

Chapter II

Literature review

“The paradox of any serious discussion about water is how this watery planet has increasingly become one in which there is water scarcity. Some suggest that it’s not a question of scarcity but one of allocation, supply, and management. Others say it’s our collective will in solving water problems that is lacking rather than the water itself. Yet some believe that water scarcity has been driven by greed.”

- McDonald and Jehl (2003)

The above quote is a pertinent remark that suits to introduce this review. The review is organized into conflicts in water, institutions, participatory approaches, and use of RPG and MAS as tools to understand the issues of water sharing in Lingmuteychu watershed.

2.1 Conflicts in water use and management

Human relation theorists stipulate that conflict is a natural phenomenon, inevitable and it should be managed as it is (Reynecke, 1997, cited in Slabbert, 2004). Similarly conflict over water has become global and is further intensifying with the pressure from forces of economics development (Ostrom, 1990). It is also evident from growing number of challenges in relation to water use faced by professionals and policy makers (Coloumb, 2002). Conflict over water occurs at different scales ranging from the farm to the community and at the international level (Van Veen et al., 2003). For the purpose of this study conflict can be defined as "any relationship between opposing forces whether marked by violence or not" (Deloges and Gauthier, 1997).

Conflicts often arise when different categories of individuals and communities interact with one another in the midst of changes and discontentment. The scope and magnitude of change in resource management regimes and the societies of which they

are part will only increase as the future unfolds. A conflict in resource use can be considered as an expression of discontentment either in terms of access, control or responsibility. It can also give impetus to users to organize and cooperate to assure getting at least some resources for all and to avoid violence. Thus centrifugal forces of competition can be countervailed by centripetal pulls towards cooperation (Uphoff, 1986). To some extent conflict can be useful in defining the competing needs for resources within communities and society (Castro and Nielsen, 2001). When conflict overpowers, chances of reaching agreement on solutions decline dramatically. Therefore, it is not to end conflicts, but to negotiate and find workable interventions.

Adams et al. (2003) present conflicts over use and management of common-pool resources as something beyond physical competitions. They say that it has to do with the way each user or group of them perceive the resource and also about the social structure itself. Therefore, there is a need to critically study the nature of conflict before any interventions. Further they mention that the level and differences in understanding and knowledge about the resource can also lead to conflict. If a shared understanding of the issue can be established, user can respond more positively to agreed actions.

Conventionally, conflicts are resolved in courts and many-a-times people have expressed their discontentment on the verdict. In case of Bhutan, courts rely on the traditional arrangements in absence of the Water Act (Jamtsho, 2002). In situation of condemnation of the court ruling, and alternative to litigation, people sought to negotiation, mediation and arbitration (Van Veen et al., 2003). Basic characteristics of dispute resolution techniques are summarized in Table 2.

Table 2. Characteristics of dispute resolution techniques.

Dispute resolution technique (DRT)	Definition of DRT	Attributes of DRTs	
		Strengths	Weakness
Negotiation	Process whereby two or more parties attempt to settle what each shall give and take, or perform and receive in a transaction between them	<ul style="list-style-type: none"> • promotes cooperation • cost efficient • promotes open process 	<ul style="list-style-type: none"> • some parties may lack negotiation skills • power balance is not assured
Mediation	An important third party attempts to keep communication lines open, point out areas of agreement, encourage and assist disputants to resolve their differences using compromise and negotiation	<ul style="list-style-type: none"> • encourages participation • high degree of participant control • helps create alternative options 	<ul style="list-style-type: none"> • process can be expensive • participants may lack skills • balance of power assured
Arbitration	Process similar to litigation but the decision of the impartial third party may or may not be binding depending on the disputants.	<ul style="list-style-type: none"> • results in conclusive decisions • Supported by established law and legislation 	<ul style="list-style-type: none"> • win-lose outcomes possible • adversarial • can be lengthy
Litigation	Involves courts and a neutral third party that decides the outcome based on law.	<ul style="list-style-type: none"> • Conclusive decisions • Supported by law 	<ul style="list-style-type: none"> • costly • win-lose outcomes common

Source: Van Veen et al., 2003. p. 91.

