A Study of Co-operative Floodplain Aquaculture: **Daudkandi Model**

A Dissertation

by

Md. Nuruzzaman
ID 06162007

Submitted to

Master of **Development Studies Program**, BRAC **Development Institute**, BRAC University
In partial fulfillment of the requirement for the **degree of**
Master of **Development** Studies

March 2011

A Study of Co-operative Floodplain Aquaculture: Daudkandi Model

A Dissertation

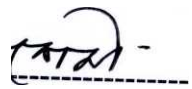
by

Md. Nuruzzaman
ID 06162007

Approved by:

Supervisor
Dr. M. A. **Sattar Mandal**
Professor, **Department of Agricultural Economics**
Faculty of Agricultural Economics and Rural Sociology
Bangladesh Agricultural University, Mymenshing

V*J



Dr. Syed M. **Hashemi**

Director
BRAC **Development Institute**
BRAC University

STUDENT'S DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

Md. Nuruzzaman

ACKNOWLEDGEMENT

It is my pleasure to acknowledge the contributions and encouragement received from the respected teachers coming from both BRAC University as well as from other reputed universities home and abroad. I wish to acknowledge the endless counseling and advisory support provided by Prof. Dr. Ferdouse Jahan, Academic Coordinator, MDS Program, without such support it was not possible to conduct the study. I gratefully acknowledge the immense support and backstopping guidance provided by Prof. Dr. M. A. Sattar Mandal during the semester teaching Course No. DEV 504 Rural Development and his follow up encouragement to undertake the study of the role of Co-operative Floodplain Aquaculture in rural development.

I convey my heartiest gratefulness to Dr. Ferdous Jahan, Academic Coordinator, MDS Program for rendering her constant support and encouragement during the whole course and giving me the opportunity to undertake the practical exposure doing this research and preparation of the thesis.

I also extend my heartfelt thanks and gratitude to the WorldFish Centre and SHISUK, the partner NGO materializing the community based aquaculture projects at Daudkandi area allowing me to undertake the field work and providing their business information for the research work. Special thanks to the participants and stakeholders from the cooperative aquaculture projects of Daudkandi area who gave interview during the field work.

Finally, I want to express deep gratefulness to my wife Alice and my children who took the pain and patience during the study for not being able to take adequate care in looking after them.

ABSTRACT

In Bangladesh, aquaculture continues to diversify and develop rapidly and is seen as the most realistic way to secure the nation's future fish supply needs. Basic fish production techniques are well understood by many farmers, inputs such as seed and feed are widely available and support thriving service provision businesses and lucrative markets exist. Apart from huge structural changes in commercial aquaculture as promising agri-business in the rural areas, a number of cooperative floodplain aquaculture projects have sprung up in recent years. These projects involve the closing of part of the floodplain, (typically 50 -100 ha area), through the construction of an embankment, creating a water body that can be managed through the stocking of indigenous and exotic fish species, feeding, fertilizing and then the complete harvesting of the stock. This cooperative approach can effectively change a seasonal open water resource into a closed productive unit of growth engine contributing considerable income and employment for the local people. The embankment work, crucial to the success of these ventures, is usually financed privately, through the issuing of shares to those landholders with land in the floodplain area. In successful projects, these shares appreciate in value and produce an annual dividend based on profitability.

A short review was carried out in Daudkandi Upazila, Comilla District, Bangladesh, to better understand how recent developments in floodplain aquaculture in the area, spearheaded by the local NGO; SHISUK, were contributing effectively in rural development along with a range of social, economic and environmental issues. Review of the current fisheries policies, legislation and action plans revealed a framework largely supportive of the development of floodplain aquaculture. The review found that the production and economic performance of many floodplain aquaculture projects were impressive and many were having positive effects on local economies, security, nutritional status and employment and service opportunities for the poor. Positive impacts were also noted in agriculture, where rice farmers were obtaining higher yields and using fewer inputs due to residual effect of nutrients applied during the fish production process. Adoption of IPM and practicing organic

farming by the SHISUK **projects was another important positive outcome in terms of safe food production.**

On the negative side, it was found that the initial screening process based on landholding, excluded many of the poorer people in the area, and the opportunity for some traditional livelihood foraging activities, that relied on open access to the floodplain, (e.g. subsistence fishing and duck raising), had been reduced or lost.

Although the spread of floodplain aquaculture in Bangladesh will be limited by certain physical and social constraints, the study concluded that Government funds would be best spent on evaluation and monitoring of floodplain aquaculture, instead of being directly involved in promoting the approach in new areas. It is imperative to take care for those development projects under DOF that intend to use project funds for the construction of initial embankment as opposed to raising funds from local landholders; because, it may be ignoring one of the key elements that have made floodplain aquaculture successful in Daudkandi raising funds from local landholders.

Acronyms

BARC	Bangladesh Agricultural Research Council
BWDB	Bangladesh Water Development Board
CBO	Community based organizations
CBFM	Community Based Fisheries Management
DOF	Department of Fisheries
DTW	Deep Tube well
FPA	Floodplain Aquaculture
HYV	High Yielding Varieties
LLP	Low Lift Pump
MOFL	Ministry of Fisheries and Livestock
NGO	Non Government Organization
SHISUK	Shikhya Shastha and Unnayan Karjakram, (Education, Health and Development
STW	Shallow Tube well
WFC	World Fish Center

Table of **Contents**

List of Tables

List of Figures & Plate

List of case studies

CHAPTER 1
INTRODUCTION

1.1 Introduction to Floodplain Aquaculture

Bangladesh is endowed with enormous amount of fisheries resources and very conducive climatic conditions to use these resources to earn peoples livelihoods particularly in rural area. Aquaculture could be one of the best options for the rural people which can generate income, employment and food security and can contribute significantly to alleviate rural poverty (Rahman *et al* 2005). There has been steady growth of 5-6% in aquaculture production in the recent years and currently about 39% of total fish production (Figure 1) coming from aquaculture (DOF, 2010). The growth and successes in aquaculture is replenished from about 0.5 million ha of inland water area including ponds, ditches, oxbow lakes and coastal shrimp farms. Whereas there remains about 2.8 million ha floodplain area having about 33% contributions in total fish production. Table I shows that the current production level from floodplain is 310 kg/ha which was about 150 kg/ha in 1999 (DOF, 2010).

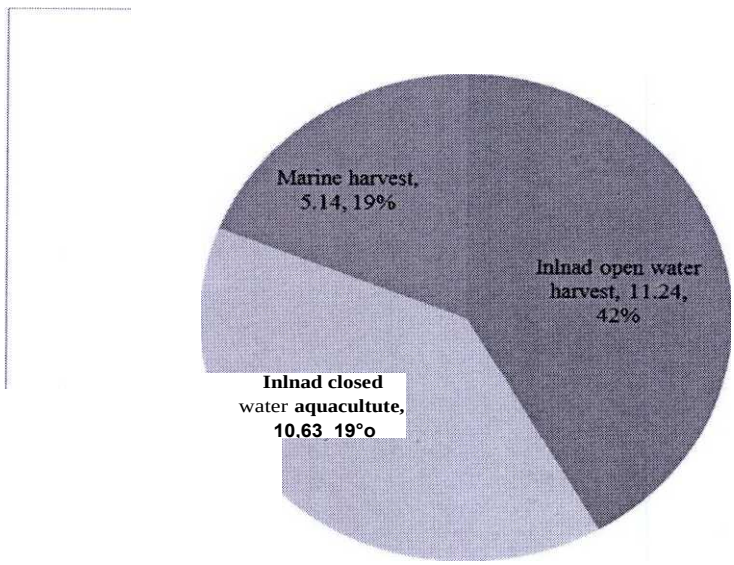
Table 1: Changes **in fish production** from **different sources** 1999 & 2009

Types of water resources	Area (in lac ha)	Production 1999 (in lac MT)	Average Prod. 99 kg/ha	Production 2009 (in lac MT)	Average Prod. 09 kg/ha	Annual change
1. Inland	45.75	13.28	290	21.87	478	+6
a. Inland open water	40.47	6.70	166	It 24	278	+7
Rivers & estuaries	8.54	1.54	180	1.38	162	-1
Brackish water in forest	1.77	0.11	62	0.19	107	+7
Beets	1.14	0.73	640	0.79	639	+1
Ka tai Lake	0.69	0.07	101	0.09	130	+3
Flood lain	28.33	4.25	150	8.79	310	+11
b. Inland closed water	5.28	6.57	1244	10. 3	2013	+6
Ponds	3.05	5.61	1839	9.12	2990	+6
Ox-bow lake	0.05	0.04	800	0.05	1000	+3
Shrimp her	2.18	0.92	422	1.46	670	+6
2. Marine		3.34	-	5.14		+5
Industrial	-	0.16		0.35	-	+12
Artisanal	-	3.18	-	4.79	-	+5
Total		16.61		27.01		+6

.Source cwf,

Data source, however, does not show anything clearly regarding the rapid growth in floodplain production. The observed productivity from floodplain certainly is a combination of harvest of natural fish from open floodplain which is declining gradually, plus the production from managed floodplain under cooperative or corporate aquaculture which has had a steady growth in recent years. Yet this production level can be increased many folds with minimum institutional support but sincere and coordinated efforts from the community where structural facilities are favourable. There was no such initiative known before in community based initiatives, except in Daudkandi area where culture-based management of floodplain water has been piloted and able to prove the prediction made in the above statement.

Figure 1: Total fish **production** (in lac MT) **and its major** sources with percentage, 2009



Source: *DOF, 2010*

Community based resource management in fisheries sector has been well initiated under different development projects under Department of Fisheries in the recent past. The Third Fisheries Project 1991-1996, Fourth Fisheries Project 1999-2005, Empowerment of Coastal Fishers Community Project 2001-2006 are the examples of such initiatives. Most of these projects had own command area and target groups to limit their supports. The Community Based Fisheries Management

Project (CBFM) in its two phases worked for about ten years ending in 2006 under the Department of Fisheries tried hard to build partnerships with NGOs and CBOs for effective and sustainable management of floodplain water bodies as natural common property resources. The approach of CBFM was to involve fishers' community and to ensure their participation in resource management (in common property resources), to ensure community access to the resources without competing with the non-fishers, and to improve resource management systems to enhance productivity and sustainability (PPRC, 2005).

But it is easy to believe that there will be no CBO still seen continuing the water management effectively in the flood plain areas after the cease of project support. Because, rhetoric expression about access to common property is one thing and sustainable production and harvesting is another dimension of addressing poverty and nutrition through fishing. Free access to common property water bodies, the *Jalmohals* in our country has led to a situation where everybody's property is nobody's responsibility and nobody cares about its sustainability (Nuruzzaman and Maniruzzaman 2003). On the other hand, the SHISUK approach in cooperative way of community mobilization in the floodplain area consists of new elements like: bringing the whole community to involve in development initiatives in private land; investment of individual capital in the form of share as a mark of participation, and formation of representative community organizations or the cooperative society and subsequent capacity building of the office bearers of the cooperative society to run the enterprises.

The Self-reliant Community Initiatives in Floodplain Aquaculture pioneered by the NGO SHISUK (Shikkha Shastha Unnayan Karzakram) in the Daudkandi area since 1995 has been able to attract national and international attention. For its outstanding contribution in community mobilization and self-reliant initiatives at the Pankowri Fisheries Project at Daudkandi, SHISUK was awarded 'National Gold Medal' in 1999 by the Ministry of Fisheries & Livestock, Government of Bangladesh (DOF, 1999). The Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP) carried out an evaluation for the Community Initiatives for Fisheries Development in Pankowri Fisheries project in 2001 with the aid from

the Pesticide Action Network Asia and the Pacific (PANAP). The study recommended further replication of the viable model and underscored the need for support from the government and other development partners (CIRDAP 2002). The Department of Fisheries recognized the innovative approach of SHISUK and invited to prepare a Technical Manual on `Strategic Planning and Implementation Guidelines on Community Based Floodplain Aquaculture' in 2004 (SHISUK, 2004).

As a progressive NGO, thus SHISUK was able to steer significant stimulation at policy level regarding the concept of self-reliant community based entrepreneurship and the government of Bangladesh adopted the model and prepared several project proposals to replicate this model through the Department of Fisheries (DOF, 2006, DOF, 2011). Due to its potential to improve the rural economy, the development of the fisheries resources was regarded in the 'Poverty Reduction Strategy Paper' (PRSP) as an important means of reducing poverty and boosting pro-poor growth.

SHISUK's initiatives have also been marked by the Food and Agriculture Organization (FAO) as `a promising model for self-reliant, community-based development' and expressed its interest to understand the model in greater depth in order to see what relevance this approach might hold for the other countries in the region. The Pesticide Action Network (PAN) Asia and the Pacific has been rendering policy advice and technical support to the community based organizations for agro ecology and food sovereignty (Rahman *et al* 2005). The farmers community associated to the Pankowri project adopted organic farming and IPM in their crop farming-cum-fisheries projects that run totally without the use of any pesticides. Much of these achievements have received good coverage in both in electronic and print media depicting details of success stories of the community development. SAARC Compendium of good practices included the Daudkandi Model as best practices towards attainment of the SAARC Development Goals (ISACPA, 2007).

