Conflict dynamics in a dam construction project: A case study

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Interface conflict is identified as a major problem in dam construction projects. Proper management of conflict can determine success or failure of a project. Thus, it is crucial to identify the causes of interface conflict in projects to avoid such problems. Qualitative data gathered from case studies and interviews conducted in Nepal have been used to develop and test a system dynamic model of interface conflict in a dam construction project. Three viable policies to avoid and minimize interface conflict in the construction stage of a dam project have been tested. Public participation, adequate compensation and resettlement and information sharing with the affected people have the potential to reduce conflict during the construction phase.

Keywords: Dam construction, interface conflict, system dynamics, sustainable construction

Introduction

Recent economic development and increasing concern on environmental change has put developing countries like Nepal, India and China under severe pressure to meet the increasing demand for clean energy and water resource management. One of the greatest challenges of this century is how to provide energy and water to improve the livelihoods of the people who currently have inadequate access to these services. Due to ongoing climate debate, and shortage of the world's finite fossil fuel resources, exploitation of water resources for electricity generation has once again become the focus of interest. In this context a dam construction project can fill the gap in an environmentally friendly way.

Construction of dam projects involves relatively large number of people of different objectives, interest, disciplines and ideological backgrounds performing interdisciplinary activities and having much effect on the environment and society. Time and physical resources limitations have added another dimension to the complexity of a project. When two social entities work together, it is not uncommon for them to have different interests, values, beliefs and preferences. They often struggle over value, claim for status, power, sharing of the scarce resources and try to gain the desired value which normally fosters the development of conflict. Two categories of conflicts have been identified in large-scale construction projects: internal conflict and interface conflict (Awakul and Ogunlana, 2002b). Internal conflicts are experienced among the project participants (Owner, contractor, designer consultant etc), whereas interface conflicts are between the construction project and groups outside the project (project affected people, NGOs, etc).

Construction conflicts are typically multidimensional, complex, and dynamic and increasingly involve competing notions of sustainability. Conflicts are inevitable on construction projects (Fenn et al., 1997; Cheung and Chuah, 1999; Pena-Mora and Tamaki, 2001; Jong and Seung, 2003) with the possibility of positive or negative consequences depending on how effectively they are managed.

Generally the conflict at the initial stage of project is very low and increases with time (figure 1). Later it changes into disputes if not settled on time; requiring additional money and time to resolve.

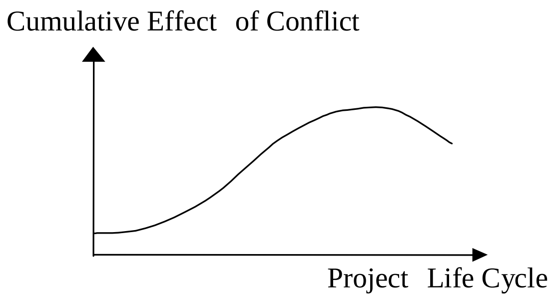

Figure 1: Conflict space in project life cycle, (Peña-Mora *et. al*, 2002)

Conflict encountered in projects lead to prolonged delays in execution, interruptions and sometimes suspension of work. For example, the Arun III Dam project in Nepal failed at the planning stage due to conflict and the Middle Marsyangdi Hydroelectric Project (MMHEP) in Nepal, under construction at the time of this research, faced many conflict inducing problems. Work on the MMHEP was interrupted and suspended several times. Consequently, the project was behind schedule and overrunning costs. When conflicts are not managed in a timely manner, they may become very expensive in terms of finance, personnel, time, and opportunity costs and also ruin the relationships among project stakeholders. However, when it is managed appropriately it can be constructive and even add substantial value to the organization (Deutch, 1994).

Considerable effort has gone into conflict research on projects. Awakul and Ogunlana, (2002a) identified interface conflict factors in a dam project; Harmon (2003) studied conflict between owner and contractors; and Ng et al. (2007) studied conflict in large-scale design and construction projects. Rarely has any researcher studied the dynamics of conflict in dam construction projects. Problems of conflict of high magnitude, ubiquitous in several dam construction projects, have remained very serious. This can be attributed to an overall deficiency in understanding and quantification of occurrence and escalation of conflicts. There remains much room for study and improvement in conflict management of dam construction projects. This research being reported aimed to develop a model for comprehensive and integrated approach of conflict management to manage conflicts early in a project's life using system dynamics modeling technique. The model will be helpful for project managers to assess and take proactive measures to manage conflicts effectively and efficiently early in a project's life.

Since conflicts in construction projects are dynamic, complex and nonlinear, they can be described as spiraling between various parties (Ng et al., 2007). In this context, a system dynamics modeling approach is well suited for conflict management in a dam construction project. The early identification and addressing of conflict will increase the chance for success and reduce cost. If, "Prevention is better than cure," then prevention of conflict should yield much benefit to project stakeholders.

Research Methodology

The structured, five-stage approach, suggested by Coyle (1996) is adopted as the principal methodology for this research. The full context of conflict, both theoretical and practical, have been explored and examined. The theoretical exploration has enabled the authors to broadly understand the related theories and subjects of conflict development in dam construction projects whereas practical exploration has provided good understanding and helped to develop the simulation model of interface conflict complying to the real world. Since conflict is a complex and dynamic problem that needs in-depth investigation, the case study method is adopted. The MMHEP, the biggest and most important project under construction in Nepal was selected for case study. Construction of the project commenced on June 25, 2001. The project was planned for implementation in 4 years. However, only 80% of the work has been completed by end of 2007 and also the cost had overrun and was estimated to be about double the original estimate at the time of investigation.