Characterization of disputes is stated to help in determining the outcome of resolution techniques. At the same time, different factors of dispute also influence outcome. Van Veen (2003) suggests four categories of dispute factors (Table 3). The factors are classified basically on specific dispute cases. In similar direction Slabbert (2004) also suggests a conflict mode instrument (matrix) that can help in assessing the outcome of the conflict depending on the degree of ability to compromise and collaborate (Figure 1).

Table 3. Dispute factor classification scheme.

Dispute factor category	Dispute factors
Background factors: <i>Factors that exist prior to a dispute and affects how it unfolds.</i>	<ul style="list-style-type: none"> • Past disputes between parties • Prospect of future business and/or social interaction between parties in a dispute • Attitude towards certain conflicts resolution technique due to past experience with them • Difference in parties' basic values or principles • Extent to which parties have communicated
Situational factors: <i>Factors that exists because of the dispute</i>	<ul style="list-style-type: none"> • Increasing personal time pressures • Number of people involved in a dispute • Involvement of parties who strongly believe in the "rightness" of their position • Parties' desires to maintain their privacy • Personality clashes between people in a dispute • Degree to which issues in a dispute can be resolved • Extent to which parties agree on the definition of the issues • Number of issues in the dispute • Presence of imposed deadlines
Capability factors: <i>Factor related to the ability of parties to participate effectively in the dispute resolution process.</i>	<ul style="list-style-type: none"> • Difference in financial resources available to the parties in a dispute • The potential of parties to learn unfamiliar conflict resolution techniques • Parties' abilities to use and understand technical and other forms of specialized information • Level of skill among participants in using dispute resolution techniques. • Willingness to risk an unfavorable outcome • Capacity to implement agreements
Water resource factors: <i>Factor of water supply and demand that affect dispute resolution processes.</i>	<ul style="list-style-type: none"> • Actual impacts of the disputed water use • Perceived consequences of disputed activity • Resource availability • Availability of temporary or permanent water supplies • How water is used • Uncertainty over scientific and technical questions

Source: Van Veen, 2003, p. 93.

The above classifications of conflicts imply that dispute, its context and resource under dispute should be intricately linked with adequate level of stakeholder participation for successful management of conflict. Although Co-management is not specified, it could be a possible approach to resource management in conflict situation. Many co-management agreements have painful births, arising out of intense conflict. Whatever the region, the resource, or the resource-using population, conflict often plays a key role in prompting the creation of co-management agreements. Nonetheless, conflict is a major factor in getting officials and other stakeholders to negotiate co-management arrangements (Castro and Nielsen 2001).

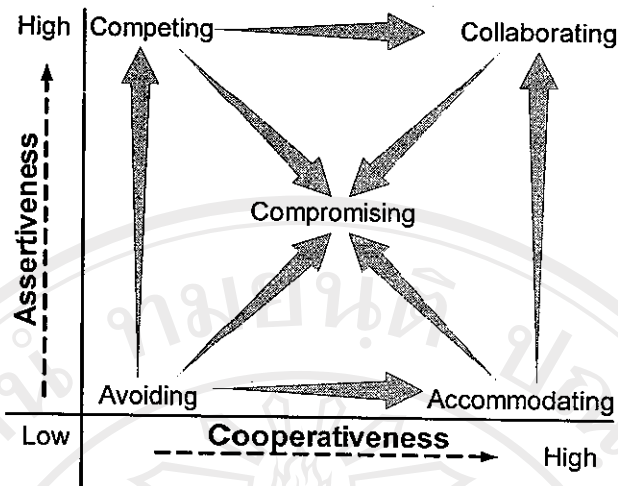


Figure 1. Conflict mode matrix

(Adapted from Thomas 1992, cited in Slabbert 2004)

The absence of a governance system at appropriate levels could further amplify the conflict. Such situation would often put environment and natural resource under threat from ravenous users (Dietz et al. 2003). However, appropriately organized institutions can facilitate sustainable use of environment. Devising effective governance system is comparable to a co-evolutionary race. With economic development, pressure on resources increase and past rules becomes redundant to current or future situations. Therefore for successful governance of commons rules should evolve in parallel with development.

