Water Use Conflict between Agriculture and Fisheries in a Selected Water Resources Development Project in Bangladesh

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Abstract

In many areas of Bangladesh, *beels* or shallow wetlands are dewatered or drained to allow dry season agriculture. Structural interventions including embankments and sluice gates are often introduced for this purpose. However, this arrangement adversely affects fisheries, ecosystem and their livelihood support in the short and long terms. So, the water use conflicts between dry season agriculture and fisheries are almost inevitable. The conflicts are more complex where the open access fisheries resources are limited due to intervention of the aquatic ecosystem. Even within a participatory process of decision-making for such interventions, the needs and priorities of the fishing communities are often marginalized, mostly because of their weak position in the community. Based on a socio-technical approach, this paper provides an understanding of the conflicts between agriculture and fisheries due to structural interventions in a selected water resources development project. Social survey and stakeholder analysis through FGDs and interviews with different groups including farmers, fishermen, and women revealed the differences in their realities and identified the conflicts by assessing the impact of project interventions on irrigated agriculture, fisheries, ecosystem, and livelihood support. An apparent discontent prevails among the less powerful fishing community as their needs, priorities, and alternate livelihood options have not been properly addressed in the project formulation process. Technical analysis revealed conflicting water requirements for dry season agriculture, fisheries, and aquatic ecosystem. This study also attempted to identify a feasible platform for conflict resolution.

Keywords: Conflict reduction, Beel dewatering, livelihood, FCD project, Structural intervention, Environmental impact

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1. Introduction

In the context of Bangladesh, water resource development activities, namely flood control, drainage and irrigation, and closures of natural canals and large/ small rivers got a boost in the 1960s. A huge number of water development schemes were constructed and still under construction as development interventions overlooking the ecology of the beel. Water requirements for aquatic habitat were totally ignored, while planning, designing, and implementing the schemes. As a result, aquatic habitats were eradicated, removed, shrunken, and / or modified with impunity affecting the open water capture fisheries and livelihood of the fishermen community (Ali, 1997). Flood control drainage and irrigation (FCD/I) projects alter the inundation pattern to create an artificial environment conducive to agricultural production (FAP 6, 1994). Flood control projects have a series of relatively specific impacts on fisheries. The conflicts between irrigation and fisheries begin as the fisheries issue in flood control is usually seen in terms of trade-offs. If the overall benefits to agriculture and other sectors exceed the disbenefits suffered by fisheries and those dependent on them, the project is acceptable to the respective authority. This kind of approach ignores many serious issues regarding distribution and what constitutes a benefit for different groups within the population (FAP 17, 1995).

Several subprojects of the Southwest Area Integrated Water Resources Management Project (SWAIWRMP) have introduced structural interventions for flood control, drainage, and water conservation (ADB, BWDB and WARPO, 2004). The purposes of these interventions is to allow storage of fresh water for dry season irrigation, drain out water to allow cultivation in wetlands, locally called beels, and prevent saline water intrusion during the later part of the dry season (BWDB and WARPO, 2005). Although these interventions have been beneficial to dry season agriculture, fisheries and the aquatic ecosystem have been adversely affected (LGED, 2007). Giving high priority to the agriculture sector and ignoring the livelihood of the marginal fishing community results in conflicts between agriculture and fisheries. This conflict may turn into severe problem in the perspective of Bangladesh as the number of FCD (Flood Control and Drainage) projects are increasing rapidly.

In natural resource management, conflict is often inevitable. The growing demand for finite or renewable natural resources to satisfy the needs of different stakeholders is a common source of conflict. As resource becomes scarce, the competing interests cannot be fully met. Faced with such situations, stakeholders will make choices about how best to act to pursue their own interests. Stakeholder negotiation will inevitably involve conflicts of interest and trade offs (Ramirez, 1999). Although these conflicts are often taken to be bad or negative, they are logical developments in the absence of proper democratic, legal, and administrative mechanisms to handle issues that are at the root of water conflicts (Joy and Pranjape, 2007)

Sectoral perception of water use result in various forms of water conflicts, which reflect different perceptions from the sectoral needs for water or from different concepts of water use priority in the process of social and economic development. This kind of conflict is termed as social conflicts in water management (Ti, 2001). The failure to integrate water resources management into the social and economic development processes will lead to the aggravation of conflicts in water management.

The following characteristics of open access resources (water and fisheries) aggravate the conflicts and make it complicated to manage (World Fish Centre, 2006):

i. Over exploitations, hence not sustainable,
ii. Difficult to manage,
iii. Favours powerful and rich, hence not equitable, and
iv. No incentive for conservation, therefore not sustainable.

Ti (2001) suggest that conflicting situations can be reduced by planning the freshwater resources development, use, management, and protection in an integrated manner, considering both the short and long term needs of the social dimension and the stability and sustainability of the social and economic development processes. It is essential to create conditions for an efficient environment for the economic use of water, including a well defined legal and institutional framework for the utilization and conditions for a fair and equitable sharing of the beneficial use of the water resources.

Franks et al. (2004) studied the situation and conflicts amongst competing uses in Usangu basin, Tanzania, and put forth some suggestions to develop a sustainable management plan with the help of local stakeholders. There is no simple solution for allocating and managing water amongst competing uses. It requires a holistic approach. Water resource management depends on the proper understanding amongst the stakeholders about the problems within the basin and linkages between them. Physical, administrative, and cultural boundaries should be borne in mind while managing water amongst competing uses. It should be noted that water resources management and use are closely related to management of other resources such as land and therefore a holistic approach to resource management within the catchment is needed. There is also a need to support bottom up participative process and to integrate them within a plan for catchment which covers a large area and supports a large resident population.

Stakeholder Analysis is an effective tool to reduce conflict. Kammi Schemeer (2001) studied the usefulness of this tool in policy formation to avoid conflicting situation. Policy makers and managers can use a stakeholder analysis to identify the key actors and to assess their knowledge, interests, positions, alliances and importance related to the policy. This allows policy makers and managers to interact more effectively with key stakeholders and to increase support for a given policy or program. When this analysis is conducted before a policy or programme is implemented, policy makers, and managers can detect and act to prevent potential misunderstandings about opposition to the policy or program. When a stakeholder analysis and other key tools are used to guide the implementation, the policy or programme is more likely to succeed.

Multi-stakeholder negotiation is neither possible nor desirable for powerless groups. Weak, disenfranchised stakeholders stand to lose much from negotiations where power differences are too acute to enable collaboration. Nevertheless, all stakeholders stand to benefit when the negotiation playing field is transparent, so that the decision to venture into a negotiation is based on reliable information (Ramirez, 1999).