Having discussed this background of the cooperative floodplain aquaculture: Daudkandi Model, it was decided to have a deeper understanding of the process and principles which underline the success of the Daudkandi experience and can establish the critical policy lessons to guide wider replication efforts in future. With this end in view the present study was undertaken purposively with the following objectives:

1.2 Objectives of the Study

1. To understand the operational principles through which the success in community mobilization in floodplain aquaculture has been possible.

2. To examine the nature of economic benefits accruing from the Daudkandi model experiences, including livelihoods impacts, forward and backward linkages and distribution of these benefits with a particular focus on poor fishermen and women;

3. To examine and assess the process through which Daudkandi model is self-replicating in the neighboring regions, in particular to assess the extent to which the community focus is being sustained in the replication process; and

4. To draw conclusions and policy recommendations on the Daudkandi model for its future potentials in managing floodplains with community management initiatives under cooperative system.

1.3 Methodology Used

The research method followed was reviewing reports and documents, reconnaissance surveys in the study areas, interviewing key informants including committee members (Chairmen, Managing Directors, Cashiers, and Directors) from the selected projects. Lists of projects were collected from the respective Upazila Fisheries offices and Floodplain Aquaculture Development Forum (FADF); an association formed aiming to protect the interest of the floodplain aquaculture projects at Daudkandi area.

The study was approached firstly, to understand the success of cooperative model of floodplain aquaculture focused on the Pankowri Project through review of literature and collection of secondary information from different sources. This is the most mature project in the area and represents a basic model from which imitators have copied and from which SHISUK have developed their 2nd generation models. Primary data were collected to understand the technology, economic performance, direct beneficiaries, secondary level beneficiaries and the wider community context. Participatory Rural Appraisal (PRA), personal interview and information checklist were used to explore the organizational management systems in place, institutional and political issues, and the interface with capture fisheries, agriculture and the marketing of fisheries produce. To some extent, quantitative data were collected and analyzed wherever possible.

Once a thorough understanding of the Pankowri cooperative model has been gained, then a number of key informants from successful and less successful imitators were interviewed to highlight the type and degree of variance from the Pankowri Project. This comparative study included the technology used, the social/community dynamics, the economic performance and the interface with capture fisheries and agriculture. The physical, social and economic constraints to the further organic spread of floodplain aquaculture were also explored.

The second generation SHISUK projects were then assessed in a similar way, to highlight variance from the original model. This concentrated on how this model has been adapted to better address poverty, gender, organic agriculture and capture fisheries issues, and how significant these changes to the basic model. PRA techniques were also used to explore livelihoods and employment opportunities and constraints within five village communities. Among secondary information, annual reports, file records including project maps were obtained from the SI IISUK office near to Pankowri project and staffs interviewed on key issues and areas where further clarification was necessary. Further updating of the information was completed during the field work. A number of case studies were also made on some catchy issues are put in boxes and placed in relevant sections.

CHAPTER 2
REVIW OF LITERATURE

2.1 Supporting Policy and Legal Framework

Inland fisheries production in Bangladesh remains crucial in providing food, income and employment opportunities for millions of people, many of them are poor. The importance of freshwater fisheries can be grasped in the extract below from the current Bangladesh Fisheries Policy (1996):

`Bangladesh is rich in water resources. Inland and marine waters are the main sources of fisheries production and exploitation. The area of total inland water bodies is 4.337 million ha; of which 4.047 million ha is open water bodies including floodplains and 0.29 million ha is closed water bodies including coastal shrimp farms..... In inland waters of Bangladesh, there are about 260 species of indigenous fish, 12 species of exotic .fish and 24 species of prawn. In 1996-97, Bangladesh produced about 1.373 million in. 1. offish, of which 0.606 million MT was from the inland open waters, 0.473 million MT from the inland closed waters and 0.294 million MT from the coastal shrimp farms and marine waters'. `Rivers, *canals, beels, haors, and floodplains are the main source of fish production in the inland open water bodies. Areas of inland open waters are about 4.047 million ha. From inland water-bodies, a total of 1.079 million MT offish was produced during 1996-97 fiscal year. Of these, 56% cane from the open waters'.*

Floodplain fisheries are robust, renewable resources that in many situations manage to stay productive despite the management regimes imposed. Through the protection of key parts of the floodplain system, these fisheries can remain extremely productive and diverse. Typical yields from floodplain systems range from 150 - 310 kg /ha /year (DOF, 2010).

Whilst these may seem modest production levels, when compared to the higher yields possible through aquaculture, they contribute significantly to national fisheries production due to the vast scale of the areas involved. Despite the scale of the resources, in recent years, the production of fish from the floodplains is thought

to have been declining, even though Bangladesh Fisheries Resource Survey System (BFRSS) data from 2000-2009 suggests an annual growth rate of 11% from the floodplains and about 1% increase from the beels areas. The reported growth in floodplain production over the last decade may be related to the limitations of the cooperative floodplain aquaculture i.e. Daudkandi Model in other districts where physical structure are conducive for floodplain aquaculture.

The need to maintain freshwater biodiversity whilst increasing the production from Bangladesh's extensive inundated areas, and improving the livelihoods of the millions of people who depend on these resources, therefore remains as a serious challenge for today's fisheries development policy makers and planners. The evaluation report prepared by World Fish Centre (WFC) emphasized to protect Bangladesh's fisheries resources from mismanagement and to ensure their equitable use through the establishment of representative community based organizations or CBOs (Rick *et al* 2007). Such CBOs are believed to be facilitating the handover of management of the water bodies to the community groups whose livelihoods is solely dependent on fishing and fisheries. NGOs have been instrumental in working with the communities in this regard. Unlike the terrestrial production systems, floodplain aquaculture appears to allow for the continued productivity of the natural aquatic system, due to the extraordinary annual regenerative qualities of the water resource which is almost free of cost.

2.2 Implications of existing Policy and Legal Framework

A short review of Bangladesh's current fisheries policy documents, suggests general support for the promotion and development of floodplain aquaculture. Only in one document, (The DOF Action Plan 2006), has a precautionary approach been recommended. A number of examples of relevant articles from key legal and policy documents follow: The fisheries laws in Bangladesh differentiate between .public' and 'private' and 'open' and `closed'. Most of the public fisheries are owned by the Ministry of Lands, although the conservation of water bodies and their fish, is entrusted to the Ministry of Water Resources, Ministry of Environment and Forest; and the Ministry of Fisheries and Livestock. Conservative authors tend to mean floodplain aquaculture poses some challenge for the existing

fisheries laws as the closing of the floodplain through the building of an embankment, essentially turns a previously public open access water resource, into a private closed one (Kazi and Rick 2008). But the people of Daudkandi area refuted this argument because inundation of private land does not give any benefit to the land owners who depend on the crop grown from the land. Before they adopted cooperative way to protect low land from regular inundation and washing. outspread unemployment and famine during the flood season lead them frequent outmigration. The Protection and Conservation of Fish Rules (1985) prohibits the construction of dams and embankments across rivers and canals for any purpose other than irrigation, flood control or drainage purposes. The raising of embankments for floodplain aquaculture in private land do not violate this prohibition and for the purpose of cooperative aquaculture in the floodplain should be interpreted as a flood control measure to protect both crops and fish grown without spending any money from the public fund. On the other hand, the Protection and Conservation of Fish Act (1950) does not define conservation and has no provision relating ownership or management of fisheries to their physical possession. Also, there is no mention of the management of fisheries through community participation, fishing communities or NGOs.

Since 1947, the fisheries laws have allowed provision for the implementation of closed fishing seasons and restrictions on gears, classified as destructive but to date has failed so far to recognize the concept of fish sanctuaries areas as a conservation approach; an important management tool in both floodplain fisheries and open water rivers and canals in riverine Bangladesh (Rick *et at 2007).*

Another policy observation is that there is a dearth adequate law to restrict the use of exotic fish species in aquaculture in Bangladesh. However, the current fisheries policy (1998), does state that the *`import or distribution and sale of any exotic, fish and fry will be restricted without prior permission of the government'.* It also proposes that *`appropriate studies shall be undertaken to assess the impact of the introduction of exotic fish on our native species and the environment. Only those exotic, fish exhibiting positive results will be promoted.for culture'.* Neither of these articles seems to be constraining the use of exotic fish species in aquaculture; the

plethora of exotic fish species freely available around the country, being testament to this. The current fisheries policy appears to support the development of floodplain aquaculture through several articles including ; `***Integrated*** *rice cum fish* ***culture shall be extended through the*** *release offish and shrimp fry in* ***the beels, haors and other*** *floodplains, especially* ***in the areas encircled*** *by dams in flood* ***control and irrigation projects'.***

The DOF Action Plan proposes a precautionary approach to the promotion of floodplain aquaculture to be followed immediately, by an in-depth study, to better understand the biological, social and economic aspects of the activity. The Action Plan then moves on to express the `need(s) for regulations to manage developments on floodplains and for the preservation of biodiversity'. The need for developing appropriate plans for floodplain management through Upazila Fisheries Committees is also stressed.

The Fisheries Sub-Sector Road Map for Implementation of PRSP Policy Recommendations 2006 - 2015, proposes the zoning of aquatic resource use; areas for pond aquaculture; areas for open water fisheries; and areas suitable for floodplain aquaculture, be conducted at local, watershed, and national levels. Having reviewed the PRSP Strategic Goals for the fisheries sector, the Road Map Drafting Committee interpreted the objectives for the fisheries sub-sector as follows; *`Improving nutritional standards of the poor through ensuring adequate fish supplies for domestic consumption; and raising the income levels of poor fishers and farmers through increased productivity and shares of value added'.* The Road Map drafting Committee also highlighted flood plain aquaculture as an approach to promote in areas where it was socially and environmentally appropriate, within the framework of pro-poor development; and called for *the regulation of floodplain aquaculture development; through the maintenance of large systems with significant fisheries, as open systems, and the use of smaller enclosed areas through participation of the poor (men and women)'.*

2.3 Historical review of Daudkandi Model

Comilla District is a densely populated area with a density of 1487 people per km2 compared to the national average of 1026/km2 (BBS, 2010). A study of Daudkandi, Muradnagar, Debidwar and Burichang Upazilas of Comilla, commissioned by BWDB in 1994 found that marginal farmers formed a large majority 61.7% (owning 59.6% of the land), with just under 30% of households being classified as landless. The study reported that only 0.3% of the population, (1,457 people), were involved in fishing at that time.

Due to its low-lying nature, the District had long been recognized as a food deficit area. In the lowest lying areas, the long seasonal inundation prevents many farmers from growing more than one crop (boro rice or some winter crops). In the] 994 BWDB study, 22.3% of land was being used for single rice cropping, 58.9% for double rice cropping and 19.1% for triple rice cropping. Despite the evenness of the topography. there are enough differences in land elevation to allow for some crop diversification away from the typical `fallow, fallow, boro' cropping pattern that predominates in the lowest areas. In slightly higher, (max water depth I m) areas an Aman crop can also be produced, and in the highest (max water depth 0.3m), areas, Aus, Aman and Boro sequential cropping is possibl e. Irrigation coverage, through DTW, STW and LLP was around 42% of the cultivated area. In recent years there has been a general reduction of profitability in paddy cultivation due to increased input costs and environmental factors, such as drought or flooding. Nitrogen and Sulphur deficiencies in the soil have been identified as constraints to crop yields may be related to higher fertilizer price in the market.

Under-employment was common and seasonal out-migration, occurred to urban areas, (in Dhaka and Chittagong), during the wet season. September to November was recognized as famine months, when great hardship was experienced by farming households. In 1992, the area was transformed through the construction of a 45.5 km long embankment that protected an area of about 327 km2, (including Daudkandi Upazila) from flash flooding from the Gumti River, and allowed more consistent crop production and settlements to become established.

Following the construction of polder, land for grazing was seen as a major constraint to livestock development, with rice straw as the main feed for cattle. Goat raising had long been popular in the area and chickens and goats were kept by around 80% of households. Aquaculture, including some hatcheries and nurseries, did exist in the area at that time but was largely confined to private pond fish production. Despite the protection offered by the embankment, regular flooding from rainfall inside the polder, or flowing into the area through culverts, caused regular water logging problems for agriculture. In addition, growing reduction of profitability in paddy cultivation due to increased input cost and occasional environmental disaster like drought or over-rain, the well-off landowner families also had to starve and face famine situation during the months of September to November every year. Therefore, the option of seasonal aquaculture in private lands that is kept fallow and inundated has been considered by the community farmers.

The possibility of utilizing seasonally flooded private lands for aquaculture had been first considered by a group of landowners in Dhanuakhola Adarsha Matshya Prakalpa, Charipara in 1987. It is understood that their first attempts were unsuccessful. However, after the Gumti embankment had been constructed, others were encouraged to try. In 1996, there were a number of new attempts to establish floodplain aquaculture, in the Daudkandi area but without NGO support; a mechanism of issuing shares to landholders; and a formal way of conducting fund transactions through local banks, these were also unsuccessful. However, in 1996, the Pankowri Fisheries Project was created and this was to become the first floodplain aquaculture project where a co-operative partnership involving local landowners forming a Board of Directors keeping UP Chairman as Managing Director and Executive Director from an NGO was to prove successful.