In Bhutan people acquire water rights depending on their ancestral rights and more so under the doctrine of “first in time, first in right” (Jamtsho 2002). According to Ostrom (1990) in such situation junior appropriators are often victimized while senior appropriators are fully protected from encroachment on their rights. Thus conflicts in resource use can be considered as an expression of discontentment either in terms of access, control or responsibility. In conflicting situation, where users do not have face-to-face communication, the governance system cannot be successful (Dietz et al. 2003).

In management of resources, four features of society are important: relation of trust; reciprocity and exchange; common rules, norms, and sanctions; and connectedness in network and groups (Pretty 2003). They can be explained as follows:

- *Relations* of trust lubricate cooperation thus minimizing transaction cost among people. In reverse situation cooperative arrangements are unlikely to emerge.
- *Reciprocity* contributes to the development of long term obligations among people through simultaneous exchange of goods and knowledge, which help in achieving positive outcomes.
- *Common rules*, norms, and sanction (collectively termed as “rules of the game”) provide individuals the confidence to invest in collective good.
- *Connectedness* (bonding, bridging and linking) is important for networking within, between and beyond ones environment.

2.2 Institutions for resource management

Institutional analysis has become a useful tool in the field of NRM for understanding how local communities manage resources, and how improvements in management could be initiated. Institutions are generally defined as "complexes of norms and behaviors that persist over time by serving collectively valued purposes" (Uphoff, 1986). They are the arrangements or 'rules of the game' which shape the behavior of local community members and include common understandings about how issues and problems are to be addressed and solved. Institutions are dynamic and respond to changes in local actors and their understanding, as well as to external power or environmental conditions, but the process of change can be difficult.

According to Ostrom (1986) an institution is a set of working rules that are used to determine who is eligible to make decision, what actions are allowed or constrained, what aggregation rules to use, procedure to follow, information to be provided, and payoffs will be provided on their actions. Institutions are imperative as they mold human behavior and their interactions and ultimately the way people use

resources to attain their objectives. Resource management institutions have been extensively discussed in literature (Uphoff, 1986; Rungs, 1992; Ostrom, 1992; and Trébuil et al., 2002) and broadly considered as “*a set of formal and informal norms, laws, rights, sanctions and conflict resolution mechanisms, designed to manage resources*”. Traditional resource management institutions have evolved over generations, and continue to evolve through constant negotiations among the community members with respect to the resource endowment. Ostrom (1992) highlighted that collective actions sustained over time, usually includes rules and decision-making structures. In the case of NRM, this might include rules on using (or refraining from using) a resource, as well as processes for monitoring, sanctioning, and dispute resolution.

The farmer managed irrigation systems in Nepal are often projected as more efficient than agency managed irrigation systems. The stated phenomenon is associated with the institutions built on the self-governing capacities of communities (Shivakoti and Ostrom, 2002). The basic incentive for operating such system is related to overall productivity. As Ostrom (1992) suggests, in a successfully organized systems, problems are overcome by the rules crafted by farmers themselves. For any individuals to organize into irrigation management systems they need:

- Secured land tenure,
- Capacity to relate and communicate with one another repeatedly on a face-to-face basis,
- A common understanding of the problem, cost, and benefit,
- A common understanding that they would have to enforce their rules on a day-to-day basis but could count on external authorities not to interfere in their rule-making, rule-following, and rule-enforcement activities,
- A common understanding of a range of rules that, if enforced, can effectively counteract perverse, short-term incentives,
- A common understanding that if they agree to a set of rules and follow accepted procedures to signify their agreement that each participant would be pre-

committed to follow these rules or be sanctioned by the others for nonconformance, and

- Trust that most of the farmers who agreed to a set of rules and denoted their agreement in an accepted way would actually follow these rules most of the time so that the effort to monitor and enforce these rules would not be itself extremely expensive.