Conflict management is urgent for sustainable development, although it is a very difficult task considering the complexity of the interactions among various factors of the water sub-sectors, and stakeholders in the integrated water resource management process (Ti, 2001). This complexity was found at the initial stages of the study through the apparent discontent among the fishing community that their needs, priorities, and alternate livelihood options have not been properly considered in the project formulation process. This study conducted a detailed investigation in these issues as part of the postgraduate programme of IWFM sponsored by the Crossing Boundaries (CB) Project.

2. Methodology

The study was conducted in the Siapagla FCD subproject that consists of Siapagla two-vent regulator on the Siapagla Khal[1] and Barmara one-vent regulator on the Khamar khal in Narail district. Preliminary investigation and literature review showed possible conflicts in water use for dry season irrigated agriculture and fisheries resulting from project interventions. The study

[1] A branch which flows away from the main stream as a tidal creek or an irrigation canal

identified these conflicts through focus group discussions (FGDs). The major groups were farmers, fishermen, and women. Seasonal variability in water requirements for irrigation, fisheries and ecosystem was estimated from an analysis of secondary information on various aspects including cropping pattern, crop water requirement, irrigation and fishing practices, and predominant fish and other aquatic species. This analysis revealed the conflicts in water requirements. Impact of project interventions on irrigated agriculture, fisheries, and ecosystem was assessed from FGDs and structured interviews.

The relations among stakeholders and the power structure for community decision-making was identified through stakeholder diagramming based on information collected through the FGDs mentioned above. This helped in understanding the potential areas and opportunities for conflict resolution. Two stakeholder workshops, one at the Administrative level and another at the local level, were arranged to identify agreeable mitigation measures and to explore the feasibility of using such workshops in future as a platform for conflict resolution.

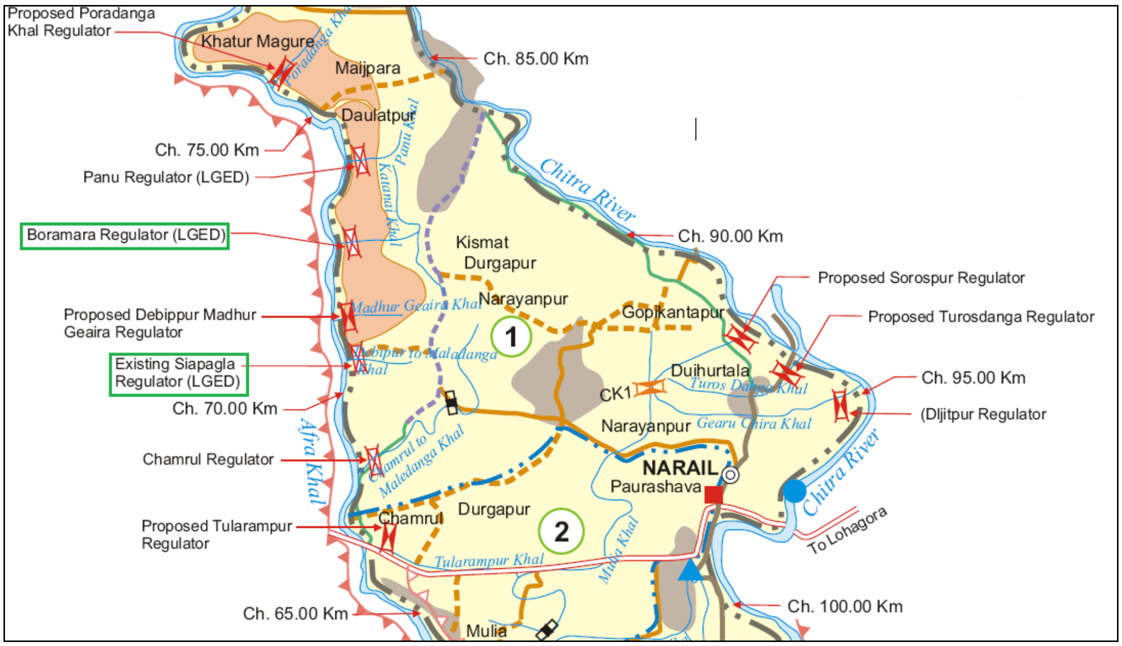


Figure 1: Siapagla FCD subproject area consisting of Siapagla and Baramara regulators (Source: LGED)

3. Conflict Identification

3.1 On the Basis of FGDs and Interviews

Field investigations were carried out to understand the prevailing situations that have created or indicated the conflicts. These situations are summarized as follows:

1. Rapid intensification of agriculture and drastic decline in open water capture fisheries due to the FCD project creates a conflicting situation between farmers and fishers.
2. Most fishermen were not aware about the project at the project-formulation process.
3. There has been severe impact on the livelihood of the fisherman. This results in extreme poverty in the fishing community.
4. The fishing community is not properly compensated.
5. Only solvent people are allowed to catch fish in the khal.
6. The beel areas of Siapagla and khamar khal have lost their aquatic habitat.

7. The condition of the Khamar beel (adjacent to the Khamar khal) is more deplorable than the Kajla beel area around the Siapagla khal. One powerful, rich farmer obstructs the flow of water by constructing a cement-concrete barrier. At high tide, fish can pass the barrier but they cannot return to the river. No fisherman except the owner of that barrier is allowed to catch fish. This creates resentment among the people, especially in the fishing community.
8. Heavy siltation was found particularly in the Siapagla khal. This siltation obstructs the free flow of water and creates drainage congestion, which in the long run has negative impact on fisheries. So, there is an urgent need for khal excavation. Some project beneficiaries and LGED (Local Government Engineering Department) have proposed that excavated soil be deposited on the bank of the khal. But this is strongly opposed by the land owners in those areas.
9. The WMCA (Water Management Cooperative Association) of the subproject is responsible for maintenance of the two regulators. But it was found from field investigations that WMCA is not doing the maintenance properly. One of the sluice gates of the Siapagla regulator has not been working at all for more than a year. As a result, inflow into the khal from the river has been reduced. Heavy silt deposition was found on both sides of the closed gate. This has created adverse situation for fish habitat and migration.
10. The WMCA was supposed to rehabilitate the affected communities by sanctioning loan, giving training, providing a training room for female members, etc. But, in fact, loans are being approved only to those who serve some of their interests. The weaker people, especially the fisher group, did not gain any benefit from the WMCA.

3.2 On the Basis of Analysis of Hydrological Data

3.2.1 Pre- and post-project water levels

Figure 2 shows that the water level in the khal (outside the gate) has been lowered in general in the post project period (1996-2008). The maximum water level in the post project situation is approximately 3.0 m in mid September. The range of water level variation in the Khamar Khal is approximately 1.24 m and in the Siapagla Khal is approximately 0.88 m. The difference between the pre and post project water levels ranges from 0.08 m to 0.28 m in the Khamar Khal and from 0.06 m to 0.22 m in the Siapagla Khal.