In this Project, the NGO SHISUK has been involved since its inception and still holds a 5% share in the venture. Production and profitability has increased over the years and records for 2010 show fish production to be around 420 metric tons. Dividends are being paid out to shareholders on a regular basis and the value of

shares has increased many folds. SHISUK have always believed that projects such as Pankowri must have a transparent and accountable management system and have spent considerable effort on building a strong Board of Directors and agreeing bylaws. The Pankowri Board of Directors is also claimed to play an arbitration role in helping resolve social conflicts, which has led to a more harmonious community. From 1997, the project was registered as a company, under the Joint Stock Company Act. For its outstanding contribution in organizing community based aquaculture in the floodplain area, SHISUK was awarded the National Gold Medal in 1999.

2.4 Conceptual Development of the Cooperative Approach

SHISUK have been working in the floodplain area of Daudkandi to demonstrate a different approach that intertwines various aspects of resource management for sustainability and community development. Instead of `target group approach' such as landless or hardcore poor, SHISUK has been working with the total community under a cooperative approach to create a favorable environment for good governance and sustainable development of the community. The main principle of this approach is that no part of the community should be isolated during development, which results in social discrimination within the community. Every community member should live with dignity and should be facilitated to overcome her/his problems. Self-reliant development actions under cooperative system to make proper utilization of community resources involving the total community has successfully been demonstrated the above principle through real participation and empowerment of the community. SHISUK has been rendering technical support for resource management as well as institutional capacity building for the community through forming of organizations, facilitating decision-making process and helping record keeping and accounts management to make the community efficient and ultimately to take over the total management and successfully run the program.

The community acceptance was triggered basically due to the built-in mechanism developed in the approach to manage such big area in the floodplain ensuring

community participation. Multi-ownership of ponds has long been a serious problem in pond aquaculture in Bangladesh. Whereas, hundreds of landowners from different villages aggregated successfully under the Self-reliant Community Initiatives in Floodplain Aquaculture projects.

Moreover, the widespread profitability of aquaculture venture piloted in neighboring floodplain areas helped to influence people to motivate in self-replicating the enterprises. It is interesting to mention that people in the area is already aware about the merit of pond aquaculture and acquired good expertise on intensive pond operation. Because there are large number of ponds already existing in Daudkandi and Muradnagar Upazila which is more than double compared to both the average pond size and number per Upazila elsewhere in the country. The total number of ponds in Daudkandi 5520 covering an area 1239 ha while in Muradnagar total number of pond is 6578 with an area of 1597 ha (Respective Upazila Fisheries Office, DOF, 2010). Due to the low-laying nature of land here, every household required to dig a pond to elevate homestead and plinth area during constructing the houses.

2.5 Operational Principles of Cooperative Floodplain Aquaculture

The basic operational principles of the SHISUK approach are understood by this study as follows:

l **Community engagement** - without targeting any specific target group like 'poor' or `women', the model emphasizes the engagement of the total community associated with natural resources such as floodplains, thereby bringing the whole community into the development process. They facilitate proper utilization of community resources involving the wider community that offer opportunities for direct participation and ownership and thereby empower the community.

2 Commercial approach - investment of individual capital in the form of share of a productive agri-business. The principle is that the investment should be

commercially viable where mobilization of capital from the community is encouraged and does not emphasize dependence on credit or any project aid.

3 **Formation of a representative executive body** - the model facilitates the formation of a well representative executive body of `Board of Directors' through choosing eligible leaders from the community. This Board of Directors is in effect the community-based organization that runs the enterprise, after NGO support is withdrawn.

4 **Establishment of Good governance - the model premises an enabling environment for good governance to run the business. Strict control is imposed and considerable** effort **expended to maintain transparency and accountability in financial transactions**. The practice of participatory **decision-making is encouraged** strongly from **the beginning** of the **initiative and allows 'the right to information'** for everybody.

5 **Institutional partnership with** NGO - This institutional partnership not only covers certain portion of financial investment from the NGO but also ensures the capacity building aspects of the entrepreneurship. The NGO stands to benefit from the profits made by the enterprise, or to share the loss, in the event of no profit being made. Involvement of NGO helps bring in regular R&D ideas to each enterprise and helps create linkages with other external organizations.

2.6 Development Steps of cooperative floodplain aquaculture project

The steps in the floodplain **aquaculture** approach adopted by SHISUK, are presented by them, as follows:

1. Self-**reliant sustainable community development** through application of scientific, technical and local knowledge aiming to develop community as well as local resources e.g. land, water, growth center etc.

2. **Facilitating people's own strength** and support initiatives that come from people themselves towards the opportunity to work on their own development without much patronization from the outside.

3. **Accumulation of capital** through floating of shares for subsequent investment jointly in resource development enterprises e.g. aquaculture project, irrigated rice farming and so on.

4. NGO-**Community partnership**: NGO (SHISUK) contributes 15%-20% of the capital through share subscription and become community partner involving directly in the community development activities and enjoy equal share of loss or profit.

5. Equity **provision**: No one is allowed to buy more than 1% of total share allowing room for everybody and prevent rich men to grab more shares. 10% shares are kept reserve for the landless and fishers from the surrounding community.

6. Institutionalization: The community based executive body is registered under Company Act as public limited company by shares. The company operates by a 'Board of Directors' where at least two Directors must come from women. The Board met every month and prepares reports of activities for every shareholder through AGM.

7. **Transparency and Accountability**: Standard book keeping and open to all systems are followed where NGO helps Board members in record keeping, prepare accounts, and provide training on transparent transactions through Bank. All financial transactions are made through Banks. NGO and CBO operate accounts by joint signature.

8. **Linkage and coordination**: NGO and CBO links with Local government bodies/political leaders/government agencies and potential donors to accumulate funds for infrastructure development and technical supports.

9. Capacity **building trainings for the community** are provided from the NGO. The trainings include community leadership; record keeping, organic farming, 1PM, aquaculture, biodiversity conservation, tree plantation and gardening etc.

10. Formation of women groups, initiate savings, providing them training on Income Generating Activities (IGA), human rights, basic health education and means of empowerment.

11. Sustainability: NGO do not think `plugging off rather than trying to roll over in adjacent areas, while graduated CBOs are encouraged to recruit own staffs locally to fit in from the community budget and to become self-reliant.

CHAPTER 3
REPLICATION OF THE MODEL

3.1 Replication of the cooperative model

The success story of the Pankowri Project spread rapidly in the surrounding areas and field survey suggest that by 2004 more than 90 similar projects had been replicated in Daudkandi, Muradnagar, Chandina, Titas and Meghna Upazilas (See Table 2 & Figure 2). It was understood from the previous discussions that the option of seasonal aquaculture in lands that was kept fallow and inundated was well considered by the community farmers. The community acceptance was triggered basically due to the built-in mechanism developed in the cooperative approach to manage such big area in the floodplain ensuring community participation.

Growing reduction of profitability in paddy cultivation due to increased input cost and occasional environmental disaster like drought or over-rain causing crop damage encouraged the land owners to unite and form cooperative association. It can be mentioned that multi-ownership of ponds has long been a serious problem in pond aquaculture in Bangladesh. Whereas, hundreds of landowners form different villages aggregated successfully under the self-reliant cooperative initiatives in Floodplain Aquaculture projects. Since 2004, there appears to have been a slowing down in the spread of the replication and the creation of new projects (See Figure I).

Table 2: Features of Cooperative Floodplain Aquaculture Projects **under** six Upazilas of Comilla district

SL No.	Name of Upazila	Total No. of **Projects**	Total area covered (ha)	Average Farm Size(a)
1.	**Daudkandi**	48	1961.7	40.9
2.	**Muradnagar**	22	166T8	75.8
3.	Titas	13	254.4	19.6
	Homna	06	598.8	99.8
5.	Chandina	02	93.7	46.9
6.	Meghna	01	20.2	20.2
	Total	92	4596.6	50.0

This may be a result of the flash floods and project losses in the year 2004, deterring people from adopting the approach, or that some sort of physical, economic or social barrier to its further spread has been reached. Perhaps the best sites have already been taken around Daudkandi Upazila. Table 2 shows that the average size of the floodplain aquaculture projects was about 50 ha while the Muradnagar farms were found bigger in size and in Titas Upazila smaller sized projects were established. As a whole, about 44% floodplain farms were below 20 ha in size while more than 30% farms are above 50 ha (Table 3). It was understood that bigger sized farms are more cost-effective and community based while the smaller ones tend to be individually owned or under corporate ownership.

Figure 2: Development of Cooperative Floodplain Aquaculture Projects **around** Daudkandi and adjacent Upazilas **under** Comilla district

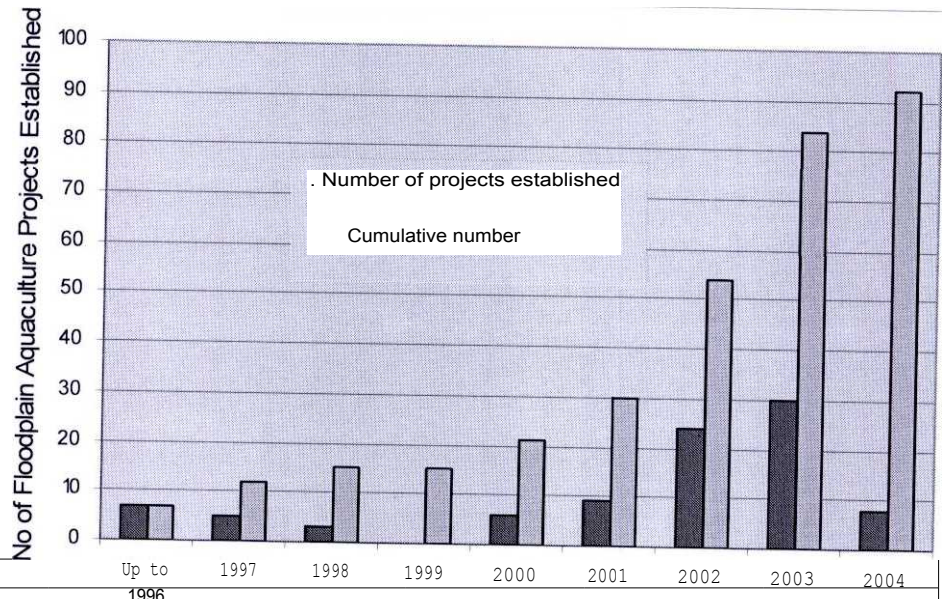


Table 3: **Distribution of Floodplain Aquaculture Projects as per farm size categories under Comilla district**

	Daudkandi		Muradnagar		Titas		flomna		All	
Size in ha	no		no.	%	no	%	no.	%	no.	
Upt010	10	21	0	0	6	46	1	17 !	17	19
10.1- 20	14	29	5	23	2	15	1	17	22	25
20.11-150	9	19	7	32	5	38	2	33	23	26
50.1-100	10	21	3	14	0	0	0	0	13	15
>100	5	10	7	32	0	0	2	33	14	16
Total	48	100	22	100	13	100	6	100	89	100

3.2 Process of community mobilization during replications

The success of any floodplain aquaculture project easily trickled down in neighboring areas replicating the model and generated a community mobilization process. In most cases the initial mobilization took place under very few number of experienced community leaders already involved or had some connections in neighboring projects. For a new project, such leaders have to express their judgments on the feasibility of the proposed projects in front of meetings comprising landowners and other stakeholders. If such feasibility description is convincing and acceptable to the wider section of the community, the process involves in the formation of extended `Implementation Committee' keeping two-three dynamic persons at key positions. This committee starts the next steps of activities formally and proceeds more analytically to find out the strengths and weaknesses both from technical and socio-political point of considerations.

Following the formation of Implementation Committee, several motivation meetings required organizing village wise or even family wise if such motivation appears crucial. Sometimes community meetings are arranged in public places inviting the stakeholders through open miking. Initial estimates and planning for establishing the project are also chalked out simultaneously because such information helps to motivate and convince the community. At the stage when majority of the landowners come under consensus, the formation of `Board of Directors' or `Management Committees' takes place.

3.3 Self replication verses controlled replication

There were marked differences in community mobilization process in self-replicated projects and projects under controlled replication by NGO SHISUK. Initial constitution of Implementation committees supposed to help much to make social balance and minimize internal politics among villages. Special concessions like offering undue shares (so called VIP share), paying of additional financial compensation or sometime buying of pieces of land falling inside a project from unmanageable landowners with premium price have been considered in many cases. Important part of the community mobilization takes place at the time of fund collection. Floating of shares and invitation of subscription either in prescribed

forms or informally just registering names are arranged. Doubt and mistrusts were reported in case of self-replications where personal collection of funds takes place. Slow pace in fund collection, misuse of funds and even total defalcation of capital by a single person also recorded during the field work. Weak leadership and less transparent transactions have been reported in case of many self-replicated projects.

On the other hand, in all cases of second generation cooperative projects, SHISUK claimed to follow all of its development stages very carefully. Smooth and quick subscriptions have taken place in case of SHISUK supported projects when share money was deposited to the Bank Account and over subscription by the extended community took place. Experienced NGO workers organize more frequent the committee meetings and discuss problems intimately in clear and transparent manner when solution becomes easy. Once the community can choose right system for operation and put right persons to keep the system to be followed very carefully, the mobilization of community and resources appeared comparatively simple and straight forward in case of controlled replications. But non-compliance or negligence of the operational principles resulted inequity and elite capture of some self-replicated projects and had to abandon operations for 7 - 8 projects known so far around Daudkandi area. The following table summarizes the marked difference in terms of community benefits, capacity building and governance among the projects under self-replication and controlled replication.