Face to face interviews were conducted with local people and experts, involved in management and construction of the MMHEP as well as in other dam projects in Nepal and in the international market. In addition, extensive literature review was done to acquire the secondary data needed to articulate the real problem and identify the variables in the Nepali context. During the interviews, the experts were guided to construct time series graphs of income of project affected people, sustainable livelihood, interface conflict, project delay and other variables identified earlier and by briefly explaining the possible causes of dynamic behavior. The data collected were organized in reference mode and causal loop diagrams to explain the behavior of the system. Causal loop diagram show how the variables are related with each other. Causal link, according to Coyle (1977, cited in Park et al., 2004) can be established through direct observation, reliance on accepted theories, hypotheses, or assumptions, and statistical evidence. Second stage interview was conducted to get expert views on relevance and practical difficulty of implementation of the policies recommended.

The system dynamic modeling technique has been used to develop the model. One of the most powerful features of system dynamics lies in its analytic capability (Kwak, 1995), which can provide an analytic solution for a complex and nonlinear system like conflict in dam construction. Use of system dynamics modeling in the management of conflict in construction projects has been proven by researchers (Pena-Mora and Park, 2001; Ng et al., 2007). The dynamic hypothesis was developed by identifying model boundary and establishing causal structure of interface conflict development. The boundary of the model was selected to address issues which are significant and relevant to the purpose of the model. Variables which have an endogenous nature, exogenous nature and those to be excluded from the model were identified. STELLA 9.0.3 ® has been used to develop the model. In order to make the model less complicated, five sub models (Income of project affected people, Sustainable livelihood, Information exchange, Interface conflict, and Project delay) have been developed.
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Dynamic Hypothesis

A dynamic hypothesis is a working theory of how the problem arose in terms of the underlying feedback and structure of the system (Sterman, 2000). It provides the basic explanation on the causes, which are responsible for the occurrence of the reference mode. A dam construction project involves relatively large number of people and has more effect on the environment and society than most other construction projects. It involves a wide rage of activities such as the construction of access roads, electricity transmission lines, water supply channels; the operation of quarries to supply rock fill; heavy transportation and construction of ancillary buildings and facilities for settlement of displaced people. It has both positive and negative aspects in relation to the environment as well as the society. Dams provide broad economic and social benefits, including hydroelectric power, flood control, recreation, navigation, and water supply. It spurs economic development and plays an important role in development of the society and a nation as a whole. Additionally, it provides much employment during the construction stage. However, a dam can displace a lot of people and who may lose their land, social values, jobs, businesses and so on. In addition, it disturbs the flow of rivers, watersheds, and creates negative impacts on aquatic and terrestrial ecosystem. In some projects historical and archeological sites are submerged in reservoirs. In most cases the benefits of dams largely go to the whole society while the local communities have to bear most of the social and environmental costs.

Many people are directly or indirectly affected by a dam project. Oftentimes the interests of different groups of stakeholders are different in a dam project. Their requirements, expectations, goals and key performance indicators (KPI) also differ. The process of dam construction is complex and lengthy making conflicts ubiquitous. According to the World Council on Dams, conflicts around dam construction originate from a number of sources; especially from the real and perceived distribution of costs and benefits, disparities in social and economic power, the roles of different institutions, and specifics of project location and design (WCD, 2000).

The dynamics of conflict can be significantly affected by the reactions participants have to their degree of access to resources and information based on their gender, culture, values, and history (WCD, 2000). When conflict is not resolved on time or people are not given any opportunity to sustain their livelihood, “A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base”, they start to protest against the project, file cases in court and interrupt the project work. To make the hypothesis less complicated, and to improve clarity, five interrelated causal loop diagrams (figure 2, figure 3, figure 4, figure 5, and figure 6) are used to represent the dynamic hypothesis of interface conflict.