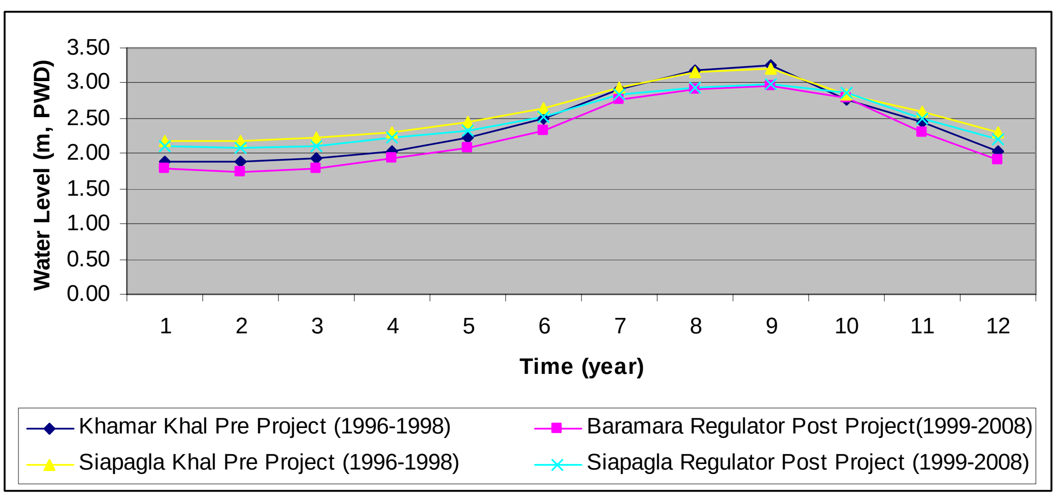


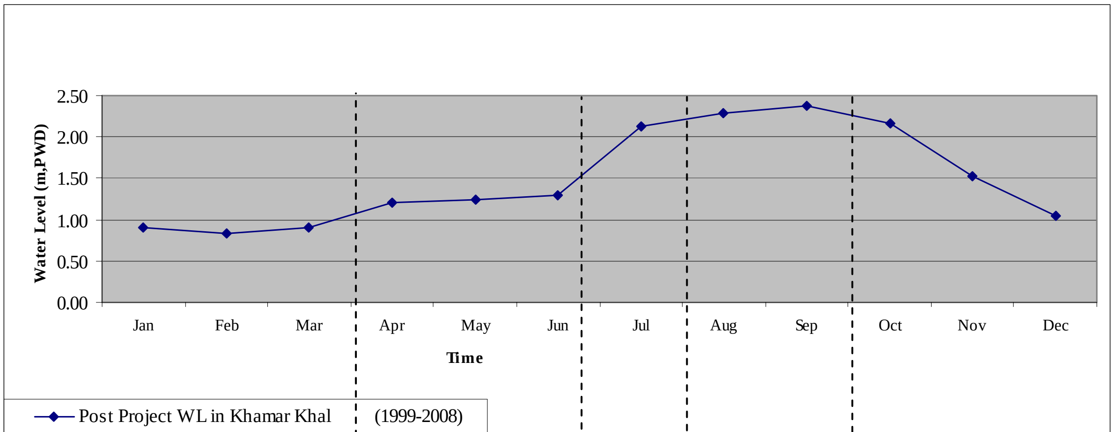
Figure 2: Water level variations (pre- and post-project conditions) in the Khamar khal and Siapagla Khal.

3.2.2 Pre-project water level variations in the khals

Table 1 gives the post-project water levels in the Khamar khal and Siapagla khal (inside the gate), respectively. These water levels were obtained from the gate operators and were verified with the local people. Maximum water levels maintained in the khals by the gate operators are 2.30 m and 2.41 m for the Khamar Khal and Siapagla Khal, respectively. Figures 3 and 4 shows the monthly water level variation and indicate the periods when the sluice gates are open or closed.

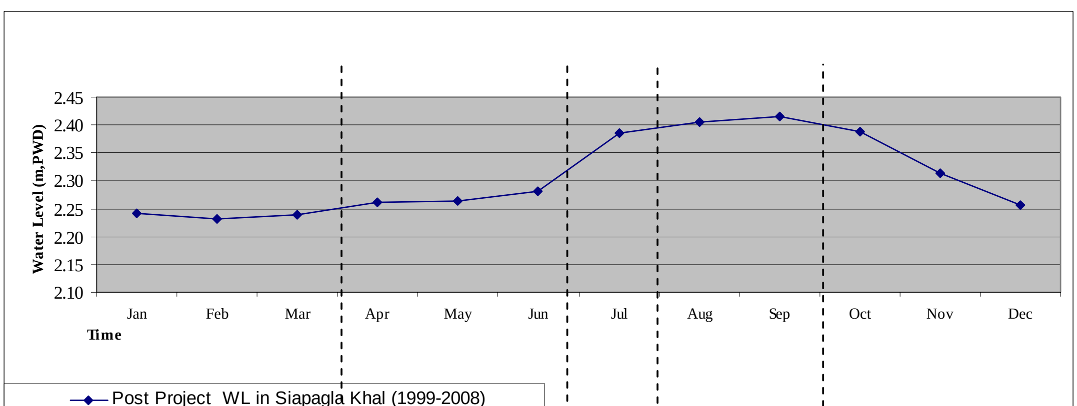
Table 1: Post-Project Water Level Variation in the Khamar Khal

Month	Post-Project WL in Khamar Khal (1999-2008)	Post-Project WL in Siapagla Khal (1999-2008)	Explanation
Jan	0.91	2.24	When the sluice gate is open, the water level variation is due to the fluctuation of the Afra river and rainfall. But when the sluice gate is closed, the water level variation depends only on rainfall.
Feb	0.83	2.23	
Mar	0.90	2.24	
Apr	1.20	2.26	
May	1.25	2.27	
Jun	1.30	2.28	
Jul	2.13	2.39	
Aug	2.30	2.41	
Sep	2.37	2.41	
Oct	2.16	2.39	
Nov	1.53	2.31	
Dec	1.05	2.26	



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sluice gate opening / closing	Open			Close			Open	Close		Open		

Figure 3: **Post-Project Water Level Variation in the Khamar Khal (1999-2008)**



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sluice gate opening / closing	Open			Close			Open	Close		Open		

Figure 4: Post-Project Water Level Variation in the Siapagla Khal (1999-2008)

3.2.3 Effects of the sluice gates on fish migration

Both the Siapagla and Baramara regulators reduce fish migration between the river (Afra Khal) and floodplins (Kajla Beel, Peruli Beel, Khamar Beel) in two ways;

1. by reducing the number of entry points on to floodplains and thereby forcing the fishes into fewer channels where they were more susceptible to capture. Field study showed that during neap tide, when the sluice gates are open and water level in the khal is very low, village people (both male and female) were engaged in fishing in the khals. They were even catching fish by straining the muddy soil of the khals.