Table 4: Marked differences between self-replication and controlled replication of cooperative floodplain aquaculture projects

Criteria	Projects of controlled replication	Projects of self replication
►. Scope of community participation		
1.1 Community mobilization	NGO initiates community mobilizations, promote program to educate community to follow social rules	No such provision exist but community leaders/Local Government representatives tend mobilize the community occasionally
1.2 Limit of individual investment to ensure equity	System to keep equity, no one is allowed to invest more than 01 % of total share under a single venture	No such limit for individual investm cnt
1.3 Formation of representative `Board of Directors' (BD) or **Management** Committee (MC)	7-11 member Board of Directors taking representatives from command areas/villages	Provision variable
1.4 Preference to the	Strict provision	Provision exist but not

Criteria	Projects of controlled replication	Projects of self-replication
local people in		practiced strictly
investment and		
employment		
1.5 Poor & Landless	Provision to keep 10% share reserved	Generally not reserved but
participation	for poor/fishers/landless	certain amount of shares were
		given to the landless in few
		cases
1.6 Women	Strict provision to keep 20% positions in	No such provision
participation in BD	the BD reserved for women	
1.7 Women group	Women groups are formed & group	No such provision
formation & savings	savings and interest free loan for group	
scheme	members facilitated	
1.8 Income	Income generating training for women	No such provision
generating activities		
for women		
1.9 Capacity building	Training and awareness program to	No such provision
for women on human	develop knowledge, skill & attitudes	
rights, health and		
gender		
2. Fund management		
2.1 Stimulus	15-20% investment by NGO stimulates	Stimulus investment done by
investment	community investment during initial	elites and thus tend to occupy
	stage	key position in BD/MC
2.2 Sharing of profit	NGO shares both profit and loss and	No such provision of
& loss	builds true partnership	partnership
2.3 Daily transaction	Strict provision of 'Bank check	No such provision exist
	transaction' in case of amount exceeding	
	faka 5000	
2.4 Bank signatory	Three signatories, one must from NGO	Provision of joint signature but
		flexibility in compliance
2.5 Emergency loan	NGO provides interest free loan in case	Emergency loan taken from
	of emergency	money lenders with high
		interest
3. Capacity building		
3.1 Record keeping	Standard formats are developed by NGO	Crude system followed, no
	and used for record keeping	standard formats used
3.2 Accountability	Strong M&F, system through Board of	No M&E was found, weak
	Directors and NGO	accountability
3.3 Regular audit	Regular internal audit by NGO and	Regular audit either absent or
	occasional External Audit by CA Farm	weak
3.4 Training/I{RD	Regular training organized by	No such training organized
	DOF/NGO	(Training needs felt strongly)
4. Institutionalization process		
4.1 Written 'Articles	Written Article of Association exist	Not found
of Association'		
4.2 Holding of	NGO facilitates to hold regular monthly	No provision but occasional
monthly meetings &	meeting & AGM	meetings are organized to meet
AGM to ensure		crisis
transparency		
4.3 Project office	Organized project offices established	Project office exist in most
	and community access encouraged	cases but community access is
		variable
5. Technical aspects		
5.1 Technological	Technical backstopping provided	Receives ad-hock support from
support	regularly by DOF and NGO	DOF as per request
5.2 Biodiversity	Strong motivation and infrastructure	Such motivation and support
conservation	support provided from DOF/NGO	absent

Criteria	Projects of controlled re plication	Projects of self-re plication
5.3 Integrated Pest Management (IPM)	1PM training provided through Farmers Field Schools and 1PM Clubs supported by DAE/NGO	No such provision known

3.4 The Second **Generation initiatives** of SHISUK

Following the success of Pankowri, SHISUK expanded its program and developed partnerships with six other floodplain projects in Daudkandi during 2003 - 2006. In these new projects, SHISUK has attempted to develop a more inclusive community approach to floodplain aquaculture and started experimenting different ways to achieve greater equity for the poor and significant involvement from women. This included becoming a partner of the Community Based Fisheries Management Project Phase 2 (CBFM 2) of the DOF where World Fish Centre had been rendering technical assistance in terms of community management, biodiversity conservation and sustainability of CBO.

Table 5: Salient features of the S1HISU **K supported cooperative flood plain project at Daudkandi area**

Description	Pankowri	Baranagar	Chargram	I, KS	Khirai	Proshanto	Shanto	Total
Area (ha)	85	38.9	98.4	54.7	63.16	157.89	103.24	601.29
No of village	7	2	4	3:	4	7	5	32
Total household	1120	430	958	856	779	900	813	5856
Land owning household	395	294	334	225	250	725	650	1498
Total number of share	2000	1830	3411	1800	1410	5700	2700	18851
Paid up capital	200	183	341.1	180	141	570	270	1885.1
Total no. of shareholders	387	295	612	247	245	730	655	3171
No. of Shares for Landless	0	84	150	67	100	285	35	821
SHISUK Share	100	341	601	367	300	1055	700	3664
SHISUK Investment (in lac Taka)	10	34.1	60.1	36.7	30	105.5	70	346.4

Meanwhile, the Pankowri project continues to develop, now guided mainly by their Board of Directors (BD) having SHISUK as Chairman, BD and salaried staffs recruited locally by the project. SHISUK has withdrawn its salaried staffs to new projects playing a less active role for Pankowri. The project is aiming to intensify production and maximize profit through a vertical integration of its activities.

Since 2005, SHISUK has developed a Training Center at Daudkandi and has been providing training on their floodplain aquaculture approach to DOF officials and other NGO workers. SHISUK have 6 new projects except Pankowri running in Daudkandi area (Table 5) and trying to streamline in implementing the model to avoid `failed replicator' due to elite capture and farmer conflict. It is important to mention that SHISUK has been kept the Chairman position in the Board of Directors in all of its replicated projects to be able to exert required institutional support. The leverage lies behind buying of 10 - 20 % of shares at the beginning by the NGO to meet the initial cost of capital investment. Out of six new generation projects, five proved to be successful in terms of financial cost and benefit. The sixth project Shanto yet tries to be at breakeven point after three years of operation in 2010.

3.5 Mainstreaming of the approach by SHISUK

Apart from Daudkandi area, SHISUK is also promoting their approach in other parts of the country including Chalan Bee] area, Netrokona haor area and in a number of coastal polder areas where water logging is being considered as problem. SHISUK also sees great potential for floodplain aquaculture in the extremely poor *Monga* area of Gaibandha and Kurigram districts in the northwest. Interested DOF extension officials comprising District Fisheries Officer, Upazila Fisheries Officers, Farm Managers and Extension Officers from different districts were invited for a day-long training-cum-orientation program at its Training Centre situated at Illiotgonj, Daudkandi. Such orientation program for DOF/NGO extension officials at field level in the floodplain area and the visual interactions between the operators and stakeholders allowed eye opening learning for many participants attending the training.

One of the Senior Upazila Fisheries Officers once attending such orientation program at Daudkandi imitated the model in his working area at Avoynagar, Jessore and successfully implemented at least six cooperative floodplain aquaculture projects around the water logged beels in those areas (Md. Akter Hossain, Senior Upazila Fisheries Officer, Avoynagar, Jessore, personal communication).

Water logging has long been a serious problem for the dwellers around Avoynagar and Monirampur Upazila of Jessore district and Tala and Kolaroa Upazila of Satkhira district where people have long been struggling against water logging. Application of this self-reliant cooperative idea through construction of common embankment and bring the land under aquaculture during monsoon and rice cultivation during dry period reversed the curse in to blessing for a number of cases. Terrible water logging for the dwellers of Beel Dakatia had long been an issue of failure in water management by the BWDB, but now one can go and see the whole area under good aquaculture (golda and finfish) integrated with agriculture i.e. rice cultivation an example of community initiatives to get relief from big natural problem.

To its credit, SHISUK continues to modify its approaches, using Pankowri as `its laboratory' while aiming to mainstream the approach. Aware of some of their limitations, they have invited BARC, DOF and WFC to h elp them carry out research on a number of socio-economic, management and technical aspects of the floodplain aquaculture model. It is believed that the model can easily trigger the community initiative for a market led development where structural feasibility and leadership co-exist. Presence of an NGO or extension agents from the public sector can bring the synergy to happen the development interactions effectively in the field.

The DOF seems now fully committed to the approach and already implemented a Government project from 2006-2011, working for a total 63 flood plain projects in Comilla District where 39 projects were in Daudkandi. SHISUK was assigned for training a total of 9,000 beneficiary farmers regarding the technical and social

aspects of the model. It was learnt that more than 62% of the total funds was spent on earthworks and other infrastructure executed by LGED.

CHAPTER 4
THE ECONOMIC IMPACT

4.1 General **Economic Impact**

The general economic impacts of these community enterprises seen around the areas are quite remarkable from other floodplain areas without cooperative aquaculture. There have been huge amount of private investments from the community during the establishment of each project. PPRC study done in 2005 estimated total amount of paid-up capital in 26 floodplain projects was about Taka 57 million while the estimated total annual transactions for operation of 92 projects having an area of about 4597 ha would exceed Taka 270 million. In 2009, an amount of Taka 10.06 million has been paid among 2500 shareholders from six floodplain projects (except Shanto) under SHISUK.

There is no doubt that a new resource system is created through the process of land enclosure and that the cooperative floodplain aquaculture projects are contributing significantly to local economies. Fish production in terms of unit area has increased more than double over the last decade. The creation and maintenance of the embankments has created work opportunities and promoted the rapid expansion and movement of people and goods. The local economy can now employ more people and out-migration has been reduced. Incomes earned from aquaculture projects have boosted the local economy through both backward and forward linkages (PPRC, 2005, Rahman *et al* 2005, Kazi and Rick 2008).

The local economy therefore gains from both the direct benefits of the projects (increased production, profits, incomes etc.) and from the indirect benefits that are transmitted through backward and forward linkages. In the vicinity of many big floodplain projects including the Pankowri Project, several growth centres, featuring a range of small shops, restaurants and outlets of businesses has sprung up, where previously there was nothing. This is a clear visual example of the direct effect of the project on the local economy.

4.2 Major benefits of the projects

The main source of direct benefits has been the increase in total production and through the increase in incomes of the actors directly and indirectly related to the projects.

4.2.1. Fish Production and profit gains

The production and profit figures from SHISUK projects have been impressive (Table 6), although detailed information is only available for the past two years i.e. 2008 and 2009. In 2009, the seven SHISUK projects produced about 1168 tonnes of fish from about 601 ha, an average fish production of 1.942 tonnes/ha. It is estimated by SHISUK that around 5,000 ha are now under floodplain aquaculture and if a more modest average production of 1.5 tonnes/ha is used, this suggests that around 7,500 tonnes of fish are now produced annually from an area that traditionally produced around 750 tonnes through conventional capture fisheries. This floodplain aquaculture production would have a value of around Taka 817 million (11.6m US$) taking the wholesale price of average Taka 70 per kg received at farm gate in 2009.

Figure 3: **Fish harvest are landed and are being weighed in presence** SHISUK representative **in in Khirai** project

Table 6: **Production, profits and dividends** in SHISUK **supported cooperative floodplain** projects 2008 and 2009

Parameter	**Pankowri**	Baranagar	Chargram	Khirai	LKS	Proshanto	Shanto
Area (ha)	85	38.9	98.4	54.7	63.16	157.89	103.24
Total production '08 (kg)	210769	65063	148969	169668;	112502;	169651	123781
Total production 09 (kg)	331170	56320:	155030	177000	116460	206190	125780
Unit production `08 (kg/ha)	2480	1673:	1514;	3102.	1781	1074	1199
Unit production '09 (kg/ha)	3896	1448:	1576;	3236;	1844,	1306	1218
% change in production	0.57	-0.13	0.04	0.04	0.04	0.22	0.02
Net profit (Tk.) 2008	7500000	1049282 3	16573	31884496753871-7168246]			394604
Net profit (Tk.) 2009	6603498	1083289	2499679;	5551310	600591;	3283010	1180563
% change in net profit	-0.12	0.03	-0.21	0.74	-0.91	1.46	2.75
Dividend 2008	1000	300	400`	1000	500	0	0
Dividend 2009	1000	500;	500	2000	500	200	0
% change in dividend	0	0.67	0.25,	1.	0	0	0

Source: Md Kamruz ***aman****, Office- in-Charge, Regional Office-cum-Training Centre, SHISUK, llliotgonj, Daudkandi.*

In Table 6 it can be seen from the first five projects, that only Khirai project made maximum 74% net profit in 2009, compared to 2008 and paid 200% dividend. While having highest unit production of 3896 kg/ha, Pankowri incurred negative net profit compared to the previous year though maintained 100% dividend for the shareholders like the previous years. In terms of production, all of SHISUK projects had increased production except Baranagar, which is a flood prone project. The share owners in Baranagar received a dividend of Taka 500 in 2009 in spite of less unit production than previous year. As new comers from 2007, both Proshanto and Shanto made significant increase in terms of unit production and for the first time Proshanto were able to pay Taka 200 dividend for the shareholders in 2009. It is important to note that it requires couple of years to reach at the breakeven point for the floodplain project given the huge capital investment needed for infrastructure development in the first year.