It is not a mechanical process; rather in most cases it is organized in informal settings, what is crucial is that the individual long-term benefits will surpass their long-term cost. In decentralized governance system the local government can play a crucial role in mobilizing community for common property resource management (Uphoff, 1986). However, without any understanding of the vulnerability of resource poor farmers, rehabilitation of homegrown institutions (to manage CPRs) may instead act as barrier to well intended restructuring efforts. For institutional sustainability, it is vital that people accept the rules of the institution in relation to all members of the community and resource status (Ostrom, 1992). This can happen in both formal and informal settings; however Joshi et al. (2000) reported that not all formal institutions contributed to the performance of irrigation systems. Therefore, the performance of irrigation systems will depend on institutional arrangements by helping to build social capital necessary for its management. It is realized that beyond technical and design specificity of irrigation channels, social involvement is of vital importance to sustain the irrigation system (Ostrom et al., 1993; and Uphoff et al., 1991).

2.3 Participatory methods

According to Chambers (1997), participatory approaches and practices enable lower and poor people in general to express and analyze their individual and shared realities. As these realities are local, complex, diverse, dynamic, and unpredictable people living in that situation can only better express the context. Today the concept of participation has become panacea and most widely used term in development projects (Michener 1998). A process can be considered participatory when there is some form of involvement of relevant stakeholders in the change process (Pretty et

al., 1995) or when the stakeholders think that they belong to the process. The process can be effective through purposeful interaction among stakeholders, which needs to be efficiently facilitated. The strategic and communicative rationality are the typical rationales behind participatory interventions (Groot and Maarleveld, 2000). Participatory interventions have become popular vehicles for both social and technical change around the globe.

The meaning of participation is numerous and has even classification systems. For instance, Deshler and Socks (1985) cited in Michener (1998) uses relative power of outsiders resulting into pseudo-participation or genuine participation. The classification of participation according to Cohen and Uphoff (1980) is more comprehensive indicating the kind of participation, who participates and how it occurs (Table 4).

Stakeholder participation in key activities of resource management in a community is crucial to ensure sustainability of the resource base. Participation is characterized by a cyclical, ongoing decision-making process, reflection and action that seek to include local people and their insights, experiences, knowledge and interests in diagnosis, planning and joint actions. Therefore, participation should be process oriented, involving people from the initial stage of problem definition to completion of the problem solving process (Narayan, 1996). According to IDRC (2003), participation increases community motivation and commitments, leading to capacity development thereby empowering the community members and ensuring greater success of actions. However, participatory methods are criticized for their inability to generate wealth of data for scientific endeavor. Rather it is considered strong to yield qualitative data (Probst and Hagmann, 2003).

All rights reserved

Table 4. Dimensions of rural development participation.

Kind of participation	Participation in decision making Participation in implementation Participation in benefit Participation in evaluation
Who participates?	Local residents Local leaders Government officials Foreign personnel
How is participation occurring?	Basis of participation Form of participation Extent of participation Effect of participation

Source: Cohen and Uphoff, 1980

A core characteristic of participatory research approaches, is a process of interaction between local and external actors to 'co-create' innovations. Participatory methods are classified into four types to elucidate linkages between different social actors according to varying degrees of involvement in and control over decision-making in the relationship. They are contractual participation, consultative participation, collaborative participation, and collegiate participation (Table 5). The purpose of participation can be to legitimize the process or action, enhance effectiveness and efficiency of demand orientation, capacity-building and joint learning, and transformation. The process is seen to increase capacity for articulation and negotiation of interests, leadership, collective action, as well as critical consciousness, and self-esteem among marginalized social groups.