2. by closing the gates for extended periods during the pre-monsoon and monsoon.

Table 2 describes the fish migration pattern of Carp and Cat fish species by the dark cells. This Table shows the periods when different types of migration are hampered due to closing of the regulator gates. For example, "dispersal of young over floodplain" for the Carp fish takes place during 21 May to 31 October. However, since the gates are closed during April 1- June 20 and August 1- September 30, this type of migration will be affected during April 01-June 20 and August 01- September 30.

Table 2: Seasonal migration of fish species affected by the regulators at different stages of life cycle

Category: Carp Fish

Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning migration												
Fingerling migration						Hamper		Hamper				
Dispersal of young over floodplain						Hamper		Hamper				
Return of young to beel and river									Hamper			
Harvesting beel and river												

Category: Cat Fish

Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning migration												
Migrate to floodplain				Hamper								
Dispersal and Growth						Hamper		Hamper				
Return of youngs to standing water												

Dry season residence in standing water												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sluice gate status	Open			Close			Open	Close		Open		

3.2.4 Rainfall-runoff analysis

Annual runoff in the study area was estimated from mean monthly rainfall using Khosla's Formula (Subramanya, 2006). Annual runoff depth was found to be 75.58 cm, and the runoff coefficient was estimated to be 0.42, which is in good agreement with the values suggested for agricultural lands (Garg, 2005).

Figure 5 shows a digital elevation model of the study area. The deeper areas indicate the higher storage areas for rainfall-runoff. Figure 6 shows the relationship between a given elevation and cumulative area below that elevation.

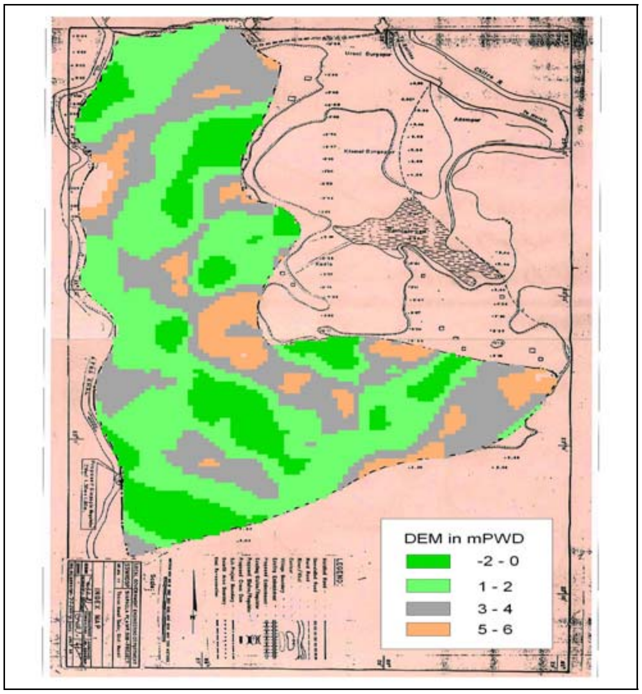


Figure 5: Digital Elevation Model of the study area

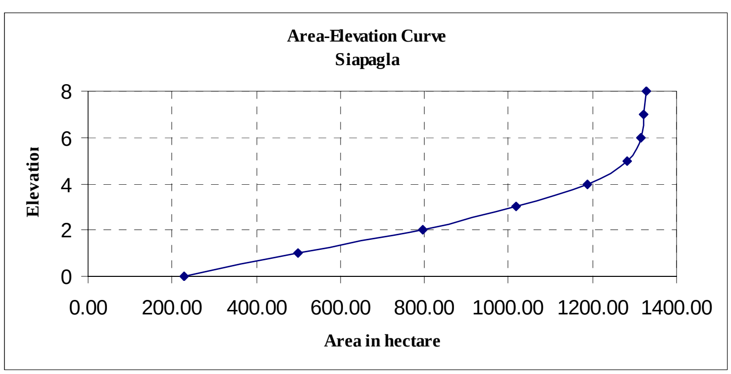


Figure 6: Area-elevation relationship for the study area

3.3 Water Requirement Conflicts

3.3.1 Irrigation water requirement

Different types of crops and vegetables are grown in the study area. The irrigation requirements for these crops and vegetables vary in application amount and time. The Table 3 presents the total water requirement for different crops and vegetables of the study area. From this table it can be concluded that the minimum water requirement in Siapagla is 120 cm.

Table 3: Irrigation water requirement.

Crop			Total Water Requirement (cm)
Rice Crops	Stages	Water Requirement (mm/season)	120
	Land Preparation	200-250	
	Crop Water Requirement	450-550	
	Percolation losses	250-450	
Wheat			30
Maize			35
Lentil			20
Cabbage			26
Cauliflower			22
Potato			28
Radish			18
Carrot			18
Tomato			25
Brinjal			35
Onion			20

(Source: Website BARI, 2008)

3.3.2 Fisheries water requirement

Distributions of fish concentration by depth class proposed by EGIS (1997) are as follows: 44% in depth class 1 (1-15cm); 285 in depth class 2 (16-30 cm), 16% in depth class 3 (31-90 cm); 9% in depth class 4 (91-180 cm); and 3% in depth class 5 (>180 cm). Fish respond to changes in water level with increased movement and concentration shift between depth classes. The highest fisheries concentration and biomass occur in depth class in 1 and decline throughout other depth classes; the lowest concentration of fish and biomass occur in the deepest portion of the floodplain in depth class 5. However, the number of species and alpha biodiversity are the highest in deep water (depth class 4 and 5) and lowest in shallow water (depth class 1 and 2) (EGIS, 1997).

Fish exhibit a preference for habitat by concentrating within certain habitat. Species of prawn, perch, gorami, barb, gobie, eel, small catfish, and puffer prefer habitat in shallow water (depth class 1 and 2, or 1 to 30cm). Glass fish do not indicate a strong habitat preference; instead they utilize all depth classes. Cyprineid, snakehead, and cyprinidone species show a strong preference for the shallowest depth class (1 -15cm). Exotic species indicate a strong preference for depth class 2 (16-30 cm), while knife fish species prefer depth class 3 and depth class 5. Species in the clupeid carp, large catfish, and mullet guilds exhibit a strong preference for deeper water (depth class 4 and 5, 91 – 180 cm and deeper). Therefore, the minimum water requirement for fish species is 180cm.