4.2.2 Rice farmers benefit

The rice farmers **under** cooperative floodplain aquaculture projects are happy now because of flood control embankment can protect his crop from flash floods. For late flood and slow recede of water, the cooperative projects can use LLP to drain water for timely seed bed preparation and plantation of *boro* rice. In most cases

irrigation and drainage facilities are built-in with the aquaculture package or otherwise a system is in place where the same management looks after the irrigation and water management matter in better ways than a place without aquaculture project. Land owners are benefited from higher productivity and it is claimed that output in agricultural land has increased by 15-20%. On the other hand input costs have declined by 25-35% because no cleaning and ploughing is necessary, no pesticides are used, irrigation is provided to the members at a lower cost, and lower fertiliser doses are required due to the residual impact of manure and feed use in aquaculture. Due to aquaculture activities the land remain clean, fertile and without any grass compared to non-project floodplain land thereby the farmer get benefit to grow rice comparatively in less production cost.

4.2.3 Shareholders benefit

The fish production obtained from the floodplain aquaculture projects around Daudkandi area became encouraging for the landowners and farmers to have the income coming additionally from their lands within 4-6 months period usually left fallow during pre-project situation. The benefit of increased rice/crop production goes individually to the landowners or sharecroppers. But profits of aquaculture are passed on to the members of the project in the form of dividends and land rent. The distribution of net profits from aquaculture amongst the members of SHISUK projects are given below:

(i) 50% of **profit as dividends to the owner of project shares**

(ii) 27% of profit **as land rent to the owners of land inside the project**

(iii) 20% of profit **is kept as reserve** (**for investment in the following year and contingencies)**

(iv) 3% is spent on social welfare (**donation to mosques, temples, and poor household** for their **emergency** family **need like treatment**, **daughter marriage etc.)**

2.2.4 Benefit for land owners

There are two types of land rent. Land rent on cultivable land in the project is determined by the amount of profit. Normally it becomes equal to the amount of dividend paid per share for per *Kani* (30 decimal) of land. In 2009, a total of Taka 10,065,500 was distributed as dividend among the 16151 shareholders from six cooperative floodplain projects controlled by SHISUK. It was also reported that the land owners were given equivalent land rent per *Kani* similar to the dividend paid per share. The calculation shows that 4100 *Kani* of land fall under six projects provided average Taka *2455/Kani* for the aquaculture use of the land over a 6 month time.

Case study 1: Benefit to a Marginal Farmer

Ali Ahmad (40) is a marginal farmer from Charipara village having 181 decimal (0.7 ha) of cultivable land distributed in six floodplain projects. Before the start of projects since 1998. he had difficulties with the income from the small amount of mono-cropped land and hence had to operate a small side business on paddy husking to maintain his five member family. His lands were taken inside aquaculture projects and he was given 17 primary shares from six projects paying a face value of Taka 1000 for each share. Since then he started to receive more or less Taka 20000 extra per year against land rent and dividend from the projects. The paddy production increased about 10-15% along with 30-35% decrease in fertilizer cost. 65-70% decrease in land preparation cast and 100% reduction in pesticide cost. He received IPM training and stopped using pesticide in paddy since last three years. Following the good returns both from aquaculture and paddy, Mr. Ahmed became motivated in aquaculture and turned to start pond aquaculture in two leased ponds as side business instead of previous paddy husking. Ali Ahmad thus became a good fish farmer and bought three milking cows for rearing. Since 1999, he has been able to buy about one acre of land with a cost of Taka 300000. He also upgraded his house spending another Taka 50000 and connected to electricity with a cost of Taka 2000. His kids are going to KG school, can afford good dresses and better food. Like many others Mr. Ali Ahmed now a happy farmer and dream more prosperous life and provide better education for his children.

Land rent act as safeguard for landholders if he failed to gain his share for any reason at the time of initial investment. It is double benefit for who was able to buy his allocated share and now getting both dividend and land rent depending on the

profit of the project. During the dry season, it is the liberty of landowners to cultivate his land at his own or can share crop to others.

But land rent on ditches inside the project is fixed at the beginning of the project based on rental value of the ditches in the past three years prior to the beginning of the project. This part of the rental income is therefore independent of project performance and has to be paid on an annual basis. In most cases the fixed land rent for ditches are Taka 200/dec i.e. Taka *6000/Kani.*

4.2.5 Benefit for new Fishers Group

Evolution of new fishers groups has taken **place in case** of many projects where there were no professional fishermen before. It is estimated that about 60-70% of the active fishers currently engaged in aquaculture projects are from non-fisher group. It is claimed that this recruitment of non-fishers **in greater** number has reduced original fishers' income from fish harvesting. The argument made by professional fishers is that the non-fishers often can adopt diversified livelihoods other than fishing and therefore, tend to bargain less for their wage. Among other options, the fishers often engage both in open water fishing and pond fishing during non-fishing **season** in aquaculture projects. Some of them were engaged in fingerling **nurseries** where regular netting is needed for thinning and shifting of fingerlings form one pond to another.

There are fishers who buy fish from their harvest from projects and sell them in retail markets around other areas. Selling fish is often well remunerated and can fetch better earning than fishing. But growing competition in fish auction by big auctioneers and direct selling to distant fish markets by project management tends to limit this opportunity for small-scale fishing-cum-trading. Nevertheless, the income opportunity for the fishing community has been more expanded and protected in and around the floodplain project area compared to non-project area.

Table 7 shows the number of fishing teams involved in harvesting and the income they have earned in 2006 (Rick *et al* 2007). Fishing is done on two contractual terms. When fishing is done through tender, each fishing team earns 3-4% of the

stocked fish and 30-35% of natural fish. When fishing is organised by the project, the fishing teams gets Tk. 1-1.5 per kilogram of fish harvested and on top of it they get 30-35% of non-stocked small fish. Total income accruing to a fishing team is divided into individual shares (each fisher receiving one share). In many cases, the team contribute equally for boat and net and distribute the income equally. In case of loose team where the team leader owns net and boat, the owner of fishing net gets two shares, one for net and one for him and the owner of a boat gets one share extra for the boat.

Table 7: Fishers **income and distribution pattern from cooperative floodplain aquaculture projects in Doudkandi**

Description	Baranagar	Chargram	Khirai	LKS
No. of fishing teams	2	4	4	3
Team size	15	49	44	38
Number of days fished	97	150	232	105
Income (Tk.)	152,471	278.607	868,142	237.689
Income per team (Tk.)	76.236	69,652	217,036	79,230

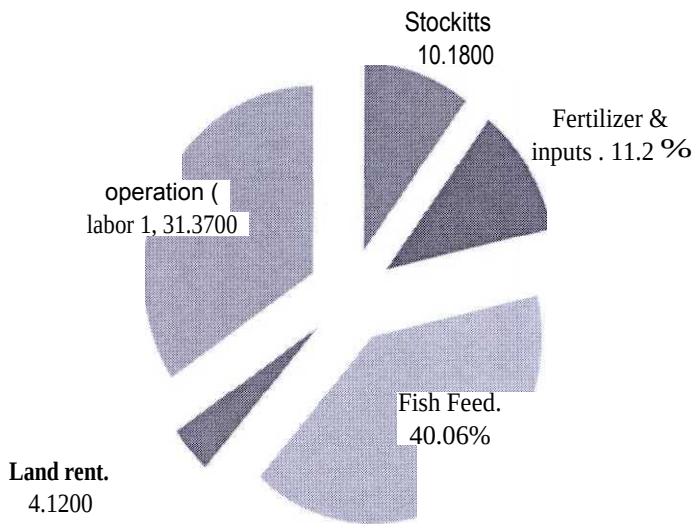
4.2.6 Employment **benefit**

Lion shares of the investments went for earthwork to make flood control embankments around the projects. The earthwork generates sizable amount of non-recurring employment while every project require 8-10 part-time labors for repair, maintenance and guarding for about 6 month time every year of project operation. Besides, one paid Accountant and one Manager for full time was seen in most of the projects employed for round the year. From the sample survey it was found that on average 129 man-days/ha employment was created during initial stage of project establishment while the average recurring employment was about 94 man-days/ha, out of which 21 man-days for repair and maintenances, and 73 man-days for project operations including security, harvesting and marketing. For example the information of recurring costs incurred by the four projects (i.e. excluding Pankowri) is provided in Table 7. It should be noted that the majority of expenses are for production costs, (e.g. fingerlings, feeds etc.) and about 35% of total costs goes for operation including payment to labour, guards, transport, harvesting etc. (Table 8 and Figure 3).

Table 8: Typical **structure of input costs from sample project under** SHISI; K

Cost break up	Cost in Taka	Cost/ha (Taka)	% of total
Fingerling Stocking	564418	6363	10.18
Fertilizer & other inputs	625300	7050	11.27
Fish Feed	2222018	25051	40.06
Land rent	228500	2576	4.12
Operation (mainly labor)	1906205	21490	34.37
't'otal cost	5546441	62530	100

Figure 4: Typical **cost break ups for a floodplain aquaculture project at Daudkandi**



4.2.7 Benefit **from structural change by construction of embankment**

The cooperative floodplain projects made significant structural changes around the landscape protecting low-lying lands from flood inundations and allowing better production and income. This embankment giving protection for the impounded land for aquaculture during flood season (June - October) and allowing the same land for rice farming during winter (November - February). This sporadic development contributed significant structural changes along with huge private investment in the low-lying landscape of the area.

As the floodplain area has lower land elevation, it become flooded regularly depending on the water level in the adjacent rivers. To convert a piece of floodplain area into aquaculture project, it requires encircling the area by

constructing good embankment and sluice gates. Such construction of common infrastructure happens to be very expensive in low-lying areas and often impossible from the community.

But in case of the floodplain aquaculture projects, it appeared huge amount of investments were made possible from the community organizations amounting up to taka 1.8 million for a single project. Most of the projects had to invest big amount of money for infrastructure development during the inception year. Once these investments are possible to make, managing the working capital for the following years becomes easy for the community.

Construction of long dykes to encircle floodplain materialized the dream of easy communications for the villagers who long been dependents on boat for day to day movement from one place to another during the wet season. It is reported that

Case study 2: Community Participation in Development of Infrastructure

A three km long embankment starting from the village Bashora to Illiotgonj Bazaar was constructed by the community to protect three floodplain projects namely Chargram, Khirai and LKS under Illiotgonj (south) union of Daudkandi. A total of about 220 ha of floodplain area under three projects were possible to bring under aquaculture when about 3 km long, 45 feet wide 10 feet height with 12 feet top width dyke was constructed under the initiatives of local community. An amount of Taka 2.8 million was spent from the three projects over a period of about three months when an estimated amount of 28,215 man-days of employment was created for earthwork. About 300-350 day-labours from the surrounding village were engaged for about three month period to complete the earthwork. To accommodate space for the embankment a total of 26 *kani (kani* = 30 decimal) land from 45 land owners were rented permanently !a. Taka 200/dec/year. Apart from protecting the aquaculture projects, the embankment is being used as road communication for people form over 6600 households of II adjacent villages. One culvert was also constructed on a flowing canal along the embankment not to create drainage congestion. Local LGED sanctioned a budget of Taka 520,000 for the construction work. Community negotiated with both the contractor and supervising Engineer to bring little change in design to fit the culvert for aquaculture purpose. Additional cost of Taka 120,000 was provided to the contractor from the community fund to change design for fixing of small-mesh iron screen across the vents to prevent escape of stocked fish.

Community allowed their own lands for constructing dykes and digging earth voluntarily in most of the cases. On the contrary, in some cases, special concessions including offering special share, higher land rent or sometimes purchasing the piece of land at higher price were considered during the construction of dykes and sluice gates to establish some projects. Such construction of dykes-cum-roads were generally well accepted by the dwellers living in far places who now can come easily through these roads/dykes otherwise they had to use boat or walk through mud during the rainy season. Increased schooling of children from the distant villages, easy movement of goods and services has been recorded after establishing community projects learned from the stakeholders.

Women mobility has increased particularly in the area and more women are now coming to the Upazila Headquarter, Health center, Banks, NGO offices and so on. Apart from constructing dykes, there were good number sluice gates and culverts also constructed by the community initiatives to mitigate any traffic disruption for incoming flood water and drainage congestion during over-rain. The sluice gates constructed by the community are also devised to allow entry of natural fish fauna from the open water habitat during the flushing period.

In fact embankment construction for floodplain aquaculture constitutes a large part of labour absorption in the local economy. PPRC study (Rahman et al. 2005) has found that 26 floodplain aquaculture projects created an employment of 129 man days per hectare during embankment construction while recurrent employment in maintaining the embankments was 94 man days per hectare.

4.2.8 Benefit from Shares - new financial instrument for rural development

The main and unique characteristic feature of floodplain aquaculture is capital finance through floating of shares. Two main points are considered initially for floating shares: (i) the size of the project and (ii) the number of landholders belonging to the project area. The aim is to make sure of community participation and raising the adequate fund for capital investment. For self-replicated projects, there is no hard and fast rules share distribution. But for SHISUK projects, it was

agreed at early stages of community mobilization that NGO will be given 15-20% share and 5% will be kept reserved for the landless. The rest will be distributed proportionately based on the amount of landownership. Again, there is a ceiling set beforehand that no landowner can have more than 01% of total share to avoid skewed distribution.

These shares act as an important financial instrument and are bought and sold or even used as collateral for borrowing from the informal credit market. This increases the creditworthiness of the small shareholders. The price of each share during initial capital subscription was Tk. 1000 each. Pankowri shares are reported to cost about Tk. 5,000 in 2007 (Rick *et al* 2007). Similarly, share price have been appreciated many folds for all of SHISUK projects, especially for Khirai project, which was reported to reach at Tk. 6,500 per share in 2010.