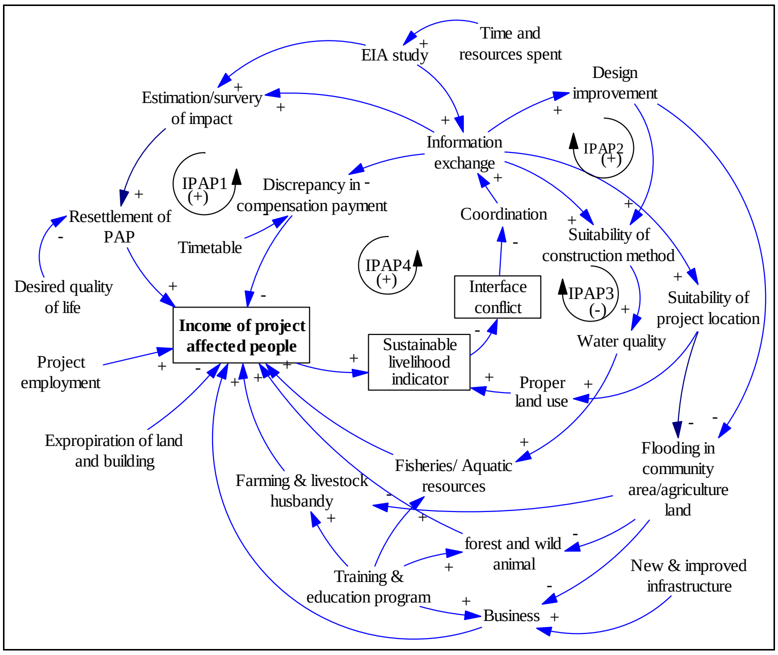

Figure 2: Feedback loop concerning income of project affected people

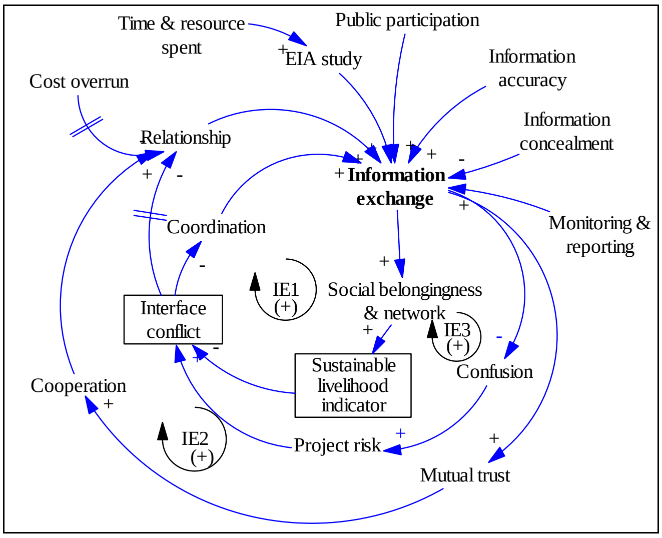

Figure 3: Feedback loop concerning information exchange

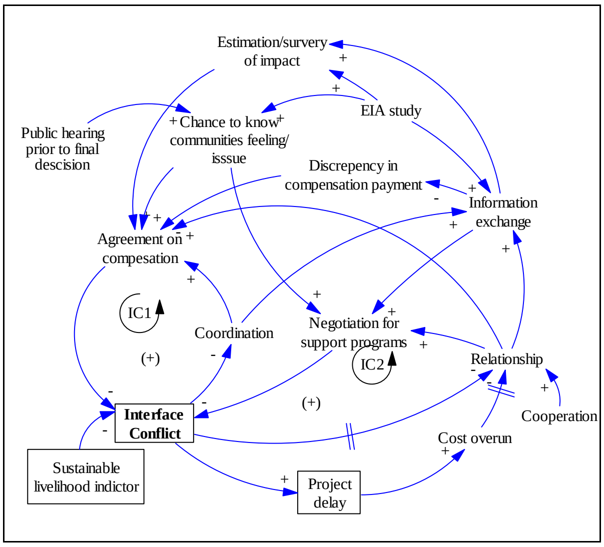

Figure 4: Feedback loop concerning agreement

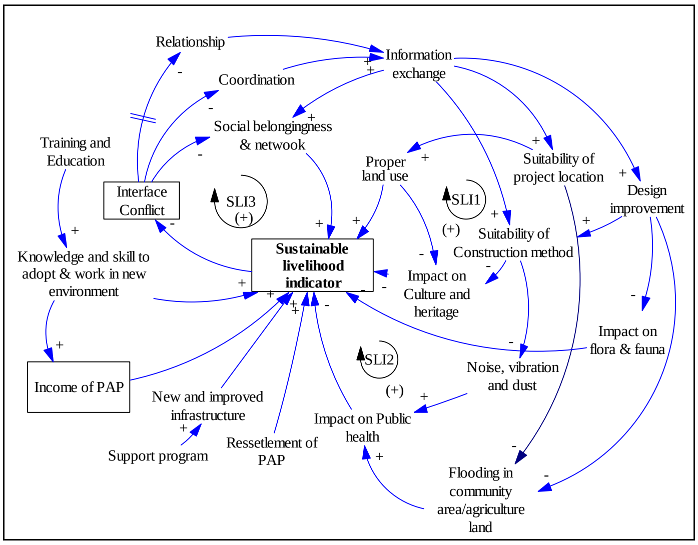

Figure 5: Feedback loop concerning sustainable livelihood indicator

Feedback loop concerning income of project affected people (PAP)

A dam construction project displaces many people and they may lose their land, social value, job, business and livelihood opportunity. The main source of income of the community in the project area is farming: livestock husbandry, forest products, fishery, and to some extent trading and services. The effect of dam construction on the people differs according to their occupation and location. Some are permanently affected and others are temporarily. Figure 4 illustrates the causal loops of this sector. Some of the important loops are explained below.

Design improvement (loop IPAP2): By using proper design, environmental and social impact can be minimized. Community participation during planning and design stage will be helpful in finding the best project location and in producing economical and acceptable design. Location is a key factor for a development project and it should be determined by social, economic, technical criteria and environmental considerations (Awakul and Ogunlana, 2002a). By giving proper consideration during the planning and design stages, the impacts on river ecology and society as a whole can be greatly reduced.

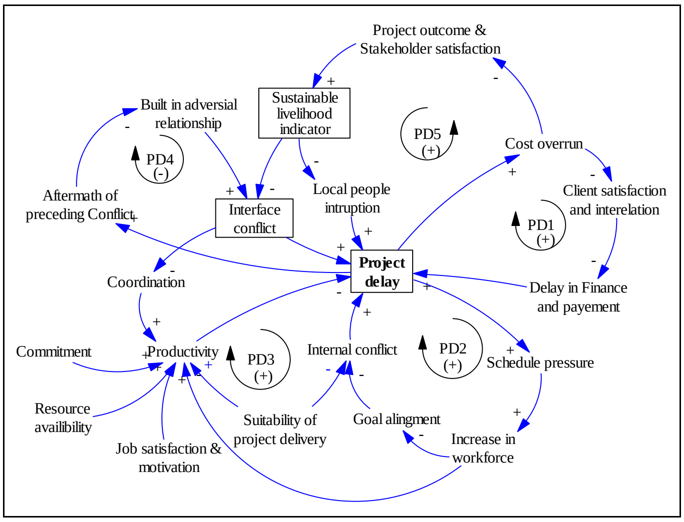

Figure 6: Feedback loop concerning Project delay

Discrepancy in compensation payment (loop IPAP4): A dam construction project requires, not only expropriation of land and buildings, but also involuntary resettlement of people from areas where they live and work to other locations. When the affected groups are involuntary moved, the main foundation on which their production systems, commercial activities, life sustaining informal networks, trade linkage etc, rest are dismantled which has significant impact on their income (Cernea, 1999). Displaced people suffer from the allotment of poor agricultural land with the usual shortage of water and inadequate facilities and substandard house and infrastructure. The concept of compensation is adversarial because the project owner usually offers less, while the affected pleads for more (Awakul and Ogunlana, 2002a). Indigenous people are often victims of no-lands no-titles no-compensation resettlement practices. Social values and non market assets (cultural, social cohesion, some environmental services, and compensation to the host community) are rarely accounted. Usually the scope of project impact boundary is underestimated. Theoretically it is said that compensation payment should be mutually agreed between the parties; but, in reality, it is rarely followed in practice (ADB, 2007). This significantly reduces the income of the affected families and has negative impact on their livelihood. Appropriate training and education to upgrade the skills of vulnerable groups can empower them and enhance their livelihood.