Table 5. Classification of types of participation based on the linkages among actors

Types of Participation	Features
Contractual	One social actor has sole decision-making power over most of the decisions taken in the process, and can be considered the owner of the process. Other stakeholders participate in the process according to the contacts.
Consultative	Most of the key decisions are kept with one stakeholder group, but emphasize on consultation and gathering information from others to identify constraints, priority setting and evaluation.
Collaborative	Different actors collaborate and are on equal footing. It emphasizes linkage through exchange of knowledge to make shared decisions.
Collegiate	Different actors work together as partners. All actors have equal responsibility on the action. Decisions are made on consensual basis.

Source : Probst and Hagmann, 2003. p-6.

Among many participatory methods, participatory learning and action research (PLA), helps in developing knowledge through critical reflection and experiential learning in an ongoing process of action in a real life context. This approach is thought to have several advantages. It is expected, for instance, that (i) practical knowledge and solutions can be developed which are directly useful to practitioners and people in the development process, (ii) by directly influencing the construction process of social reality, there is an increased probability that behavioral change and impact can be achieved, (iii) the people's capacity for experimentation and adaptive management can be developed, and last but not least, (iv) scientific knowledge can be generated concerning action, reaction, links, and factors that influence processes of change in a real life context (Probst and Hagmann, 2003).

In participatory learning and action research the mandate of science is no longer satisfied by scientists remaining external actors/observers developing knowledge for people. Instead, science's mandate includes helping people at different levels of social aggregation to develop knowledge (Röling 1996 as cited by Probst and Hagmann, 2003) and to enhance their capacity for adaptive management. According to Chambers (2002) cited in Probst and Hagmann (2003), great level of self-reflection, critical awareness, and continuous learning/improving on the part of researchers and other implementers is therefore a key success factor to exploit the potential of participatory approaches.

2.4 Multi-agent systems modeling and role-playing games

Models have been known to represent the systems structure and dynamics in a simplified form to enhance the understanding of the complex systems. Models play an important role in devising monitoring protocols as well as in providing a useful set of evaluation tools to assess the critical threshold of resource use. It particularly allows the explicit representation of a heterogeneous collection of agents of variable sizes, and the analysis of its evolution at both individual and collective levels. Model building is considered as prerequisite for comprehension and generating options. New modeling approaches are needed to effectively identify, generate, and relate information for better understanding of the systems. It is also needed to make shared knowledge to guide management decisions (Costanza and Ruth, 1998).

Multi-agents systems is an assembly of agents with specific goals capable of perceiving, communicating, interacting and acting in an environment with other agents (Ferber, 1999). These agents are intelligent and more or less autonomous objects in the system with specific relationships among each other and within a common environment (Figure 2) by way of different operations.

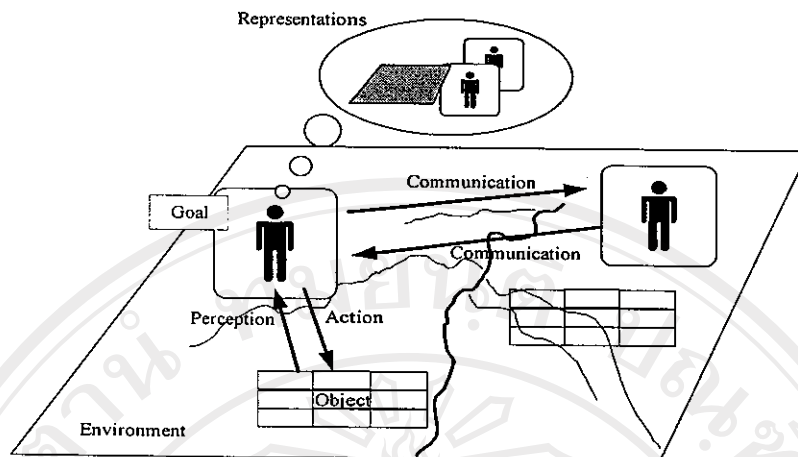


Figure 2. Multi-agents systems general organization and principles. (adapted from Ferber, 1999)

The underlying principle of MAS is the interaction between agents, which makes it useful as research tool, teaching aid, and decision-making tool (Barreteau et al., 2001). MAS can also help to understand the relationships among agent behaviors, their interactions, and the resulting dynamics at different levels of organization.