4.3 Forward and Backward Linkages

The entire activities of floodplain aquaculture in and around Daudkandi area have created dynamic changes clearly visible in the locality. The study found so many new activities created linking both backward and forward linkages of floodplain aquaculture **in the area**. To run about hundreds of cooperative projects under floodplain aquaculture, there were over 90 fish hatcheries established in Comilla district. To stock about 5000 ha floodplain with adequate number of fingerlings, it requires thousands of nurseries to grow fish fingerlings at stockable size.

Apart from huge earth work at the beginning absorbing local labour force, the aquaculture projects require several other agents to accomplish different activities listed in Table 9. As per estimates made that about 7500 tons of fish are produced annually from about 5000 ha area under floodplain project. For their quick growth it requires at least 1.5 times of fish feed to grow 7,500 tons of fish (1.5 **ton feed x 7500 ton fish**), **meaning a rough consumption** of 11250 **tons of fish feed per flood season. Good number of outlets is opened across the Daudkandi areas from notable fish feed companies.**

It is easily understandable how much effort would require growing such huge amount of fish, their harvesting, handling and finally marketing of fragile and

perishable product up to the dispersed consumer level maintaining its minimum quality. The visual linkages during the study are listed in the Table 9 and it is sure there remain many other elements of forward and backward linkages if the whole production cycle can be studied. It is clear, however, that the total number of stakeholders is substantial benefiting both downstream and upstream and they are scattered across a wider geographic area.

Table 9: **Agents associated with the project through backward and forward linkages.**

Backward linkages	**Forward linkages**
1 Fish f l atchery ope rators 2 Fingerling nursery operators	1 Ice plant ope rators 2 Ice supplier / middlemen
3 Fingerling traders	3 Ice carriers (transport)
4 Fi sh feed mil l ers 5 Fish feed dealers and sellers	4 Fish Aratder 5 Fish auctioneers
6 Lime traders	6 Middlemen in fish Arats
7 Fertilizers dealers 8 Transport truck / trolley owners	7 New Fishers 8 Permanent labors and guards for projects
9 B amboo made fencing makers	9 Per manent em ploy ees for p rojects
10 Bamboo made fencing sellers	10 Seasonal labors and guards for projects
11 Rickshaw / Van owners	11 Seasonal employees for projects
12 Rickshaw/ Van puller	12 Dry fish producers
13 Cow dung /Poultry litter suppliers	13 Fishing boat and net owners
	14 Transport truck / trolley owners
	15 Bamboo made fish basket makers
	16 Bamboo made fish basket sellers
	17 Ric kshaw / Van o wners
— — —	18 Rickshaw / Van puller

For example of Pankowri project, which has been in creasingly integrating its activities vertically, they have their own truck that carries the harvest to distant markets in Sylhet, Chittagong or Comilla. On the other hand the projects keep over wintering fingerlings for stocking in the following season, thereby reducing the need to purchase from outside.

The importance of these agents in floodplain aquaculture can be understood well from Table 8 where the cost structure of the four SI-IISUK projects is presented. As high as 65% of total cost involves what has been termed as production costs. The major component of production costs arc fish feed which is 40%, followed by cost of fertilizers and fingerlings, comprising 11% and 10% of total cost. The operation costs which mainly include labour costs comprising both casual and permanent workers constituting 34% of the total cost. To grow these bulk amount of fish

ranging from 1.5 tons to about 4 tons per ha in marketable size within only six month from flooded rice field, it requires intensive care like guarding, feeding and fertilization, implying more dominant backward linkages than the forward linkages.

CHAPTER 5
THE LIVELIHOOD IMPACT OF FLOODPLAIN AQUACULTURE

To better understand the livelihoods impact of the projects PRA at village level were conducted. The two villages studied were Khillalpar under the Khirai Project and Minardia under the Baranagar Project. The study also used household level information as provided by SHISUK. Some information such as land holding and occupation was also collected on the members of Board of Directors. Thus the study had to combine both qualitative and quantitative methods to understand livelihoods impact of cooperative floodplain aquaculture projects at Daudkandi.

5.1 Livelihoods strategies in rural area

As in other parts of rural Bangladesh, it was found that the poor as well as the rich pursue a diverse range of livelihoods. Generally for an agricultural labourer he will involve in farming through sharecropped or leasing in land on top of selling labour for other landlords or in earth works. Other poor find suitable non-farm activities like small business, tea stall, restaurants, mobile vending shops and pulling rickshaw or van transporting goods and services in rural areas. From the richer household group, a typical combination of livelihoods would be farming and business or service. Amongst the richer household groups, there are some international migrants as well as those who work in the service sector in the urban areas.

The participants in the village level PRA were asked to identify the poor, middle and rich income groups and the livelihoods pursued by each of these groups. The participants preferred to do the classification mainly on the basis of landownership. Then they identified the livelihoods pursued by the households in each group and afterwards they also identified the livelihoods that benefited most from the projects within each group of households.

In Khillalpar the poor benefited from earth work, fishing, and to some extent from rickshaw pulling and large extent from agricultural labouring. Labour contractors

are also poor and organize labour for fishing and earthwork benefited from the low income category. The middle income groups comprising small landholders, petty businesses, owners of few cattle heads and undertake some farming activities. From the rich households those who have land benefited most followed by those involved in fish culture and fish trading fall also under middle income group.

In Minardia the poor benefited from fish harvesting and labouring in the project including earthwork, guarding, feeding, and weed cleaning and so on. Landowners and fish traders from the middle income group also benefited from the project. The relatively larger landowners and households associated with business also benefited from the project from amongst the rich income group.

5.2 Distribution of benefits, inequality and poverty

The study attempted to analyse the distribution of benefits accruing from the cooperative floodplain aquaculture projects for the households from the two villages. Village Khillalpar belongs the Khirai project which is the most profitable project in terms of profit and dividend distribution. On the other hand village Minardia belongs to a project Baranagar which has taken 4 years to declare token dividend of Taka 200 in 2006 and Taka 300 and Taka 500 in 2008 and 2009 respectively (Table 6).

It was seen that in Khillalpar, the rich constitute 15% of the households but they own 85% of the crop land, 80% of the project shares and 70% of total benefits. In Minardia, the rich consist of 13% of the households but own a half of the land, 43% of shares and 40% of total benefit.

The middle class here derived benefits from the project similar to those by the rich. The poor received some benefits. The benefits distribution is relatively un-skewed in Minardia as compared to Khillalpar. The distribution of benefits observed here suggests that stable and risk free project accruing more dividend compared to risky and unstable projects where more pro-poor employment generate through backward linkage effects of the project. The poor labour had more chance to benefit from the huge earth work and maintenance for the embankment. Thus it is

clear that the poor could benefit less from the floodplain projects when more dividends and land rent are provided from profits seen in either village.

Table 10: Livelihoods **impact from floodplain aquaculture** (PRA findings)

Khillalpar	% of HFl	% Cropland	%Share	% of Benefit
Rich	15	85	80	70
Middle	55	15	10	22
Poor	30	0	10	8
Minardia				
Rich	13	50	43	40
Middle	66	50	43	40
Poor	21	0	15	20

5.3 Distribution pattern of project share

The research collected information on the distribution of shares amongst the project beneficiaries, the land owned by the shareholders and their occupation from SHISUK.

5.3.1 Land **and share ownership pattern**

it can be seen from Table 11 that most of the shares went to the large landowners (36%) and the landless (34%). That the landless owned 34% of the shares surprised us. Upon further investigation with the SHISUK staff it was later clarified that this group mainly involves shareowners who live with their parents and have not yet inherited land. This group can also involve cases where no landownership information was available or even VIP shares (i.e. the shares distributed amongst local influential).

Table 11: Land ownership by shareholders

Land owner categories	**% of share (all shareholders)**	**% of share (Board of Directors)**
Landless	**34**	**3**
Marginal (< 50 decimal)	**17**	**10**
Medium (between 50 and 100 decimal)	**12**	**5**
Lark (ov cr 100 deci **mal)**	**36**	**82**

If we look at the shareholders from amongst the members of the Board of Directors we see that the large landowners own 82% of the shares owned by the members of the Board of Directors. Thus it is clear that the marginal and medium landowners are under-represented on the Board in terms of ownership of shares. These large landlords control the only community institution of the project - the Board of Directors.

5.3.2 Practice of good **governance**

The study found all of six second generation projects have held elections on regular intervals for the positions on the Board of Directors, except the Pankowri. The Pankowri Project has passed 10 years of its life span already without any election of the Board of Directors. The reason for holding no election they said there was a court case against the Board of Directors. There is reason to doubt that it is a clear case of elite capture of the Board of Directors and lack of transparency and accountability in the project institution although having better and steady performances. In case of self-replicated projects, lack of good governance and elite capture has been reported by previous studies (PPRC, 2005; Rahman *et al* 2005; Rick *et al* 2007)

Huge transactions by different sub-committees, (e.g. tendering, marketing) formed by the Board of Directors would therefore have a good interest to be included in the Board of Directors from the elite group. In almost all village transects undertaken by the researcher received allegations of corruption by the Board of Directors mostly in case of self-replicated projects mentioned by the respondents.

5.3.3 Distribution of Shares

Looking at the distribution of shares as presented in Table 12 we can see that almost 3/4 of the shareowners own between 1-5 shares. About 1% of the share owners own more than 20 shares - i.e. the upper limit of the shares that can be owned by an individual.

Table 12: Distribution of shares

Share groups	% of shareholders	% share (Board of Directors)
1-5 shares	74.05	14.89
6-10 shares	14.64	23.40
I 1-15 shares	7.23	34.04
16-20 shares	3.27	17.02
21-25 shares	0.52	4.26
more than 25 shares	0.29	6.38

If we look at the share ownership pattern of the members of the Board of Directors we see that more than a third of them own between 11-15 shares, about a quarter own between 6-10 shares. What is interesting is that more than 10% of them exceeded the 20 share ceiling. The study by CIRDAP (2002) on the Pankowri Project found similar results. In the CIRDAP study found about 9% of the shareholders owned more than 20 shares. Thus the equalizing effect of the 1% cap on the number of shares an individual can own is not functional.

5.3.4 Sustainability of the benefits

The above discussion is based on actual distribution of the shares at the beginning of the projects. But shares change hands - there is a secondary market for shares at the village level. The actual distribution of shares cannot be easily known. In this context it is difficult to know whether a land-poor household **can retain** shares over time. The study found **cases** where shares have been used as collateral in the informal credit market. Until and unless the loan is paid back, the benefits of the share go to the informal lender. However, the research could not ascertain how widespread these types of transactions **are in** the project villages.

Some of the previous researchers raised question about the ability of the landless to retain their shares even if they are able to gain ownership over them. Since share transactions are done in the informal capital market and transactions are not recorded, it is very difficult to assess and identify the major buyers and sellers of shares. In a well-performing project (where the share appreciates in value and dividends are high and regular), one would expect a tendency for the rich to attempt to buy shares from the poor. This is one dimension of inequality within a

class of landowners - between the small and marginal land owners on the one side and the large landowners on the other. Thus sustainability of the benefits depends not only on the profitability of the project but also on the ability of the small shareholders to hold on to their shares over time.

5.4. Social safety nets and community networking

It is clear that social safety nets and community networks have increased as an impact of the floodplain aquaculture projects. The local level leaders of the projects meet with each other in project offices and share and exchange information on various aspects of rural life. The mobile phones keep on ringing as they talk! The construction of the embankments increased mobility of the people during the wet season and hence increased social interactions. Most projects have funds for community expenditures that help rebuilding social safety nets and strengthen community relationships.

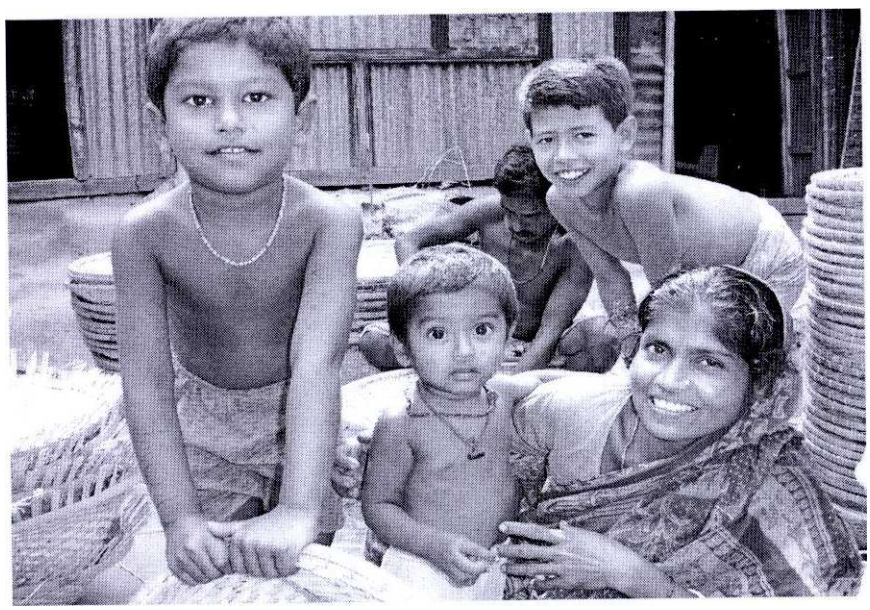
5.4.1. Law and order situation and conflict resolution

There is considerable evidence to suggest that the law and order situation has improved as a consequence of the projects. Poor people now find work in the project, at non-traditional labour times of the year, and therefore refrain from becoming involved in criminal activities. Conflicts are also said to have decreased and resolved out of the court through participation of local level institutions, individuals and in some case of Pankowri; the Board of Directors. Solaiman (2007) reports that floodplain aquaculture projects increase the level of interaction between neighbouring villages, and have a wide, positive benefit.