Early information, adequate input from the affected people and/or organizations trusted by them on compensation strategies/assessment procedures will reduce discrepancy in compensation payment. Timing of compensation payment is equally important. Participatory, interdisciplinary, integrated, transparent, adoptive and systematic EIA will minimize the interface conflict during implementation of resettlement plan.

Construction method (loop IPAP3): Some of the worst impacts occur during the construction phase. Construction activities change water quality and quantity in rivers; create noise, dust and many other hazards which may have ecological health impact including the extinction of many fish and other aquatic species, huge losses of forest, wetlands and farmland. By using suitable construction method, impacts such as boomtown effect, water quality in rivers, pollution and many more can be reduced.

Feedback loop concerning information exchange

Information exchange is the cornerstone of a dam construction project. If the agencies fail to inform the public and to gain their understanding at the planning and design stage of the project, it will lead to conflict at later stages. People affected need clarification about the end benefit of the project and wish to be informed and consulted when decisions are likely to impact their lives. Disclosure of accurate and timely information for public knowledge will reduce the anxiety of local people about the project and establish transparency beyond suspicion. Figure 3 illustrates the causal loops of this sector and the important loops are explained below.

Coordination (loop IE1): The affected people need to possess information in a timely and accurate manner because they are the primary recipients of project impacts (Dahal, 2006). Effective information sharing is essential at different phases of project life cycle for better coordination among the project stakeholders which reduces the confusion & misunderstanding and reduces conflict. Effective public participation and mutual consultation at the early stage of a project will provide an opportunity to the project development team to know public feeling, their issues and to acquire detail data on magnitude, extent, and duration of direct and indirect impact of the proposed project on environment and society. The monitoring and reporting component of environmental and social impact of dam construction projects are very poor in Nepal. This has long impact to create negative perception in the local people. High level of coordination is required between the project team and local people to foster information sharing and mutual trust. The information feedback cycle should be maintained to hold the public's interest and prevent alienation.

Mutual Trust (loop IE2): Trust appears to be an important factor in information and knowledge sharing. Lau (1999) stated that it is not easy to tell whether trust leads to communication or communication leads to trust. Communication is necessary in establishing an atmosphere of trust. Mutual trust and cooperation foster good relationship among project stakeholders whereas cost overrun and high interface conflict disappoint project developers and ultimately affect interrelationship.

Confusion (loop IE3): When the community where the project is located is not clear about the project plan and its objectives, confusion will be created. Confused and worried local community will add to project risk and, later on, can create a conflicting situation.

Feedback loop concerning agreement

Every person has his/her own priorities and requirements. People have different thoughts, ideas, beliefs and interact differently. It is a human tendency for individuals to seek and choose the most pleasant outcome for themselves. During the negotiation process, a cooperative attitude results in efficient solution to problems. Efficient negotiations further motivate the local people to be more committed to project and consequently increase the agreement on conflicting issues. Efficient negotiation helps to reduce conflict between the parties; otherwise it will reach a level capable of degenerating into a dispute by eroding trust. Figure 4 illustrates the causal loops of agreement on compensation payment and support program. The important loops are explained below.

Agreement on Compensation payment (loop IC1): The public participation component of EIA is the main vehicle through which public feelings and their feedback on project, magnitude/extent/duration of direct and indirect impact can be known. Effective public hearing may result in high level of conflict in the early stage of a project but reduces conflict during construction. Klein (2001) claimed that public participation provides a number of benefits that include improving the quality of decisions by anticipating public concerns and attitudes and thereby offering governments the opportunity to use consensus-building to avoid confrontations. Although the agreement on compensation payment is multidimensional, it mainly depends on the amount of compensation and the timing. In addition, participatory and detail estimate of project impact will help to prepare better packages of compensation which will increase the possibility of agreements. Coordination with good attitude will contribute to achieving public acceptance.

Negotiation for support program (loop IC2): Effective implementation of support program as required by the community will contribute to prevent or to minimize conflict during the construction phase of the project. Identification of the real needs of project affected group with their effective participation will minimize lengthy negotiations. Zikmann (1992) noted that mutual consultation leads to mutual understanding and mutual understanding depends on that successful negotiation Good relationship and information exchange between PAP and project team will increase efficiency.

Feedback loop concerning sustainable livelihood indicators

Sustainable livelihood comprises of five capitals namely, human capital, social capital, natural capital, physical capital and financial capital (DFID, 1999). Sustainability of dam construction project and livelihood security of local people is closely related. A dam construction project displaces people from their homes and land to other areas which destroys their production systems and causes them to lose the opportunity to sustain their livelihood. If water-related development projects and programs are not able to contribute to the livelihood security of people, such projects will not get public support and they will fail simply on the grounds of public resistance, mistrust or lack of ownership (Upreti, 2007). Figure 5 illustrate the causal loops of sustainable livelihood indicator. Some of the important loops are explained below.

Cultural and heritage (loop SLI1): Culture and heritage is a part of social capital of sustainable livelihood. People resist the way that change affects their social relationships, upsets their status, and threatens their security rather than resisting the technical requirements of the change itself (Davis, 1972). Cernea (1997) states that sudden inflow of a large army of construction workers and related groups within small, often traditional local communities cause social/health/economic and cultural problems particularly at the local community level.

Public health loop (loop SLI2): The exposure of the poorest people to illness is increased by forced relocation, because it tends to be associated with increased stress, psychological traumas, and the outbreak of parasitic and vector-born diseases (Cernea, 2004). According to Awakul and Ogunlana (2002a) the impoundment of huge mass of water could promote the growth of mosquitoes, snails, etc., and lead to the spread of water-borne diseases like malaria, liver fluke infection and schistosomiasis.