A multi-agent system (MAS) consists in a number of interacting autonomous agents. These agents can represent people, animals or organizations; can be reactive or proactive; may respond to environment; communicate with other agents; learn, remember, move and have emotions (Janssen, 2002). MAS provide simulation methods rich in potentials capable of modeling interactive processes between social and ecological dynamics (Bousquet et al., 1999). MAS can be applied for five main categories: problem solving, collective robotics, multi-agent simulation, building artificial worlds, and kinetic design of programs. According to Ferber (1999), MAS brings a radically new solution to the very concept of modeling and simulation in environmental sciences, by offering the possibility of directly representing individuals, their behavior and interactions. In resource management, MAS uses arbitration and negotiation to resolve conflicts, to stop disagreement between individuals from turning into open struggle. Thus it tries to maintain network of agents.

If used in an interactive mode, MAS can help to create a shared perspective of a complex ecosystem and to generate management scenarios which are relevant for negotiation and collective decision among stakeholders (Barreteau et al., 2001; and Trébuil et al., 2002a) to enhance the accountability and decision-making capabilities of the community. Bousquet et al. (2002) reiterates that development and use of MAS models in conjunction with role games for collective decision-making in NRM is new. Role games have been suitably used to support negotiated processes (Piveteau, 1995 cited in Bousquet et al., 2002) as well as for educational purposes (Burton, 1994 cited in Bousquet et al., 2002). However, role games need excessive resources and time for design and implementation. It is also reported that it is difficult to control parameters and to compare results of different gaming sessions. To alleviate these difficulties, Bousquet et al. (1999) suggested coupling of role games with MAS because of their complementarities (Table 6). As both proposes simple representations of complex realities, using them jointly can complement and supplement each other, towards the building of a shared understanding of the system to be managed among all concerned stakeholders.

Table 6. Similarities between role games and MAS.

Role-playing game	Multi-agent system
Players	Agents
Roles	Rules
Turns	Time step
Game sets	Interface
Game session	Simulations

Adapted from Barreteau et al., 2001.

A role-playing game can provide a suitable methodological framework to build a negotiation support tool (Etienne, 2003). If RPG and MAS tools are used in a mediation process – the social dimension of companion to co-evolve the social interaction, temporal and adaptive decision, this method is called ‘companion modeling’. Barreteau and Bousquet (2000) also summarize several studies that successfully used role-play games: For instance in studying the viability of irrigation

system in Senegal MAS model “SHADOC” was developed. RPG was used to simplify MAS model to communicate the result to farmers, validate the model and used to negotiate irrigation system management; In Madagascar, integration of agrobiodiversity management knowledge was done by using RPG (STRATAGENES); To simplify MAS model used for representing sylvo-pastoral development and its impact (SYLVOPAST); RPG helped in putting the people in the virtual environment of MEJAN model, which provided appropriate setting for generation of negotiation processes in encroachment of coniferous forest. The differentiation of household under cooperative period in Vietnam was modeled in MAS (SAMBA), RPG was used to collect further information for validating the model and also to see emergence of new rules; RPG was used to generate information on sustainable land management in northern Senegal. The output from RPG was used to develop a common model implemented later into a computerized MAS model (SELFCORMAS). It is suggested that role-game and simulation models are appropriate to involve stakeholders in the exploration of scenarios simulated rapidly on the computer by using MAS models similar to RPG used with stakeholders. Bousquet et al. (2002) emphasized that MAS has considerable potential in NRM research for modeling and simulation of complex processes among stakeholders, as well as between social and ecological dynamics.