5.5 Women's involvement in the Projects

Based on interviews with women and women groups associated with the project, it seems that women are not directly involved in the floodplain aquaculture operation. They do not participate in embankment work, nor other types of labor associated with the fish production. But they are deliberately put on the Board of Directors in the case of SHISUK supported projects. The latest SHISUK projects have 2 women on the Board of Directors but it appeared that in most cases these women are not able to voice their opinions or ideas strongly in the Board Meetings.

Figure 5: A Happy **family of a female group member who took loan from their CBO founded** by SHISUK for **bamboo-basket making.**



However, women are involved in small scale fish drying and fish trap making, at a number of the projects. As a complementary activity, SHISUK have organized a number of women groups in each of the project sites. These women are involved in a range of activities, including, poultry raising, livestock, vegetable gardening, fruit selling, tailoring, goat raising, Due to these efforts, a close integration of the floodplain aquaculture and women's group activities is possible. Many of the women investing their husband's and male relative are earnings from the fish production, into the group's savings scheme.

The women interviewed generally agree that household fish consumption is similar to or has increased since the Project began. `Before, the project, eating big fish was a dream' was quoted by one member of the Chargram Group. However, they also admitted that they still prefer the small indigenous wild fish. These species are known to be more nutritious than the larger cultured fish, are more tasty and easier to divide up fairly within the family.

Overall, the Chargram women were impressive and it was clear that they felt liberated through their involvement with SHISUK and the Projects. They reported

that they used to be confined to the homestead but now felt more useful and respected due to their economic contributions.

5.6 Negative impacts perceived

Floodplain aquaculture in Daudkandi has created a new resource system but some critics tend to indicate that it has replaced a common property resource (CPR), the floodplains into a private property inaccessible to th e common people. It has therefore created a new set of rights - some old rights are lost and some new ones gained. In other words there are losers and gainers. During this study, several concerns were raised by the people to whom we talked. Most of these concerns were verified and supported by members of SHISUK that we met in Daudkandi.

5.6.1 Loss in fishing rights

In some project villages there were no professional fishers. But in most villages, the poor and sometimes people from other social classes were previously involved in subsistence fishing and some of them also sold fish in the market. The wild and small fishes were a major source of animal protein for the poor and the landless. But now, these poor households including the fishers were found fishing using mosquito net and harvesting eggs, larvae, juveniles from the floodplain, outside of project area, without considering the consequence of mass killing of eggs and larvae. Because they have the rights to fish from water for their survival and there is none to refrain from this practice. The rhetoric acts to conserve fisheries resource not practiced in the field.

5.6.2 Problem in raising ducks

Raising ducks has become more difficult now because their main feed (aquatic snails during the recession period) have been lost through aquaculture. Snails are a major source of food for stocked Black Carp and Common Carp and as a result the availability of snails has been reducing in traditional duck foraging areas.

5.6.3 Water hyacinth

Water hyacinth is increasingly becoming scarce as it is now increasingly used by the project to protect the embankments from the wave effects of floodplain waters.

This wave effect may be more significant now as higher water levels are being maintained. Many households in the project villages used water hyacinth for raising livestock. Livestock raising is also affected by the declining grazing ground. As a consequence people are investing less in livestock in the project villages.

5.6.4 Jute Retting

The retting of jute is incompatible with the fish culture and as a result no longer takes place in the floodplain areas. At Baronager, cultured fish mortality has been blamed on this activity. Farmers who wish to ret jute must do it in sites outside of the project areas, thereby increasing costs and adding pressure to wild fish stocks.

5.6.5 Loss of straw used as fuel

Some households reported loss through the termination of broadcast Aman cultivation in the wet season, now made impossible due to the raised water levels. Although it had a lower yield that HYV boro and can only be grown in some parts of the floodplain, people used the long rice straw collected from these Aman fields as fuel. This source of cheaper fuel is another casualty of floodplain aquaculture.

5.6.6 Loss of cultivable land due to the embankment

The creation of the embankments has resulted in the loss of cultivable land. As high as 10% of cultivable land is reported to have been lost, (although the practice of raising existing embankments rather than creating new ones does minimise this effect to an extent). In addition, an increase in the excavation fish ponds has also shrunk the size of available land for crop cultivation.

CHAPTER 6
THE ENVIRONMENTAL IMPACT OF FLOODPLAIN AQUACULTURE

6.1. The Effects on Biodiversity

There is no clear evidence that floodplain aquaculture is increasing pressures on the natural floodplain fisheries. Rather the poldering of areas retaining water flows from the rivers along with eggs and larvae of many fish migrating onto the floodplain project and getting better protection inside the embankment. Those who argue privatization of the flooded area increase fishing pressure in areas outside of floodplain aquaculture areas. To refute this argument the answer should be to see the fish production figure from DOF where it is clearly shown that production has been increasing from culture based floodplain areas over the last decade (Table 1).

An analysis based on the fish production records from the 5 SHISUK projects, was carried out in an attempt to assess the effect of the floodplain aquaculture projects on biodiversity and the environment. The data show that in all five cases, naturally occurring fish form an important part of the overall fish production. This was found to be between 2.7 - 14.6 % in the 2005 and 2006 data. The wild fish proportion in Boranager Project was more than 80% during the flood affected year of 2005. As would be expected, naturally occurring fish production appears to be inversely proportional to the overall fish production; i.e. the higher the overall fish production, the lower the proportion of wild fish in the catch.

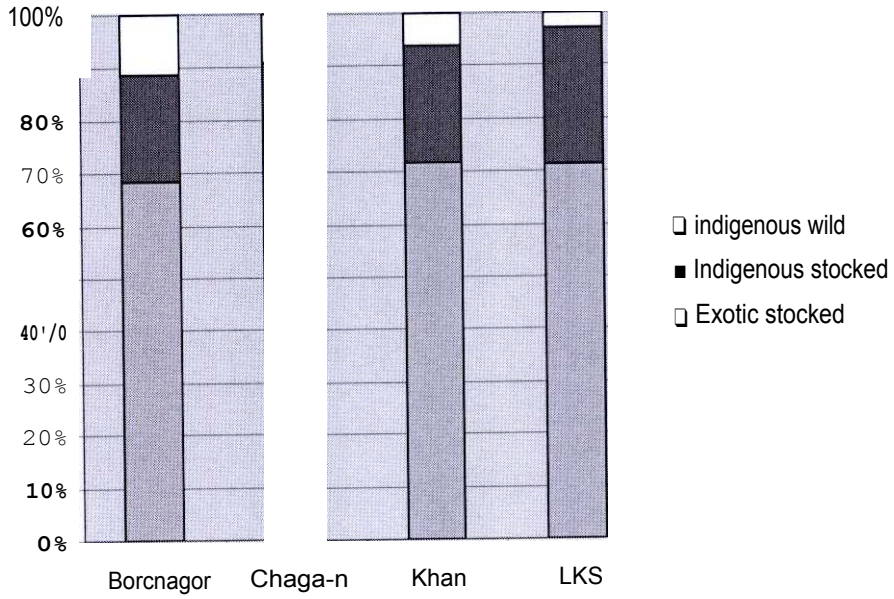
Production of wild fish ranged from 71 - 351 kg/ha. This was generally higher than found in open floodplains and is certainly due to the positive effect of feed and fertilizers on the wild fish populations as well as the restriction on harvesting larvae or juvenile.

Ten indigenous fish species are commonly found in wild fish **harvests from floodplain aquaculture in Daudkandi**. **These are Shol,** ***(Channa striatus),*** Taki, ***(Channa punctatus),*** Mola, *(Amblypharyngodon* ***mola),*** **Tengra** *(****Mystus vittatus),*** **Koi,** ***(Anabas testudineus*** *.),* **Shing**, *(****Heteropneeustes*** *fossilis),* Foli, *(Notopterus*

notopterus) Puti, (Puntius spp), Boal, *(Wallago altu),* Bairn *(Mastacembelus armatus),* and Gura, *(Leiocassis rania).* Small shrimp are also an important contributor in some projects. Managers interviewed at the Pankowri Project thought that the wild fish catch numbered between 25-30 fish species.

A significant part of the catch is from indigenous fish species, stocked as fingerlings. This ranged from 20.7 - 26 % of the total catch, in all five projects studied. A total of seven indigenous fish species are stocked in the projects, with most projects stocking at least six. However, the bulk of the fish production is from exotic fish species. This ranged from 68% - 71%, (a very narrow band) in the four projects where disaggregated information was available.

Figure 6: **Sample composition of fish species stocked in floodplain aquaculture projects in Daudkandi area**



A total of 9 exotic fish species are commonly used in the floodplain aquaculture projects. These, and their potential risk to indigenous species and the environment are listed below.

Table 13: Exotic **fish species and associated environmental risk**

Species: Common name	**Risk level**	**Threat to biodiversity and the environment**
Silver Carp	Low	Probably not able to form feral populations
Big I lead	Low	Probably not able to form feral populations
		Able to form feral populations.
Common Carp	Medium	Can cause deterioration in water quality
		Probably able to form feral populations.
Silver Barb	Medium	Hybridisation with native Puntius spp. Likely
		Unlikely to form significant populations in floodplain areas where
Tilapia	Medium	Snakehead exist. More likely in closed water bodies
		Probably not able to form feral populations.
Black Carp	Low	Negative effect on freshwater mollusk populations
Pachu	Medium	No information on possibility of feral populations.
Pangasius	Medium	Risk of escapees hybridizing with native river Pan gas.
		Probably not able to form feral populations.
Grass Carp	Low	Negative effect on macrophytes.

6.2. Environmental claims by Floodplain Aquaculture projects

SHISUK and a number of other authors claim that floodplain aquaculture has a beneficial effect on biodiversity and the environment through a number of ways. These are now presented and their validity, discussed.

6.2.1. Building awareness amongst local people of the importance of protecting naturally occurring fish, for conservation of biodiversity

This does appear to have taken place to some extent with farmers observed, deliberately conserving some fish species in perennial water bodies within both SHISUK Project and imitator project floodplains. Many of the farmers appear to be following IPM principles in their rice cultivation which often discourages the use of pesticides and other poisons. Those interviewed, explained the importance of conserving fish stocks through the *boro* cultivation period. The participation in the fish project by *boro* farmers may make IPM approaches more attractive to them.

Farmers growing vegetables along the non-project areas were still using pesticides freely and in one case were observed where fish in a small ditch had died, quite possibly as a result from the spraying pesticide on tomatoes.

The likely impact of the Projects is thought to be **positive**, in terms of raising awareness of biodiversity and conservation issues

6.2.2. Constructing sluice gates and culverts at levels and intervals that allow fry of naturally occurring fish to enter the projects

The use of large meshed screens across the sluice gates to allow the easy passage of fry, fingerlings and juveniles inside floodplain project during intake of flood water claimed not to be disturbing fish migration . The Projects observed had a number of culverts constructed at strategic locations through their main embankments, to allow for the equalization of water pressures and the movement of wild fish. For example the Pankowri project has seven culverts through the main embankment. These culverts were screened with meshes of at least '/4 "diameter, large enough to allow the entry of fish eggs, larvae and fry but larger fish will not be able to enter, (or leave) the floodplain aquaculture projects. These culverts are closed as the water begins to recede, in order to conserve water and extend the grow-out period. No passage of fish is therefore possible after that time. Despite the claims, the projects can only be having a **positive** effect on the growth and survival of stocks arrived but movement of wild fish into and out of the floodplain aquaculture projects will have a **negative** effect.

6.2.3. A **reduction in the dewatering of perennial water bodies inside the floodplain**

A number of farmers in the private floodplain projects were observed pumping perennial ponds/ditches in the floodplain in order to prepare them for fingerling nursing. In one case, the fish caught were transferred to a nearby pond for conservation purposes. These water bodies may be significant sources of recruitment within the floodplain, especially those that are perennial and in a derelict state. However, it is these that are most likely to be brought under ¡mproved management for nurseries.

The project is seen to have a generally **negative** effect on the numbers of perennial ponds dewatered in the floodplain As aquaculture intensity increases, requiring more fingerlings, this trend is expected to continue or possible accelerate.

6.2.4. The excavation of ditches as sanctuaries for fish during the dry season

Many of the projects have areas designated as wild fish sanctuary **areas. In** Pankowri, water from deep tube wells maintains the sanctuary areas, with excess water being used for boro irrigation. These sanctuaries are generally of a small size and lack cover that many of the **smaller** fish species require, if they are to avoid predation by the carnivorous fish species also present. As a result, biodiversity within each sanctuary would be expected to be very low by the end of the dry season, with 3 predatory species dominating.

The Pankowri Project has 4 sanctuary areas operating, totaling 200 decimals. This represents 0.9% of the total floodplain area. Research work carried out under CBFM, suggests a designated dry season sanctuary area of around 20 - 25% of the total floodplain area, as being close to optimum. They do also have 15 acres of nursery ponds (a further 6.8% of the total floodplain area) which may well contain a number of wild fish species.