Table 4: Post project water level in Siapagla khal.

Month	Post Project WL in Siapagla Khal (1999-2008)
Jan	2.24
Feb	2.23
Mar	2.24
Apr	2.26
May	2.27
Jun	2.28
Jul	2.39
Aug	2.41
Sep	2.41
Oct	2.39
Nov	2.31
Dec	2.26

Table 5: Post project water level in Khamar Khal.

Month	Post Project WL in Khamar Khal (1999-2008)
Jan	0.91
Feb	0.83
Mar	0.90
Apr	1.20
May	1.25
Jun	1.30
Jul	2.13
Aug	2.30
Sep	2.37
Oct	2.16
Nov	1.53
Dec	1.05

The water depth in the Siapagla khal is adequate for fish species but that in the Khamar khal is not adequate, especially in the dry season for the species clupeid carp, large catfish, and mullet guilds as they exhibit a strong preference for deeper water (depth class 4 and 5, 91 – 180 cm and deeper).

It was found from the field survey that 3 LLPs (Low Lift Pumps), 210 nos STWs (Shallow Tubewells -run by diesel) and 18 nos STWs (run by electricity) were active in the subproject area during the dry season. These numbers indicate that the irrigation system in the study area is mainly dominated by groundwater irrigation. The khal water was mainly used for seed bed preparation, jute rotation, etc. Jute rotation pollutes the khal water which negatively impacts the fish species.

So there was almost no conflict between surface water irrigation and fisheries in the khal. The conflict mainly rose due to the beel dewatering in Kajla and Khamar beel for agricultural purposes. The required water depth or fish species, especially for depth class 3, 4 and 5 was not maintained at all.

4. Conflict Resolution

As part of this study a Stakeholder Analysis was performed on the basis of field surveys. Two stakeholder workshops were arranged to assess the suitability of a platform for conflict resolution**.**

4.1 Stakeholder Analysis

The stakeholder analysis was performed in three stages to accomplish the study objectives. At every stage, it was checked through FGDs and interviews ,which stakeholders are relevant to be involved in the process and whether the stakeholders have the same "rights". The role and involvement of the stakeholder may differ from stage to stage. Each stage of analysis focuses on a specific question that leads to the answer for that stage. The roles and involvements of the stakeholders are clarified while answering these questions.

During the stakeholder analysis the degree of involvement of every stakeholder (per stage) was labelled as (ARB toolkit, 2002)

- Co-operating: the stakeholder that will actually participate in and contribute actively to the process (i.e. active involvement)
- Co-thinking: the stakeholder that gives input with respect to content, it is a source of knowledge like experts (i.e. consultation)
- Co-knowing: the stakeholder which does not play an active role in the process but should be informed of its progress (i.e. information supply)

And the identification approach was redefined by identifying the actor as (ARB toolkit, 2002)

- Decision maker: stakeholders which decide about the project
- Users: Stakeholders which use the result of or are affected by it
- Implementer: the stakeholders that have to implement the result or new policy
- Expert/ supplier: stakeholders which put information, expertise, or means at the disposal of the project.

The analysis results are presented on a stakeholder diagram to help identify the differences, similarities, and relationships among the stakeholders. On the stakeholder diagrams, the stakeholders are arranged in three tiers: Co-operating, Co-thinking, and Co-knowing; and four quadrants: Experts, Decision-makers, Implementers, and Users. To identify the initial stage of conflicts, the roles of the stakeholders in the planning stage was analyzed, which is the main goal of Stage 1. Second stage leads to identification of water use conflict and the third stage attempts to find a feasible platform for conflict resolution. Stakeholder list for Stages 1, 2, and 3 are given in Tables 3, 4, and 5, respectively, on the basis of degree of involvement of the stakeholder at each stage.

At Stage 1, the planning stage, farmers play a decision-making role because of their strong position in the community power structure. Since the fishermen and women are relatively weak, they play merely a co-knowing role during the planning process. At Stage 2, the roles of water users in the sub-project area were analyzed. Figure 8 shows that farmers, fishermen, women, and other local inhabitants are all affected, positively or negatively, because of the project interventions. Water-use conflict is apparent at this stage. Farmers are the only stakeholders who are benefited, whereas many others are adversely affected. Moreover, since WMCA consists of mostly farmers the rights and privileges of the weaker groups are neglected in their decisions. At Stage 3, the conflict resolution process, the farmers, fishermen, women, local inhabitants, WMCA and Fisheries Officers are the main stakeholders. The Union Porishod (local government) may play the most important role at this stage since it has a decision making position.

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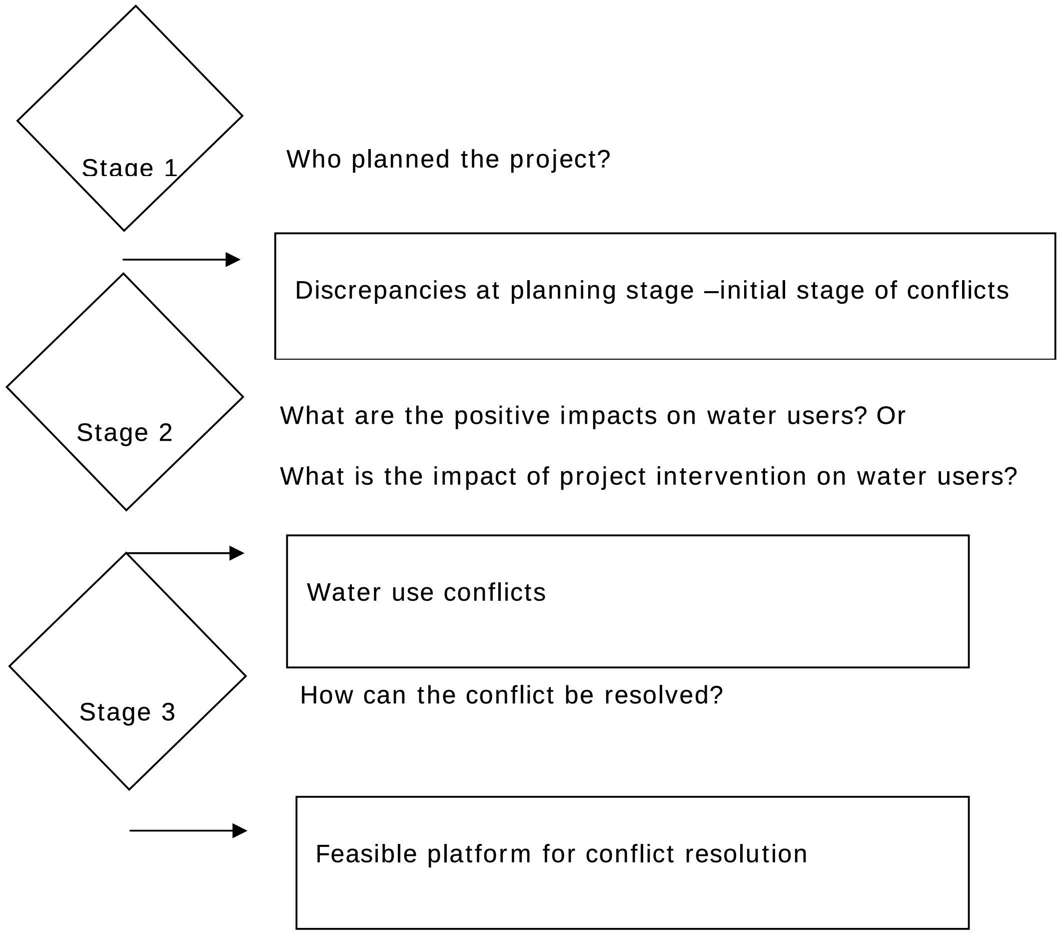