Feedback loop concerning Project delay

Project delay is a multidimensional variable. It depends on the availability of resources, inflation, supporting infrastructure, conflict, political stability of the country and so on. Project delay affects project cost and reduces client satisfaction and poisons relationships. If corrective actions are not taken on time further delays to the project can occur and, finally, the overall outcome of the project is affected. Figure 6 illustrates the causal loops of project delay. The important loops are explained below.

Cost overrun (loop PD1): Project delay leads to many problems like cost overrun, need for extra resources, relationship breakdown and others. Clients want to complete projects within specified time, budget and to specified quality. However, cost overrun has become a common problem in projects which dissatisfy clients and trigger other problems. For instance, delay in payment may result in internal conflict which may create further project delay.

Internal conflict (loop PD2): To recover the schedule, project managers usually hire additional manpower. If the people employed in the project do not have the same attitude and interests, this can foster internal conflict. Additionally, risk sharing system also differs across project delivery systems. Project delivery system defines the roles, responsibilities, and relationships of participants. The distribution of potential conflicts varies among parties depending on delivery systems used in the project (Pena-Mora and Tamasaki, 2001).

Productivity (loop PD3): Increasing the workforce on a project does not proportionally increase productivity. Newly hired workers are more vulnerable to accidents and rework which ultimately reduces project performance. However, more commitment and resource availability increase the productivity level and reduces project delay. Delivery systems have a strong influence on the interest of participants. It also leads to different organizational structures and relationships among project participants. Adopting an appropriate delivery system increases job satisfaction and motivation of the workforce resulting in high productivity.

Aftermath of preceding conflict (loop PD4): When project delay occurs project participant blame each other and they file claim. If the claim is not resolved on time, it may potentially escalate into dispute and lawsuit where involvement of third parties or lawyers may be needed to settle the dispute. Since claims involve additional money and time, the tendency is to postpone them until the end of the project. This may affect project cash flow. Ultimately it may lead to delays, added cost to participants and adversarial relationship. Adversarial relationship often creates distrust among parties and leads to further conflict in project.

Local people interruption (loop PD4): People emotionally resist changes if they are adversely affected economically, personally, and socially (Awakul and Ogunlana, 2002) and put pressure on project developers to take corrective actions or meet their demands.

The simulation model

The model has been formulated from the dynamic hypothesis discussed above. Integration of several positive and negative variables leads to a complex system. In order to make it less complicated, five sub models have been developed: (1) income of project affected people; (2) sustainable livelihood; (3) information exchange; (4) interface conflict; and (5) project delay. Each sector of the model consists of an array of building blocks such as stocks, flow, converter, and connectors. The causal loop diagrams were transformed into a formal simulation model using STELLA 9.0.3®. The main advantages of the simulation software is the ability to model non-linear relationships in a user friendly way. Graphical functions and equations have been used to describe the interrelationship of variables. Each variable is assigned an equation to establish its position and relationship with other variables in the model. Due to the complexity of detail model and limited space in this paper, only the interface conflict sector of the final model is presented here in figure 7. A complete listing of all the models, graphs and equations used in model is available from the authors.

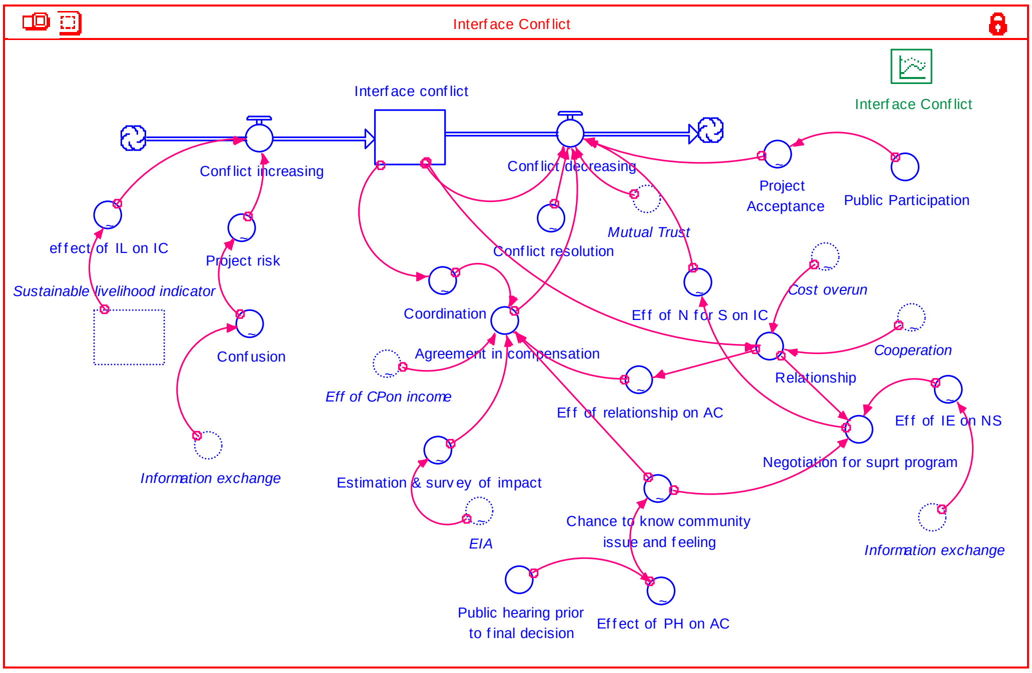

Figure 7: Model of interface conflict sector

Model validation and sensitivity analysis

Model validation is carried out to verify whether a model replicates historical behavior, whether every equation corresponds to a meaningful concept in the real world, whether every equation is dimensionally consistent and whether the model is sensitive enough to analyze policy recommendations (Sterman, 2000). However, Forrester and Senge (1980) states that there is no single test which serves to validate a system dynamics model. Therefore, structural validation tests, extreme condition, behavior validation, sensitivity analysis have been done to validate the model. Some of important tests are explained below.