None of the sanctuaries visited had signboards erected stating that they were sanctuaries but to be fair, this may not be that necessary as fishing within the floodplain is now carefully regulated, except in private ponds. Managers reported that the sanctuaries are self-policing and the few infringements that occur are from children and easily dealt with.

The impact of these sanctuaries on the abundance of wild fish, locally, will vary each year, based on the extent and duration of the wet season. In very wet years, the sanctuaries will have less measurable impact than in drier years, when wild fish movements are more constrained by the lack of water and recruitment onto the floodplains is delayed.

Overall, the project sanctuaries **are seen** as having **little effect** on the wild fish species diversity caught within the floodplain, except in the case of a number of

key protected species. It is thought that most of the recruitment that determines wild fish production within the floodplain projects is certainly from the outside i.e. from the perennial open water.

6.2.5. The **reintroduction and protection of rare fish species**

Stocking and rearing of local fish species already became rear or endangered in the nature and command high price in the market have been a remarkable issue in SHISUK supported projects. Chitol *(Notopterus chilala)* and Aor *(Mystus aur)* are two large sized river fish species already became rear in natural stock. But all of the five projects stocked these species and took special husbandry measures to make them breed inside floodplain projects and succeeded. Both the fish species reported to spawn inside projects.

Figure 7: SHISUK **supported projects stocked** Chitol *(Notopterus **chitala**)* **and Aor** *(Mystus **aur**)* **are being reared to breed inside floodplain projects**

It should be noted that high numbers of these predatory species within projects can only have an adverse effect on many of the other wild fish species both in terms of their abundance and diversity. In some cases, unrealistic expectations from the high stocking of these species, was noted, reflecting an ignorance of the biological principles that constrain production of these types of species. Production from the

SHISUK projects shows the relative proportions of filter feeding, omnivorous and some predatory fish species in the production models. The floodplain ecology food pyramid, does not allow for a high proportion of predatory fish species.

Moreover, the use of exotic fish species on a large scale and their inevitable escape from some impounded areas, could increase the chances of feral fish populations becoming established in the wild which would increase pressure on wild fish stocks, or the hybridization between species of the same genus, which could result in erosion of the gene pool and progeny less able to adapt to the prevailing conditions. Although the projects are on a weak footing in their use of exotic species, overall some of the projects are performing a useful role in conserving some key species, even if it is for economic rather than biodiversity reasons. In my opinion, it is this aspect of biodiversity that the projects should focus on and stress in their publicity campaigns.

6.3 Other possible effects on the environment

It may be ironic that the name that has become synonymous with floodplain aquaculture; `Pankowri' is the local name for a migratory duck species that probably depends on the natural floodplain conditions for wet season foraging. It is unlikely that the new conditions created for floodplain aquaculture are an improvement over the natural foraging areas.

Floodplain aquaculture tends to result in a reduction in floating and emergent vegetation. The pond like controlled conditions that are created through floodplain aquaculture create fewer ecological niches that can be exploited by both aquatic and terrestrial animals. A general reduction in biodiversity is therefore to be expected.

The common practice of planting trees on the polder embankments has obvious environmental benefits and should certainly be encouraged by those promoting floodplain aquaculture.

It can be expected that other animals dependent on the floodplain, including a number of birds, reptiles and mammals, may be more deliberately targeted for control now if they are considered to be predating on, or competing with the cultured fish stocks.

6.4 Non-**shareholder** / **Non-participant's perception about the flood aquaculture** projects

Apart from the discussions made above, the notion of non-shareholders and non-participants regarding the environmental impacts of cooperative floodplain aquaculture projects are not negative. Rather they are interested to enter in to the system by any means where there is no initiative has taken place yet for cooperative aquaculture in the floodplain. The over-subscription during fund raising by the neighboring dwellers of villages for the sixth and the seventh project run by NGO SHISUK is the example. In both the cases, many applications were lodged to subscribe as shareholder by the adjacent landholders those land does not fall inside of this two projects.

General people see the benefits of employment and income opportunities created by the entrepreneurs and tend to compare the trickle-down effects of profit made with the non-project areas. Missing the availability of fresh fish at the doorstep to buy noted by villagers from non-project areas of Daudkandi during the field work reminds me to evaluate the perceptions of non-participants and non-shareholders regarding the floodplain aquaculture system.

CHAPTER 7

CONCLUSIONS

7.1 Potential growth engine for rural development

There is no doubt about the high production and positive economic performance of floodplain aquaculture. The success of floodplain aquaculture is thought to be due largely to the practice of raising funds from landholders, for the construction of the main infrastructure that makes the enterprises possible. This instills a sense of ownership by the stakeholders.

Floodplain aquaculture, in its current form, may not be considered an inclusive community approach as it involves selection of shareholders from the community, based on land holding, before the project community is formed. Despite the efforts of NGOs, the direct benefits of floodplain aquaculture are usually skewed towards the richer, more influential people in the community while the trickled down benefits for the poor are also notable. The involvement of women looks superficial and unlikely to be sustainable beyond the influence of NGOs. However, floodplain aquaculture is a significant employer of local people, including the landless and marginal farmers, and is creating many service opportunities and non-farm activities for the stakeholders in economic involvement.

Floodplain aquaculture cannot be considered to be improving the general floodplain fisheries production or biodiversity, except in the cases where selected species are deliberately targeted for protection and propagation. It should be the origin of flood from where water comes to maintain the flood level and fisheries biodiversity. Perennial water bodies, not the seasonal floodplain should be considered as sanctuaries contributing recruitments for floodplain fisheries production and biodiversity conservation.

7.2 Community based approaches and Floodplain Aquaculture

The study did not find any serious conflict situations arising between traditional fisher communities and floodplain aquaculturists. This may be because of the ability of the entrepreneurships to accumulate the production factors and taking

risk generating better employment and earnings for many unemployed including the poor and fishers. On the other hand the natural harvest from the floodplain falling so small day by day, the fishers have not had to contest the same floodplain area where they could fish for their subsistence. Alternately, they found source of good opportunity forming new groups taking even non-fishers from the villages to harvest and market the fish produced in floodplain aquaculture projects.

The areas targeted for floodplain aquaculture are of those private lands that do not flood to a great depth and are most easily controlled through embankment work. Therefore, those who are against spread of this approach (Kazi et al 2008), 1 want to refute their ideas. It is the landowners' prerogatives to decide how better he could utilize his precious resources for his livelihoods without affecting others right. However, if the approach continues to spread, and the potential floodplain lands are modified, then instead of conflict situations apprehended over resource use, will turn into competitive situation who can start first and get benefit utilizing and managing available water both for growing fish and rice.

7. 3 Policy **recommendations**

The cooperative model of floodplain aquaculture should be replicated in seasonally water logged areas where poor and small landowners are selling land and facing compelled migration to other areas even crossing the border in case of ethnic group. Zoning for floodplain aquaculture should be based on the physical feasibility of creating viable projects considering land holding patterns into account, with areas where land holdings are small, should be prioritized. Areas where land holdings are large, should not be prioritized, as, in such areas, the benefit goes to comparatively less number of farmers.

Floodplain aquaculture and floodplain fisheries should not be used synonymously. Floodplain aquaculture could be defined seasonally shallow flooded or water logged private land that can be used both for rice and fish production to ensure food security and economic growth. On the other hand, floodplain fisheries could be defined as deep flooded area falling under *khas* land connected directly with perennial open water sources like rivers and flowing canals.

The term **floodplain fisheries should not be used to describe floodplain aquaculture**, **even though some natural fish form part of the harvest. The approach should** focus **more community based**, **a more inclusive approach to involving diverse members of the community including poor and women in the enterprise. As participation usually depends on land holding**, **this tends to exclude the landless. It is proposed that this floodplain aquaculture model be termed, 'Co-operative floodplain aquaculture', to avoid confusion.**

The popularization of floodplain aquaculture may result in *Khas* lands in some areas being utilized for this purpose. Floodplain aquaculture should be restricted to only inundate private lands. Whilst SHISUK's efforts to involve the poor as direct beneficiaries of floodplain aquaculture projects, through allocating them shares, the sustainability of this approach and the poor's ability to retain share ownership, as its value increases, is questioned. However, the considerable employment and service provision benefits that are available to the poor, should not be underestimated.

NGOs should maintain databases of the social economic status of their shareholders, including information on occupation, education, age, etc. as well as landholding in the floodplain area. To give rational benefit to the landless, NGO should have a stronger poverty focus than they actually do. Propagation of entrepreneurship under cooperative model, NGOs should therefore focus on the compliance of fundamental aspects of floodplain aquaculture development rather than attempting to include the poor directly in floodplain aquaculture.

The Ministry of Agriculture, Fisheries and Livestock, (MOFL) the Department of Fisheries has an important role to play in planning, zoning and regulating the development of floodplain aquaculture. There would seem little point in using public funds for establishing floodplain aquaculture infrastructure and management, when there are many examples of using funds accumulated from within the community, to pay for the necessary earthworks and input costs. Public fund can be used for initial zoning and technical assessment on the feasibility and for initial mobilization of community.

There should be strong monitoring and evaluation both from the NGO and public sector extension departments to check the compliance of tested and proven principles of cooperative floodplain aquaculture model seen in Daudkandi area.

References

1. Bangladesh Bureau of Statistics, 2010. Statistical Pocket Book of Bangladesh 2009.
2. Bangladesh Fisheries Policy, Ministry of Fisheries & Livestock, Government of Bangladesh. 1996
3. Bangladesh Water Development Board, (1994) Agriculture and Fisheries Development Studies for FCD-111 Project. Final Report Gumti Phase -1 Subproject. Vol 1; Main Report, Kranti Associates Ltd.
4. CIRDAP, 2002. CIRDAP Study Series 194. Community Initiative for Fisheries Development: An Evaluation of the Pankowri Fishery Project in Daudkandi, Bangladesh. Centre on Integrated Rural Development for Asia and the Pacific, ISBN 984-8104-42-5
5. Department of Fisheries (DOF). 2011. Development Project Proforma (DPP) on Community Based Floodplain Aquaculture Project, Department of Fisheries, Ministry of Fisheries and Livestock, 57p
6. **Department of Fisheries** (DOF). 2007. **Ministry of Fisheries** & Livestock, **Government of Bangladesh**. **Fisheries** Action Plans, 2007.
7. Department of Fisheries (DOF). 2007. Ministry of Fisheries & Livestock, Government of Bangladesh. Fisheries Strategy, 2007
8. Department of Fisheries (DOF). 2006. Development Project Proforma (DPP) on Infrastructure Development for Floodplain Aquaculture in Comilla district (Daudkandi Model), Department of Fisheries, Ministry of Fisheries and Livestock, 78p
9. Department of Fisheries (DOF). 1999. Fisheries Compendium published during observation of National Fish Fortnight, 1999.
10. Department of Fisheries (DOF). 2007. Project Proposal on Infrastructure Development for Floodplain Aquaculture in Comilla District, (Daiudkandi Model).

1 1. Department of Fisheries (DOF). 2010. Ministry of Fisheries & Livestock. Government of Bangladesh, Fisheries Compendium published during observation of National Fish Week, 21-27 July 2010.

12. http://en.wikipedia.orL/wiki/**Bangladesh**#Demographics **accessed on 5** February 2011.

13. ISACPA, 2007. **A Compendium of Best Practices towards Attainment of the** SAARC **Development Goals** (**SDGs**), pp 7-13.

14. Kazi All Toufique & Rick Gregory, 2008. Common waters and private lands: Distributional impacts of Floodplain Aquaculture in Bangladesh, Food Policy **Journal**, 33:6, Elsevier Ltd. pp 587-594.

15. Morshed S.M., 2005. Community Based Aquaculture in Flood Plains: Implementation Guidelines.

16. Nuruzzaman, M. and M. Maniruzzaman, 2003. Impact of shrimp industry on coastal communities, Technical paper *1. In Proc.* The Second Meeting of Bangladesh Fisheries Research Forum, 27 April 2003, Dhaka. pp 18-24.

17. PPRC, 2005. Draft Final Report, The Interface of Community Approaches and Agri Business: Insights from Floodplain Aquaculture in Daudkandi, Draft Final Report, December 2005.

18. Rahman Hossain Zillur, Md. Nuruzzaman, Syed Ziauddin Ahmed, Md. Zillur Rahman and Md. Billal Hossain, 2005. The Interface of Community Approaches and Agri-Business, Final Report for WorldFish Centre on the evaluation of Floodplain Aquaculture Model in Daudkandi.

19. Rick Gregory, Kazi Ali Toufique & Md. Nuruzzaman, 2007. Common Interest Private Gains, a Study of Cooperative Aquaculture, report prepared for the World Fish Centre, Dhaka, Bangladesh, 49p.

20. SHISUK, 2004. Strategic Planning and Implementation Guidelines on Community Based Floodplain Aquaculture, a technical training manual in Bangla published by SHISUK under joint authorship of DOF and SHISUK.

21. SHISUK, 2005. Annual **Progress Report, Mainstreaming the best Practice for Self-Reliant Sustainable Community Development Program**, **Project Number:** 342/10079, 12p.

22. SHISUK 2006. Annual Progress Report, Mainstreaming the best Practice for Self-Reliant Sustainable Community Development Program, Project Number: 342/10079, 20p.

23. Solaiman Md. 2007. Community Based Fisheries in the Floodplains, Article published in the Daily Star, 16 February 2007.