Figure 7: Different stages of water use conflict identification and resolution

Table 3: Stakeholders for Stage 1 (Pre-Project Stage – Who planned the project?):

Group	Actors	Degree of involvement	Role
LGED	Implementer	Co-operating	Actively participate in the project area selection process
Farmers	Decision Maker	Co-operating	Actively participate in the initial project selection process
Fishermen	User	Co-knowing	Affected by the FCD project
Local Inhabitants	User	Co-knowing	Affected by the FCD project
Women	User	Co-knowing	Affected by the FCD project
UP Members / Chairmen	Decision Maker	Co-operating	Participate in decision making process
Agriculture officer (AO)	Expert	Co-thinking	Provide information about the agriculture benefits
Fisheries officer (FO)	Expert	Co-knowing	Just informed about the project
Foreign Consultant (FC)	Expert	Co-operating	Actively participate in design
Donor Agency (ADB)	Implementer	Co-operating	Provide fund to implement the project
NGO	Expert	Co-knowing	Informed about the project
UNO	Decision Maker	Co-thinking	Participate in the final decision making process

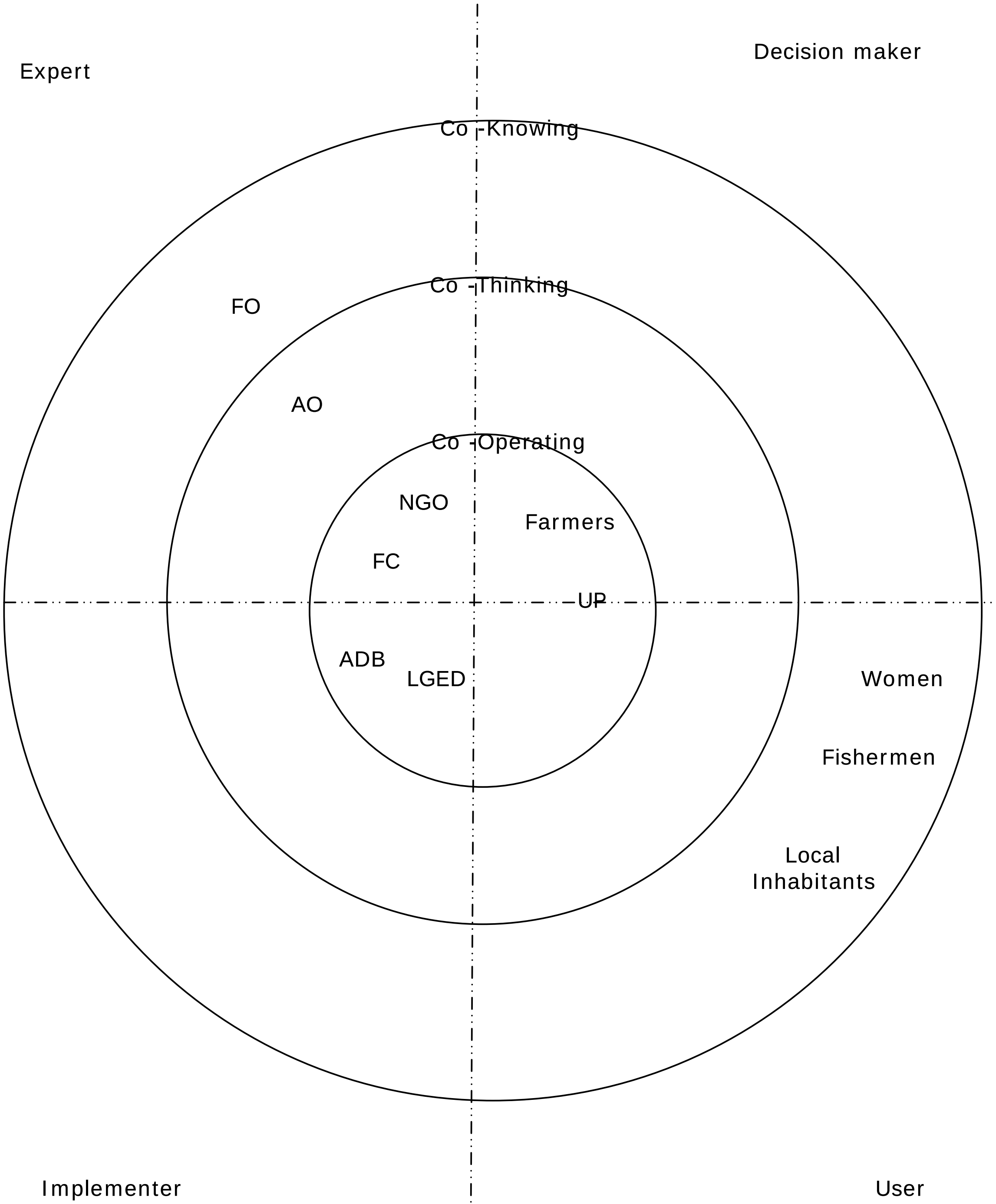

Figure 8: Stakeholder Diagram for Stage 1

Table 4: Stakeholders for Stage 2 (Post-Project Stage - What are the positive impacts on water users or what is the impact of project intervention on water users?)