Structure validation: Causal loop diagram, along with stock and flow diagrams, which are derived from various information sources have been inspected carefully and validated by comparing them with the existing literature and through consultation with field experts on dam construction. Subsystem diagrams, flow diagrams, and partial model tests were used to assess the structure of the model. Model equations have been inspected, and expert opinions have been gathered to confirm model consistency with real system. The model has been checked to determine whether or not any potentially important feedbacks loops have been omitted.

Extreme condition test: The model should behave realistically no matter how extreme the inputs or policies imposed on it. The robustness of the model was tested by applying extreme conditions and the model behavior was observed. Several extreme conditions and combinations of these conditions were tested. The model was found to be robust because the behavior during the tests was explainable (figure 8 and figure 9).

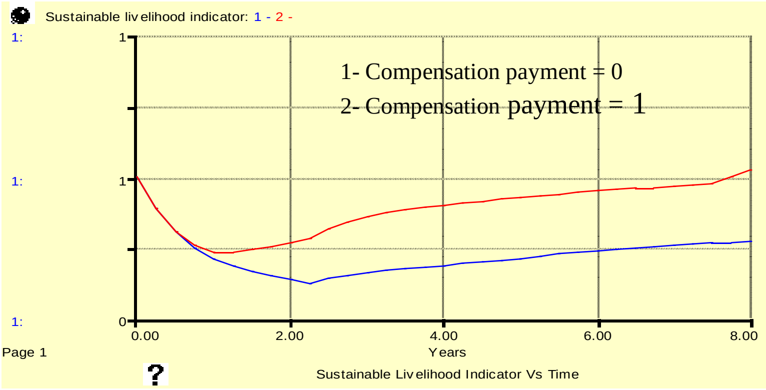

Figure 8: Model behaviors at extreme values of compensation payment

Behavioral validation: Test of model behavior evaluated adequacy of model structure through analysis of behavior generated by the structure (Forrester and Senge, 1980). In this research, qualitative comparisons have been carried out because the reference mode of the study was developed based purely on qualitative data. The model passed behavior test to check whether the hypothesis of feedback structure generates the same behavior as in the real world. Behavioral validation is attained by comparing the graphs generated from a base run of the model with time series graph (reference mode) plotted with expert's opinion. The model was found to be behaviorally valid.

Sensitivity analysis: Behavior sensitivity is a test to check model behavior by changing parameter values. By performing behavior mode sensitivity analysis the authors have gained more confidence in the model. Highly sensitive variables are considered for policy analysis. Public hearing, public participation, information accuracy & its disclosure, compensation payment and settlement program and monitoring and reporting were identified as sensitive variables. The sensitivity analysis of public hearing for different parameter values 0.5, 0.625, 0.75, 0.875 and 1 is represented by graphs 1, 2, 3, 4 and 5 respectively in figure 10. Different scenario of conflict at various levels of public hearing support the statement by Bureekul, (2000) and Mantalumpa et al., (2000, cited in Manowong, 2006), instead of resolving disputes public hearings sometimes create more conflicts.

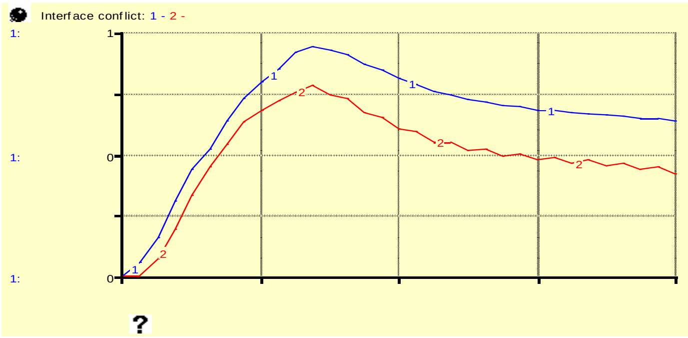

Figure 9: Model behaviors at extreme values of Public participation

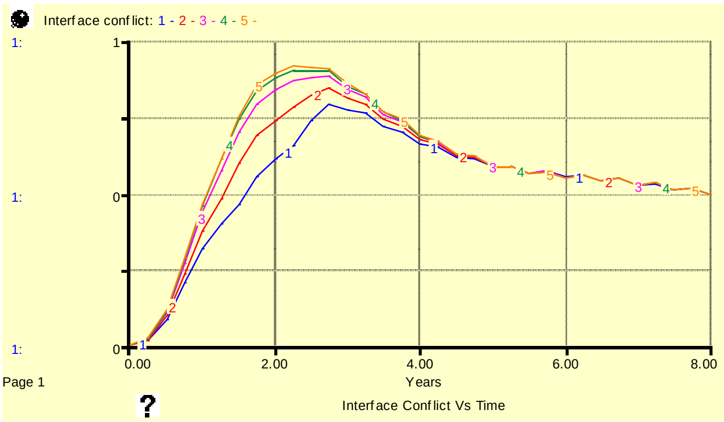

Figure 10: Sensitivity analysis of public hearing

Policy analysis and Design

Formulation of an effective and implement-able set of policies to avoid or minimize interface conflicts at the construction stage of dam construction project through model simulation is a main objective of this study. Extensive model experimentation, validation and sensitivity analysis has been done to identify the important variables to attain suitable leverage point. A set of policies are addressed to achieve the objectives. While choosing the policy, practicality and usefulness have been checked with the experts working in dam construction projects.

Public participation to create sense of belongingness and project acceptance (Policy 1)

From simulation it has been learnt that EIA is an effective tool to identify, to predict, to evaluate and to communicate impacts in order to make more environmentally acceptable decisions. During the interview, experts pointed out that EIA process was not participatory, integrated and transparent enough. It was done to fulfill a bureaucratic requirement for project approval and was isolated from the project planning and implementation cycle.