Daré and Barreteau (2003) have further shown that the association of RPG and MAS has the capability to tackle complex and dynamic social systems dealing with the sharing of common resources. The representation of reality and interference of social status in the actions during the game helps to reveal social interactions among players and communities.

Barreteau et al. (2001) stated that MAS models have the potential to facilitate the study of complex natural ecosystem management dynamics and the role of people in the system. MAS allow running repeatable and controllable scenarios for reasonable durations. However, these authors underline the need for a validation of results prior to field implementation of theories generated from MAS modeling.

As the natural ecosystem operates with multiple agents with varying objectives, CORMAS (Common-pool Resource and Multi-agents Systems) <http://cormas.cirad.fr> simulation platform has been developed to provide a multi-agent framework that can be used to simulate the interactions between agents and their environments. In other words, CORMAS is best suited to simulate natural resource management (Bousquet et al., 1998). CORMAS is a multi-agent simulation platform specially designed for integrating knowledge in a collective learning process on integrated natural resource management (Barreteau et al., 2001; and D'Aquino et al., 2002b). It is stated that the goal of CORMAS is not to make accurate predictions about the behavior of complex systems, but to provide framework to help people develop new ways of thinking.

2.5 Synthesis of the literature review

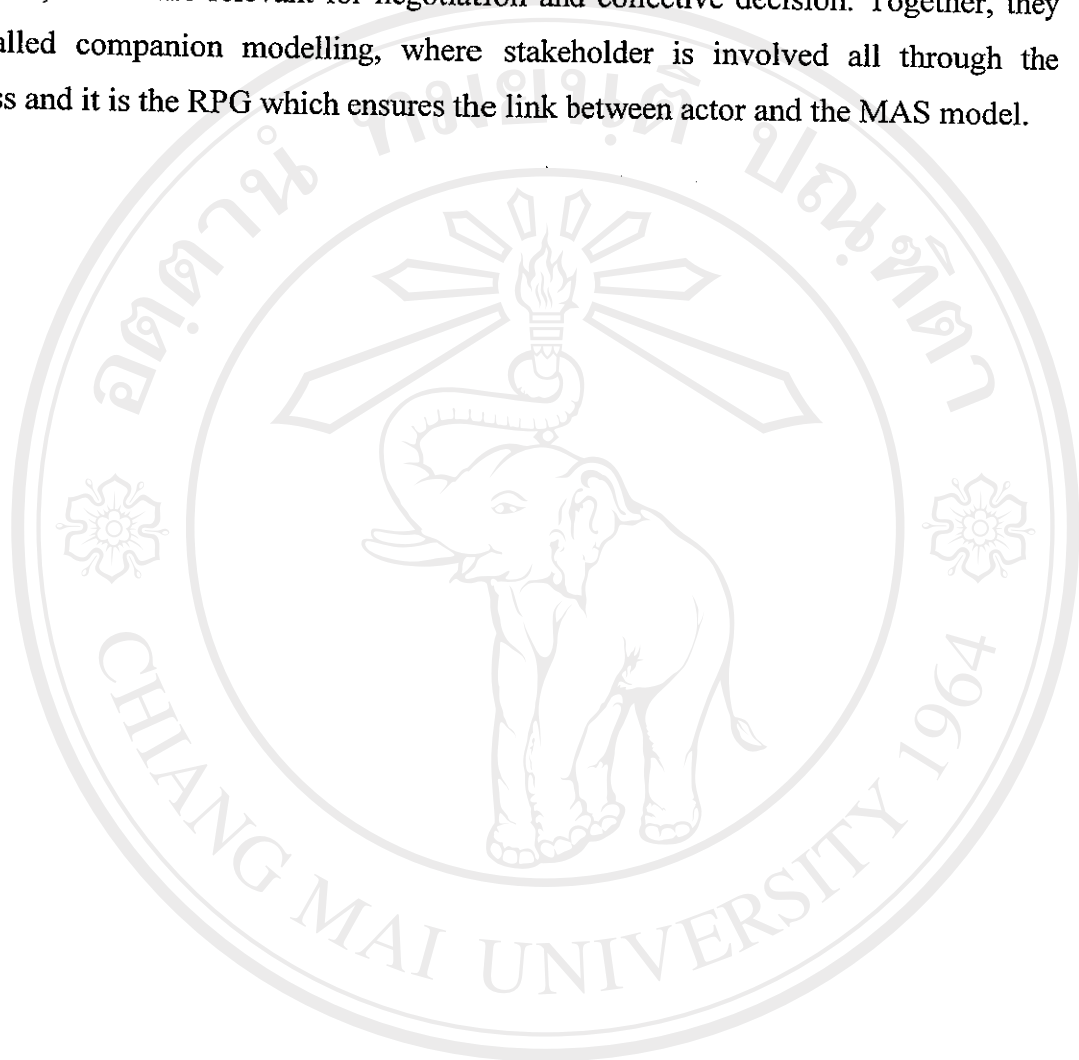
Conflict in natural resource management and in particular water resource is an inevitable phenomenon due to increasing demand and contestation for access. Often conflicts are expression of discontentment, inequitable access and discrimination. It is a indication of pressure on resource and also the need for change. However, if conflict bogs down, the scope to achieve a shared solution declines dramatically. In the extreme cases, it is suggested that resource conflicts can sometimes become severe and debilitating, resulting in communal riots, and more resource degradation that would undermine the society. Conflicts depend on many factors; background (factors that existed prior to the current conflict), situational factor (current state due to the conflict), capability factor (ability of the parties in conflict to participate in conflict management process), and water resource factor (supply and demand that influence resolution process). In many cases conflict also depends on the degree of cooperation and influence each conflicting society has. In view of this interconnectedness, intricacies of conflict and its relevance to the society, a thorough diagnosis and analysis of the systems is necessary before any interventions are planned. In case of any intervention, it is suggested that conflict should be managed.