Group	Actors	Degree of involvement	Role
WMCA	Implementer	Co-operating	Control sluice gate operation; benefited group
Farmers	User	Co-operating	Increase of potential command area, protected from saline water intrusion; benefited group
Fishermen	User	Co-operating	Negative impact on livelihood (The term co-operating indicates active involvement. In this stage the main target is to identify the impact both positive and negative. As the fishermen are directly impacted by the project intervention in a negative way, so their degree of involvement is co-operating.)
Local Inhabitants	User	Co-operating	Positive impact on livelihood
Women	User	Co-operating	Positive & negative impact
UP Members/Chairmen	Decision Maker	Co-operating	Participate in decision making process of gate operation
LGED	Expert	Co-Knowing	Informed about the situation
UNO	Expert	Co-Knowing	Informed about the situation
Agriculture officer (AO)	Expert	Co-thinking	Actively participate with farmers to observe and provide guidance in agriculture process
Fisheries officer (FO)	Expert	Co-knowing	Informed about situation
NGO	Expert	Co-thinking	Provide suggestion to increase positive impact

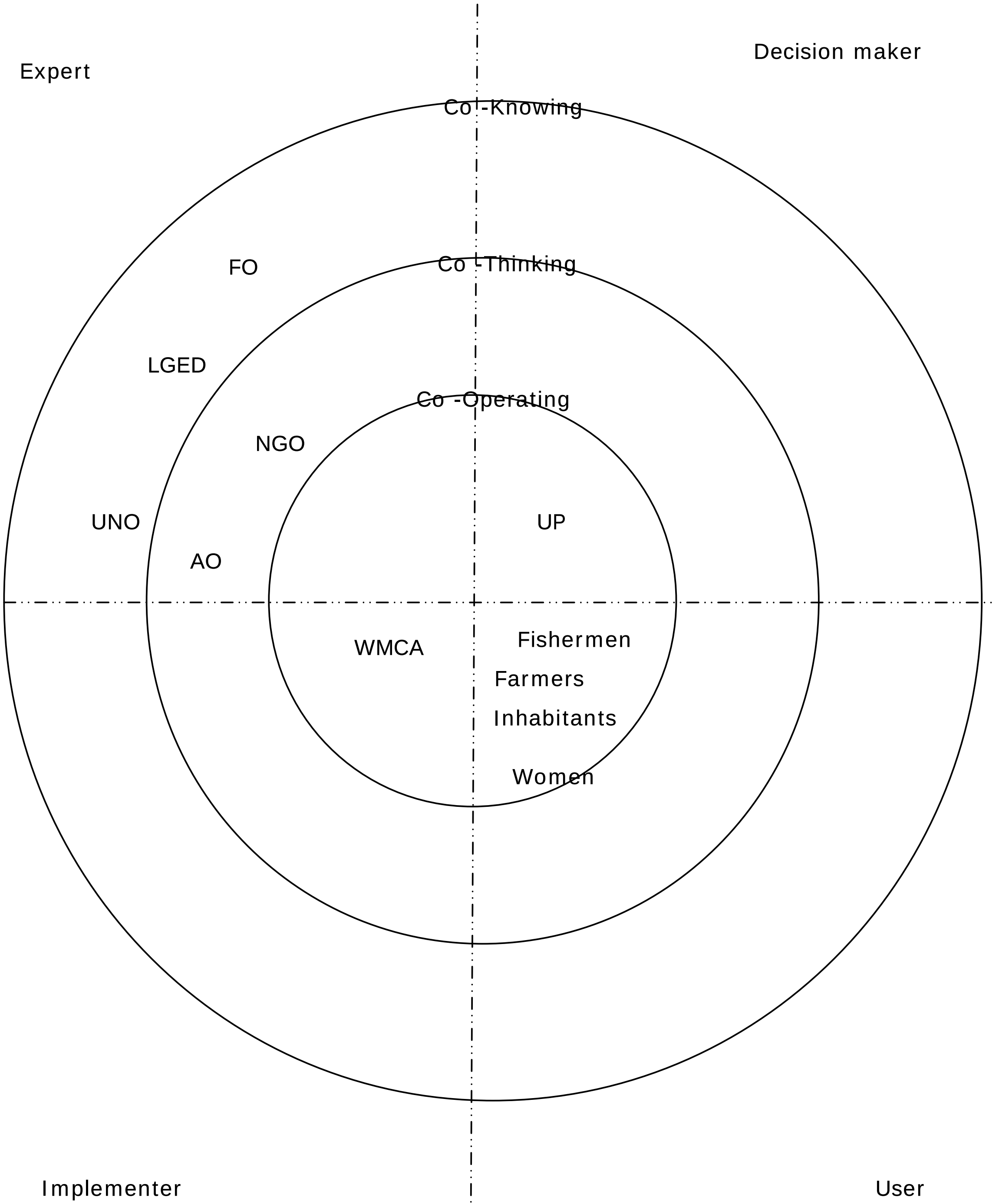

Figure 9: Stakeholder Diagram for Stage 2

Table 5: Stakeholders for Stage 3 (How can the conflict be resolved?)

Group	Actors	Degree of involvement	Role
WMCA	Implementer	Co-operating	Consult with each and every stakeholder; responsible for conflict resolution
Farmers	User	Co-operating	Involved in agriculture practice
Fishermen	User	Co-operating	Informed about situation
Local Inhabitants	User	Co-operating	Informed about situation
UP Members/Chairmen	Decision Maker	Co-thinking	Participate in decision making process of conflict resolution
LGED	Expert	Co-thinking	Ensure a balance trade-off
UNO	Expert	Co-thinking	Ensure a balance trade-off
Agriculture officer (AO)	Expert	Co-knowing	Provide guidance in agriculture process
Agriculture Engineer (AE)	Expert	Co-thinking	Provide guidance for water delivery system, maximum utilization of water use can be ensured
Fisheries Officer (FO)	Expert	Co-operating	Minimize negative impact on fish species
NGO	Expert	Co-thinking	Rehabilitate the negatively impacted group

