the smallest scale available (1:10,000 or smaller). Prepare a number of copies of the maps for this session. Experiment with different materials. For overlay maps, transparencies and colored erasable markers can be used without an overhead projector.

Chart 16a.1

<u>WHAT ARE MAPS USED FOR?</u>

Chart 16a.4

PARTICIPATORY MAPPING

Participatory mapping allows the PRA team to discover the "mental maps" of community members.

Steps:

1. Decide what sort of map should be drawn (social, natural resources, farm, etc.).
2. Find people who know the area and the topic of the mapping exercise, and who are willing to share their knowledge.
3. Choose a suitable place (ground, floor, paper) and medium (sticks, stones, seeds, pens, pencils) for the maps.
4. Help the people get started but let them draw the map by themselves. Be patient and don't interrupt them. It's their map.
5. Sit back and watch or go away!
6. Keep a permanent (paper) record including mappers' names to give them credit.

Chart 16a.5

EXERCISE: MAPPING OF THE PRA SITE

1. Split into ____ groups.
2. Draw an outline map of the community in which the PRA will be carried out (use available maps).
3. Show:
   - major infrastructure
   - different residential (ethnic, religious, house type), commercial, and industrial areas
   - landmarks
   - landuse (agriculture, livestock, forest, fishing, etc.)
   - other features related to the topic of the PRA

Time: One hour

Present your results to the whole group and compare the maps.

Module 5

Toolkit of Participatory Methods

Tools for observation in the field

Community map

Objective

- To identify the natural characteristics of the community such as mountains, rivers or slopes.
- To obtain information on the public infrastructure such as roads, electricity supply, etc.
- It indicates the location of the community's natural resources such as arable or grazing land, forests, etc.
- To pinpoint the location of private as well as public buildings, meeting places, etc.
- To illustrate the residential area of different families, ethnic minorities, landless farm families, women-led households, etc.

Questions

How do the villagers perceive their own community?

Example

Mechanics

- The field work team walks around with a group of community members to observe the village site.
- The village walk provides opportunity to start talking about the physical characteristics and to take some notes.
- While walking or later on a map may be drawn on a large sheet of paper by the community members.
- In some cases, it may be appropriate to make a map on the ground using local materials such as branches, grains, etc.

Reflections

It gives the field work team a good impression on how villagers perceive their own community and the importance they give to the different physical features. The map can also identify areas with specific problems (lack of water, soil erosion for example) and provides a good starting point for the discussions later.

inWent 5

International Workshop on Integrated Methods in Poverty Reduction   Phnom Penh, Cambodia 2002

General Information on the field area

Area Images and Road Maps

Objective

- To gain a first impression on the location of the area of interest
- To identify some physical characteristics of the area e.g. mountains, rivers, roads, etc.
- To get an idea about the agro-ecological situation
- To make out some of the elements that may have an impact on the economic activities in the area

Questions

What are the basic characteristics of the area?

Example

Mechanics

- From the image or road map of the area where the PRA shall take place, some general geographical characteristics can be identified, such as location of rivers, mountains, valleys, vegetation etc.
- Location of roads, villages and bigger cities can give information about socio-economic aspects of the area, such as infrastructure, nearby market places, population density, etc.

Reflections

It is important to have some basic information about the area, its location and its surroundings. It will help to crosscheck the information which will be gathered later. It will show community members that you are interested in their place.

4   THE LUTHERAN WORLD FEDERATION

International Workshop on *Integrated Methods in Poverty Reduction*   Phnom Penh, Cambodia 2002

Tools for observation in the field

Community transect

Objective

- To record the biophysical characteristics of a community like hilly or mountainous areas, forests, arable land, rivers.
- To characterize ecological diversity and different patterns of land use for example agricultural production, animal rearing, wood land, fish ponds.
- To identify the opportunities and limitations for sustainable land use, for increasing agricultural production or alternative non-farm income generating activities.

Questions

- Where do they grow cereals, vegetables, etc.?
- What other crops might be suitable to this area?