During EIA, the project developer focused more on the economic aspects rather than the social and cultural aspects.

Warner (1999) pointed out that in economic infrastructure projects public involvement is principally about involving the local population and/or their representatives and working with them to find ways to mitigate the adverse environmental and social effects of the project. All stakeholders especially potentially affected people should have the right to participate in the area of design, through decision-making, construction operation and decommissioning (Awakul and Ogunlana, 2004). Through public consultation and incorporation of local knowledge in project development, it is possible to gain the trust of local communities and, hence, facilitate smooth implementation of projects. However in case of the Nepali project, the developers neglected some of the stakeholders at the identification stage especially the marginal and ethnic groups.

Information accuracy, openness, education, funding, time and effective communication of all project related data, policies, and decisions are regarded as important factors for public hearing process. However, discussions with the project stakeholders revealed that information about the project was not easily accessible in terms of language and style. The public should be given all the critical information accurately in advance to bring all the stakeholders to the same level in order to enable them to participate meaningfully in the decision making process. Siwakoti (2005) pointed out that most of the negative effects are by-passed in such a way as if they do not exist or they are treated as "little things" to be easily mitigated. The public is not fully informed in advance about the pros and cons of proposed projects. From the discussions it was noted that superficial EIA, information concealment, lack of public participation at the early stage of the project and ineffective public hearing prior to making final decision significantly reduced the quality of decisions and impeded the project team from having the opportunity of early consensus-building to avoid confrontations at later stages of the project.

Therefore, a project team needs to improve the EIA process and include the local people in the planning and design stage of a dam construction project. Parameter value of public participation; public hearing prior to final decision; training & education program; information accuracy; and time and resource spent in EIA has been increased whereas value of information concealment is decreased in the model keeping all other parameters unchanged from the base scenario. Model behavior after implementation of the policy is presented in Figure 11. It can be noted that by implementing policy I, more conflict surfaced early in the project. However, at the later stage (construction) conflict reduced significantly. The sooner the conflict can be identified and addressed, the higher the chance for resolution success and the lower the cost (Harmon, 2003).

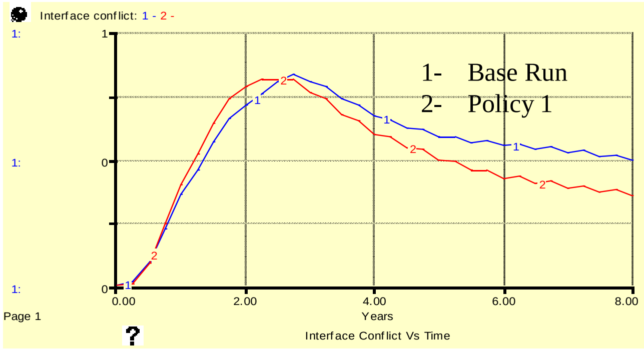

Figure 11: Evolution of interface conflict over time according to base scenario (1) and policy I scenario (2)

Compensation and Resettlement program to sustain livelihood (policy II)

This touches the weakest section of the community and brings in a vast change to the affected population (Dalua, 1993). Management of compensation payment and resettlement of project displaced people can determine the success or failure of a project. However, the issue of compensation payments in the developing world is adversarial; the payer usually offers less than adequate while the displaced people (payees) plead for more than they should be entitled to (Awakul and Ogunlana, 2002a). Payments are often delayed with people who have voice often receiving payment easily and earlier than the others. Cernea and Kanbur (2002) stated that resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to give the persons displaced by the project the opportunity to share in project benefits. The effectiveness of any resettlement plan is largely dependent upon the participation and feedback from various stakeholders at all stages of the project cycle. It was noted from the interview of experts that resettlement programs have mainly focused on the process of physical relocation rather than restoring the livelihoods of displaced people. It is a paramount need to prepare a realistic action plan in a manner that would give the opportunity to PAP to physically establish and economically self-sustain in the shortest possible time. A part of project earnings should be earmarked for development of communities where the displaced have settled or for those who are affected but did not receive compensation due to various reasons. Attention has to be given to the institutional aspects of implementation of action plans.

It has been pointed out that although the Land Acquisition Act (LAA) 1977 is a major legal document for handling acquisition and compensation, it has no provision for granting compensation to PAPs who are not land owners. It has difficulties in addressing delay in compensation, ensuring the vulnerable groups, ethnic minorities of making proper use of compensation money to resettle to a living standard not less than that existing prior to the project and is also inadequate to effectively deal with the problem of involuntary resettlement. Dahal (2006) stated that there are other related acts but they do not address issues of resettlement of people affected by development projects. Resettlement policies differ across projects depending upon donor agencies that formulate and implement their own project specific resettlement policies which have led to inconsistencies in compensation and resettlement standards. This can give rise to disappointment and conflict among various interest groups. However, effect of rules and regulations of the country was not directly incorporated into the model.

This policy has been implemented to improve livelihood of the people by keeping human beings as the primary stakeholders and the local people who are adversely affected by the proposed project as the first beneficiary of the project. The parameter value of compensation payment; support programs; employment in project; and training and education programs were increased in the model while keeping the values of other variables constant. The behavior of the model after implementation of Policy II (see figure 12) shows significant reduction in interface conflict during the construction stage.