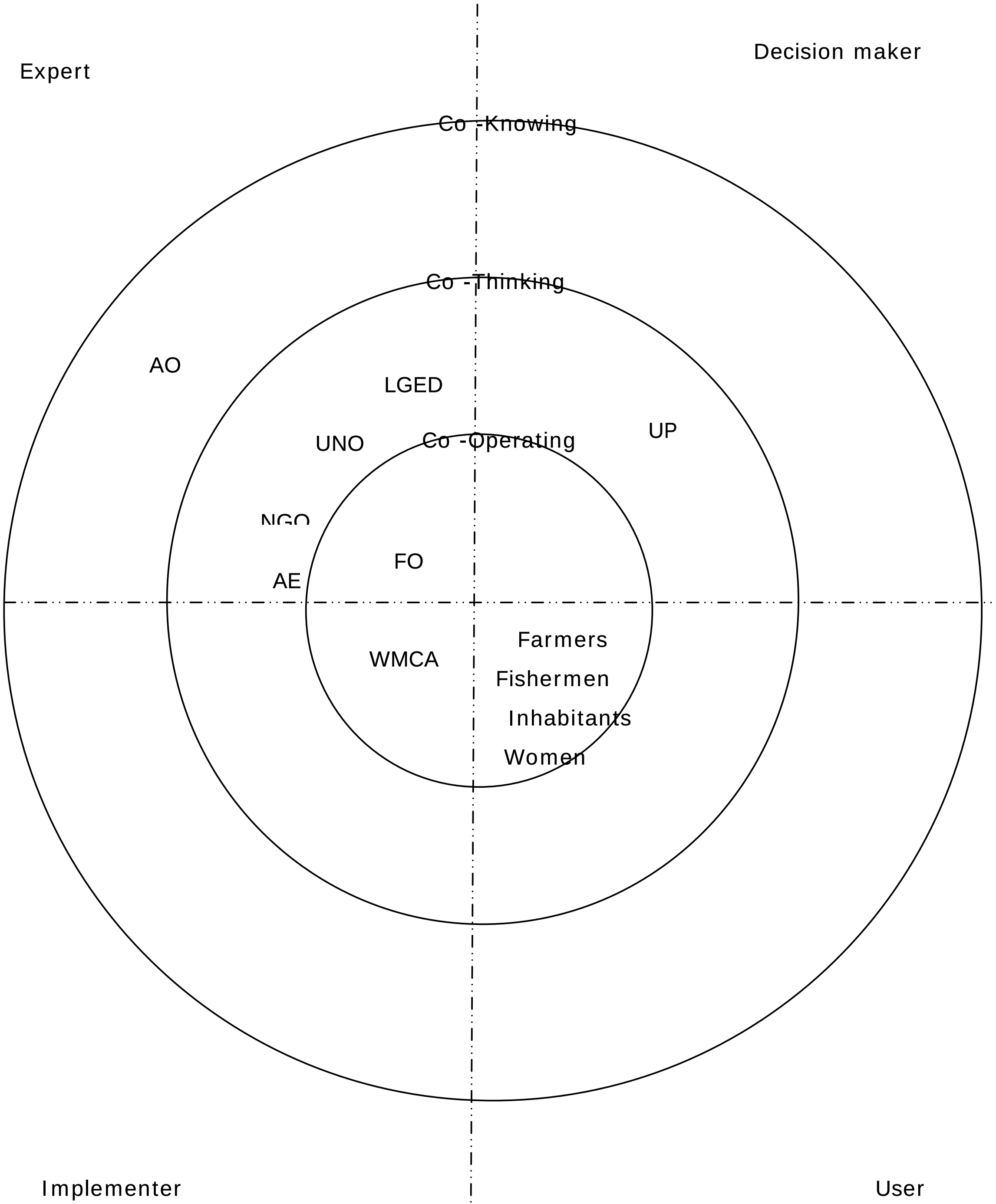

Figure 10: Stakeholder Diagram for Stage 3

4.2 Stakeholder Workshops

After conducting the stakeholder workshops (one at the administrative level and another at the local level) it was felt that these workshops at the local level may not serve as effective tools for conflict management in a situation where an unbalanced power structure prevails. The facilitation of an external powerful entity (e.g. UNO, LGED/ BWDB officials, Fisheries Officer, Agriculture Officer, etc.) is essential for the success of such workshops. However, arranging more stakeholder workshops at the local level may give better results for conflict reduction.

It was observed during the workshops that the weaker groups were very hesitant to express their problems, feelings, and demands in front of the powerful groups. They proposed many possible solutions for conflict reduction during the FGDs and interviews, but remained almost silent during the stakeholder workshops. So, stakeholder workshops at the local level in a community having unbalanced power structure may not be a feasible platform for conflict reduction. In these situations, regulatory or legal approaches may be more effective.

According to the National Water Policy (1997) of Bangladesh the ownership of water resources belongs to the state only and the state has the power to allocate water to ensure equitable distribution, efficient development, use, and to address poverty. Stakeholder involvement at all stages of the project cycle should be ensured by making a complete reorientation of the institutions to make the decisions affective regarding water resources management. So, the practical implication of this policy is an urgent need to manage the water use conflicts.

5. Conclusions

The risk of conflict between beel dewatering and fisheries tends to increase with increasing scarcity of water resources. The diversification of such conflicts indicates that their probability of occurrence is significant. These conflicts may not be always expressed because of suppression of the voice of the weak in the community power structure.

Beel dewatering to increase agricultural land is the main reason behind the current conflict. Besides, exclusion of the fishing community prior to implementation of the project, absence of proper compensation schemes to cope with post-project adverse situation, non-functioning of WMCA indicated by irregular meeting, partiality in loan disbursement, improper maintenance of sluice gates, khal excavation, etc., and unbalanced community power structure (farmer-dominated community) are some sources of conflicts between agriculture and fisheries.

Hydrological analyses show that fish migration pattern is adversely affected due to project interventions. It also indicates a remarkable difference between pre- and post-project water levels at the Siapagla and Khamar Khal. Pattern of regulated flow on to the floodplain was also investigated to illustrate a significant reduction of water area coverage for fish species due to the Siapagla FCD subproject. The digital elevation map (Figure 5) and area-elevation curve (Figure 6) clearly shows that due to the closing operation of the gates of the Siapagla and Baramara regulators, a huge portion of the beels remain dry when the outside water level is relatively high. The annual runoff depth is 0.76 m and it can inundate only about 425 hectares. This indicates an increase of agricultural land.

Pure engineering solutions fail to resolve such social conflicts. Solution to such problems lies in the combination of a socio-technical approach. Stakeholder participation from all levels of the society is a must to address the conflicts, enter into the depth of the problems, and find a suitable platform for conflict resolution. Identification of stakeholders was done on the basis of FGDs and interviews. Stakeholders were prioritized based on the degree of influence and degree of importance. After prioritizing, stakeholder analyses were performed in three stages and arranged on three-tier, four-quadrant diagrams on the basis of role and involvement of the stakeholders. The stakeholder analyses show that the weaker fisher community was not involved at the planning stage. Farmers, fishermen, women, and other local inhabitants are all affected, positively or negatively, because of the project interventions. Since WMCA consists of mostly farmers, the rights and privileges of the weaker groups are neglected in their decisions. The Union Porishod may play the most important role in the conflict resolution process as it has a decision making position.

Many good solutions may emerge from FGDs and interviews. But in a stakeholder workshop, where multi-stakeholders interact, the weaker group may keep quiet in front of the powerful group. Powerless, marginal fisher community usually does not feel comfortable and reassured to express their feelings and opinions. Stakeholders' involvement is essential in conflict identification and reduction; but the most effective mechanism for conflict management may be the regulatory and legal procedures, especially in a community where unbalanced power structure exists. In the case of Siapagla FCD sub project, further study can help to bring an optimum water level for fisheries and agriculture sectors by taking the interests of all the conflicting groups in a trade off situation.

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