Example:

Transect of a village in Kampong Thom Province, Cambodia

	Primary forest	Degraded forest	Upland crop	Paddy	Home garden	Resident. area	River bank
Land use	Primary forest	Degraded forest	Upland crop	Paddy	Home garden	Resident. area	River bank
Soil	rocky	gravel	gravel/sand	sand/clay	sand/clay		sand/clay
Crops + Vegetation	timber, bamboo, rattan	Bamboo, fuelwood	Cassava, maize, beans, upland rice	Paddy	vege-tables, fruits		watermel. sweet potato, yam, cucumber beans
Problems	logging, poaching	soil erosion	drought, pests, low soil fertility	drought, pests	flood	flood	flood
Opportunities	timber, rattan, wild fruits, wild vegetabl, wild animals, cardamom, gum	fuelwood, bamboo, fodder, mushroom, herbs, honey, pasture	improved upland farming, pasture, tree plantation	improved varieties, application of fertilizer	inter-sive gar-dening	market, health centre, fish pond, rural credit, brick production	egg plant, pumpkin, tobacco etc. small-scale irrigation, flood control

| Agroforestry |

Mechanics

- The field work team walks together with a group of community members through a section of the community which includes the greatest possible ecological variety (the route can be decided on the basis of the community map).
- After the walk the community members prepare the transect diagram on the basis of what they observed together. Notes are taken by the field work team.

Reflections

The transect diagram gives a more detailed view of the physical characteristics of a community area. It allows to identify problems and potentials related to these characteristics. The community members who participated in the transect walk should be the ones to draw the diagram, not the facilitators.

Appendix 5 Good practice sequence to P-Mapping and P-GIS (McCall 2004c)

Pre-conditions:

- "Purpose, purpose, purpose" – analytical clarity about the purpose of the P-GIS exercise is the key element. Purpose can be translated into the intentions of participation – facilitation, collaboration, and empowerment.
- Local people and their communities are the principals or partners, not the clients. Thus the P-GIS initiatives emanate from them, not from the outside.
- P-GIS is directed towards the marginalized, the unrepresented, the inarticulate, the resource-poor, the power-deficient. Show positive discrimination towards people identified by gender, age, wealth, resource levels, caste, religion, class.
- Envision from the start, what are the GI outputs / products going to be – are they of any use to anyone – if so, for whom? And what are they?
- Consider collaboratively what might be the negative impacts of the outputs – PSP and P-mapping can lead to more conflicts, and more concentration of power or resources in a few hands.
- Despite the necessity for a long-range vision, nevertheless, the approach should remain flexible, adaptive, and recursive in the actual approach, without sticking rigidly to pre-determined tools and techniques, or blindly to the initial objectives (participation is learning).
- Participation is always a learning process – best if it is learning in two directions-:
- Experts learn the interests, objectives, limitations, constraints, and variability from the insiders.
- Insiders (community traditional leaders, elected leaders, NGO, CBO, civil society, etc) learn from the expert (planner, GIS, mapper, geographer, doorkeeper to outside knowledge, contact with outside power). Insiders learn technical knowledge, and new technical, economic and social skills, but also a wider vision.
- Participation is always slow – by design if not by definition; this is true also of P-mapping, P-GIS.
- Adherence to deep PRA and Participatory-RRA principles and methodology, especially in terms of their information needs assessment; and not just blindly use the tools of RRA to exploit local knowledge.

Process and Procedures – the Works:

i.   Essential element is the indigenous technical and management knowledge (ITK) and local expertise, seeking to understand local culture, society, spatial cognition, and livelihoods, local resources, hazards and options, etc.

ii.   Usually there is special need for the historical perspective in IK and ISK - conflict analysis especially needs a historical understanding.

iii.   Make full use of non-conventional information and knowledge acquisition – semi-structured interviews, open-ended discussions, stories, songs, pictures, serendipitous meetings, and the panoply of RRA/PRA methods.

iv.   Collaborative, scientific selection of appropriate software and hardware by insiders and outsiders together.

v.   Acquisition of professional geospatial information – base maps, aerial photos, remote sensing imagery, etc.

vi.   Prepare in advance for any desired protection of indigenous data layers. How can they be protected? How accessed? etc. Clarify the current and future status of the ownership of ITK and ISK, taking into account guidelines on the protection of Indigenous Intellectual Property Rights.

vii.   Follow international survey guidelines such as the AAA [8] Code of Ethics which reminds anthropologists that they are responsible not only for factual content of information, but also the socio-cultural and political implications.

viii.   Apply local indigenous spatial knowledge (ISK) concepts of boundaries, core areas, conflict and risk zones, resources, priority areas, time-distance relations, dynamic spaces and landscapes, etc.

ix.   Collaborative selection of the appropriate spatial scale for geo-data inputs, and especially for the map and GIS products, based on social, political as well as scientific criteria.

x.   Utilise spatial PRA tools – participatory joint interpretation of air photos, RS images; ephemeral maps, participatory sketch maps, time-space diagrams, transects, etc.

xi.   Prepare a series of countermaps representing the interests and values of various groups of actors, especially the marginalised and power-deficient.

xii.   Identify and record spatial information directly on the ground using GPS with mobile GIS (using iPAQs or Tablet PCs).

xiii.   Supplement these information sources with digital photography, video, sound recordings, and with sketching where photography is ineffective.

xiv.   If it will be appropriate for specific spatial planning and management purposes, translate the ISK visualisations into user-friendly GIS software, e.g. ArcPad.

xv.   Transfer participatory maps into appropriate visualisation software, such as FreeHand10, or MaPublisher, which are better attuned to the ISK rich information characteristics of indeterminacy, qualitativeness, fuzziness, metaphor, emotion, holistic and not reductionist. [9]

xvi.   Cross-check the ISK visualisations and the geo-referenced point ITK data with geo-information from standard maps, topographic maps, etc.

xvii.   But do not treat the ISK maps, or 'mental maps', simply as perceptual aberrations; i.e. do not take standard official maps as the only authentic base against which to measure.

xviii. When appropriate for specific spatial planning and management purposes, apply GIS versions (e.g. ArcPad) of the ISK visualisations.

xix.   Make use of interactive visualisation software for further development and for participatory spatial planning (PSP) with user groups. Presentation and visualisation, interpretation of outputs, and understanding.

xx.   Apart from visualisation, if applicable, use physical three-dimensional models, sound, multimedia, or web-based (dynamic) GIS and mapping.

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8 American Anthropological Association(1998-2004).

9 E.g. in mapping competition / conflicts over water resources in Lake Naivasha catchment. (Boix Fayos 2002)

xxi.   Distribution, delivery and dissemination of GI and other outputs should be pre-planned col-
laboratively so as to meet good governance objectives of equity, respect, transparency and ac-
countability

xxii. Follow-up, monitoring and evaluation should be designed into the P-GIS process from the
outset, and with an independent component./.

Appendix 6   Check list for PRA good practice (Chamber 2002)

Many good ideas can be found in statements from workshops in Sussex in 1994 (Absalom et al 1995), Bangalore in 1996 and Calcutta in 1997 [all three published in PRAXIS 1997]. Here is a personal short list.

Time, resources, patience and good practitioners run through them as recurrent themes:

- Donors, governments and INGOs to be warned repeatedly of the dangers of too much, too fast, and with too few resources

- Support for further technical and ethically sound R and D and training [the researcher/trainer's typically self-serving recommendation]

- Care in selecting sensitive, experienced and committed innovators to explore, pilot and develop appropriate approaches and methods to fit each case, and assuring them adequate time and resources (not so impossible, as there are now many more capable, experienced and suitable people around)

- Care in the selection and training of facilitators, with adequate resources and time, recognising that training will be a substantial proportion of expenditure, and will bring other long-term benefits through capacity building

- Independent monitoring and evaluation by community members of party numbers processes combined with self-critical reflection built in

- A code of conduct drawn up in a participatory mode for party numbers sponsors, trainers and practitioners, and widely shared, adapted, and further developed. Participatory work on this by practitioners has already begun. Participants in this conference are warmly invited, on behalf of those who have brought it thus far, to contribute your suggestions.

27 June 02   Robert Chambers