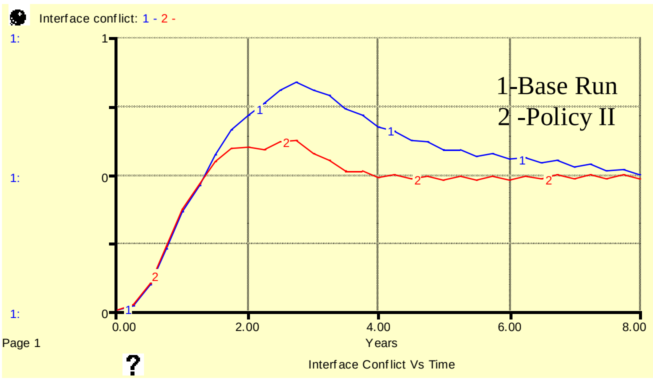

Figure 12: Evolution of Interface conflict over time according to base scenario (1) and policy II scenario (2)

Monitoring and reporting program to develop positive perception of dam project and mutual trust (Policy III)

Sharing knowledge, experience and information relevant to proposed project enhances the cost effectiveness of projects while the disclosure of timely information will allow community level participation in decision making, which is necessary for consensus building (Dahal, 2006). However, in the Nepalese context the situation is different; generally the project developer tries to hide project information. An example is the Arun III project where the case was filed for access to project documents and information both at the level of the Supreme Court and the World Bank's Inspection Panel (Siwakoti, 2004).

Implementation of Policy III will improve the positive perception of the local community and increase mutual trust. Parameter values of variables monitoring and reporting program and information accuracy were increased in the model keeping all other parameters unchanged from the base scenario. Model behavior after implementing Policy III is presented in Figure 13 showing slight decrease in interface conflict in the project. An effective implementation of policy on monitoring and reporting should identify success stories to be replicated and failure to be avoided which will ultimately decrease negative perception of the community and enhance mutual trust. This will reduce interface conflicts in future dam construction projects.

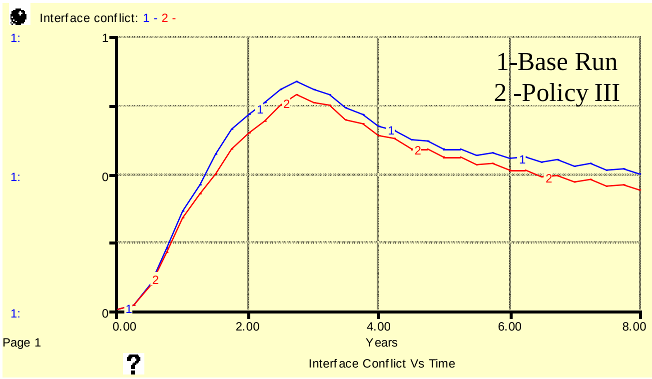

Figure 13: Evolution of interface conflict over time according to base scenario (1) and policy III scenario (2)

Implementation of Policy I, II & III together

The local public has the greatest potential to influence the plan. Changing the plan at an early stage in the project cycle has lower implementation cost and higher chance for success. Policy I will provide the chance for the project team to interact with the community to gain broader public acceptance, assessing magnitude, extent and duration of direct and indirect impact of proposed project which will help to formulate and implement policy II. Meanwhile, policy III will help to gradually develop positive perception about dam construction project. To get the best result all the three policies should be implemented together. Implementation of all three policies resulted in interface conflict surfacing early in the project but reduced the conflict during the construction stage significantly (Figure14). The extra time and resources spent on implementing all the three policies together can be justified with the benefit derived from it.

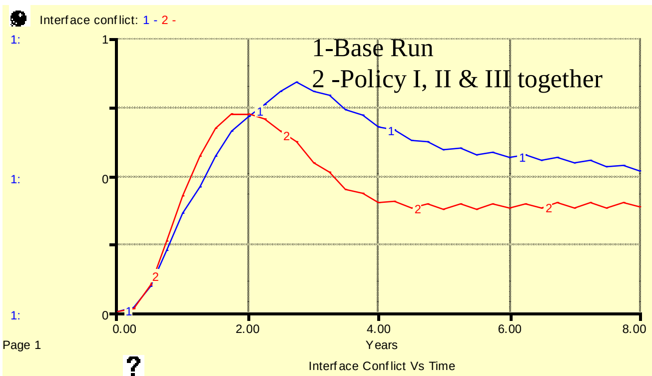

Figure 14: Evolution of Interface conflict over time according to base scenario (1) and policy I, II & III together scenario (2)

Conclusion

Interface conflict is a major problem in dam construction projects leading to many projects being stopped at the planning stage whereas others are subjected to high levels of conflict during the construction stage. Identification of root causes of interface conflict is necessary to avoid and minimize the problem in present and future projects and to add substantial value to projects. The causal loop diagram developed from qualitative data gathered from case study and expert opinion was converted into mathematical model using STELLA 9.03 modeling software. The model was validated through structural and behavioral validation tests. Extensive model experimentation, validation and sensitivity analysis results indicate that the model is robust and capable to replicate the general behavior of interface conflict in a dam construction project.

This study reveals that interface conflicts at the construction stage of a dam project could be caused by lack of effective EIA, public participation and mutual consultation with timely and accurate information at the early stages of projects. This has impeded the project development team from working in harmony with the affected people to know public feelings, their issues and to adequately gauge the impact of the project on the environment and society. Failure to work in harmony with the affected people has significantly increased discrepancy in compensation payment, resettlement and support programs and finally reduced the quality of decisions and the opportunity for consensus building to avoid confrontations at the later stage of the project. Lack of monitoring and reporting of ex-post situation of the project affected people, including environmental impact, has created long term negative perception in the local people about the dam project.

Three promising polices have been explored to avoid and minimize interface conflict in dam construction projects; viz: (i) public participation to create sense of belongingness and project acceptance; (ii) compensation and resettlement program to sustain livelihood; and (iii) monitoring and reporting program to develop positive perception of dam project and mutual trust. Policies (i) and (ii) have the potential to reduce the level of conflict significantly. To derive the most benefits for the project and the affected people, all three policies should be implemented together - since the policies are mutually reinforcing. The cost of implementing them can be greatly offset by the benefits of conflict reduction and the positive image the project gains in the community.

Emerging from this study is the utility of system dynamics as a modeling tool for understanding the dynamics of conflicts on dam construction projects. A model developed through qualitative data can be simulated to create a computer based learning laboratory for the project. This is a useful tool for policy makers on large projects, especially those likely to be subject to social and environmental conflict.

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