In any society, institution plays a major role is upholding the social coherence, and collective actions. Local institutions represent both formal and informal norms, which promote collective decisions and actions. It has been shown in many countries that locally managed institutions are better in productivity compared to agency-managed institutions. It highlights the ownership of the institution and their common goal, which ensures cohesion among the community members, and success of the institutions. In a successful institutional system, conflicts are overcome by the rules crafted by the farmers. Therefore, building the social capital necessary for management of natural resources will facilitate in sustaining the resources.

To ensure ownership of the social capital, institution, actions, and outcomes, participatory approaches are often hailed for its strength in harnessing local participation. Particularly, to ensure sustainability of resource base it is crucial for all stakeholders to involve in the process of interventions. As such it is said that participation should be process oriented and not one time intervention. Although participatory approaches are criticized for its inability to generate quantitative information for scientific endeavor, it is now considered to help people to develop knowledge to enhance their capacity for adaptive management. Participation increases community motivation and commitments, leading to capacity development, empowerment and success of the actions. The key factors to use participatory approaches are the level of reflection, critical awareness and continuous learning it generates on the part of all stakeholders including researchers.

The experiences in use of role-playing game and MAS models have shown a definite promise in its ability to adequately represent the environment, people and their interactions. The strength of role-playing game in enhancing non-confrontational collective interactions and discussion between conflicting communities outweigh its weakness of design complications and result analysis. RPG has definite strength to promote productive discussions and generate new rules during the gaming sessions. MAS can help to incorporate human factors in natural resource management and represent almost precisely the social interactions among users and between environments. It also helps indirectly representing individuals, their behavior,

interactions and maintaining the network. It further helps in integrating knowledge in a collective learning process on NRM. As an interactive and iterative tool, RPG and MAS can create a shared perspective on a complex ecosystem and generate scenarios, which are relevant for negotiation and collective decision. Together, they are called companion modelling, where stakeholder is involved all through the process and it is the RPG which ensures the link between actor and the MAS model.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved