VALUE CHAIN ANALYSIS

SHRIMP, PRAWN and TILAPIA from the SOUTHERN REGION of BANGLADESH

&

FEASIBILITY ANALYSIS

BRACKISH WATER SEA-BASS in the SOUTHERN REGION in BANGLADESH

October 2012

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Executive Summary

Background and Methodology: The WorldFish Center is implementing the FtF Aquaculture Project in 20 southern districts in Bangladesh. The project is implemented under USAID's *Feed the Future* initiative in collaboration with the Government of Bangladesh. The project contributes to achieving the *'Feed the Future'* goals through four objectives: (i) dissemination of improved quality fish and shrimp seed, (ii) improving the nutrition and income status of farm households, (iii) increasing investment, employment and fish production through commercial aquaculture and (iv) policy and regulatory reform and institutional capacity building to support sustainable aquaculture growth. The project commissioned this study to gather insights into the value chains of shrimp, prawn and tilapia in the project region and the feasibility of promoting culture of brackish water sea-bass in the region. The findings and recommendations are expected to provide the foundation for the project to design its interventions for achieving its goals.

The study was conducted in 11 districts in the southern region in four steps. First, available literature was reviewed to gather details about the sub-sectors and the value chains. The secondary literature review was followed by three PACA workshops in Jessore, Barisal and Khulna and 50 in-depth interviews with key informants from the public and the private sector in the region. Based on the preliminary findings questionnaire survey was designed and conducted involving 311 respondents. The finding from the questionnaire survey was used to develop the overlays in the value chain maps and for analysis of the value added and profitability at different level of the value chain.

Findings and Recommendations on Shrimp and Prawn Value Chains: Even though production practices, factor conditions for production and input supply for the two value chains are different, the raw and processed shrimp and prawn are marketed through the same distribution channels and are reported under the generic name 'shrimp'. Distinction could not be made in trade and export data and therefore the analysis for the two value chains was combined. The scope of the analysis was limited to the black tiger shrimp *(penaeus monodon),* locally known as *bagda* and fresh water prawn *(macrobrachium rosenbergii)* as production of other species were found to be insignificant.

End market analysis reveals that there have been some shifts in the market due to the economic recession in EU and the USA. Export of shrimp in FY 2011-2012 has declined by around 12% in volume and 11% in value from FY 2010-2011. In contrast, export of prawn has sustained in the EU which indicates at a strong niche market. EU has emerged as the largest exporter of shrimp and prawn from Bangladesh while the US market has declined and shifted to Vannamei, supplied by countries like Vietnam, Thailand and India. Netherland has emerged as the gateway for export replacing Belgium. Russia, Saudia Arabia and India have emerged as new markets even though volume and value of export is still low. The market in Japan has shifted to value added shrimp products. The EU currently holds 60% share of the total export from Bangladesh.

Sustenance and growth in export of shrimp and prawn will thus depend on the capacity of Bangladesh to ensure EU compliance in production, distribution, processing and export. Since

countries like Vietnam and Thailand are concentrating more on Vannamei, Bangladesh has emerged as one of the key producer and exporter of fresh water prawn. This provides an opportunity to position prawn in the high quality-high price spectrum in consumer preference index.

Southern region contributes around 70% of the total national production of shrimp and 95% of the total national production of prawn. The region thus holds key to sustaining production and export of shrimp and prawn from Bangladesh. Large farmers (farm size 1 ha or more) dominates both the value chains in terms of production, however number of small farmers (farm size 1 ha or less) is higher in the prawn value chains. Besides, production of prawn is expanding in new districts surrounding Bagerhaat, the hub for production and marketing of prawn. Because of lack of support services for skill development and quality control, the hatcheries in the new regions failed which made the growth of prawn sluggish in new districts like Madaripur, Shariatpur.

Increasing salinity in the coastal areas of Satkhira and Khulna because of climate change has increased the potential for expansion of shrimp. However, anti-shrimp movement has gathered momentum in recent times with the high court directive on ban of forced flow of saline water into agricultural lands. Reportedly, the directive is used against shrimp production in areas which are naturally saline and are not suitable for rice cultivation. Conflicting interpretation of the verdict and hostility between the value chain actors in shrimp and the NGOs driving the anti-shrimp movement has aggravated tension and threatened production. Facilitating coordination and collaboration between DoF, NGOs working for anti-shrimp movement, BFFEA and National Shrimp Farmers' Association holds the key to resolving the conflict.

Value addition at grow-out stage for shrimp (66%) and prawn (67%) is very high. Gross profit margin (21% for shrimp and 49% for prawn) is also very high. Thus the farmers do not have much incentive to increase production by adopting improved and intensive production practices. However, production of shrimp has been hit by an unknown virus attack which has forced the farmers to reduce the production cycle and sell lower grade shrimp (g30-35) at lower market price. Besides, virus attack on PL has almost shut down most of the shrimp hatcheries in the current fiscal year which is expected to decrease production and export in the next fiscal year. Even though the threat of virus is severe, the hatcheries are found reluctant to conduct PCR test of the brood and the PL mainly because there is no premium in the market for virus free PL. The PCR labs in Cox's Bazar, Satkhira and Khulna have thus remained mostly non-operational. Promotional campaign can stimulate demand for higher priced virus-free PL and create incentive for the hatcheries to adopt appropriate practices to control virus attack.

Production of prawn has remained dependent on wild PL (WPL). Low production of hatchery produced PL or HPL (approximately 5 crores as opposed to the demand of 79 crores) and low demand arising from poor quality of HPL have restricted the market for HPL. However, the price of WPL has increased by around 200% over the last four years and reportedly the catch has declined. This provides an opportunity to reposition HPL in the market. But this would require support to build and sustain the capacity of the hatcheries to produce and market quality PL. Besides, demonstration on the quality of HPL might prove to be effective in building farmer's confidence on HPL.

Trading of shrimp and prawn is capital intensive and this has attracted several intermediaries in the value chain whose primary task is to share the capital need. Besides, government subsidy of 10% on export has attracted many processors in the value chain as opposed to the account holders who lies at the heart of the connection between the processors and other intermediaries. There are 19

account holders in the value chain serving around 149 processors, 1000 depots, 3000 beparis. Lower down the chain, there are around 2500 farias or small traders and another 500 arotdars trading directly with the farmers. Value added and gross profit margin at these levels are low but quick turn-over of rolling working capital makes the trade lucrative. However, this makes traceability a difficult process. Besides, quality of the shrimp and prawn deteriorates heavily as it is bulked and de-bulked many times over a period of around 24 hours. Also, it fosters adulteration like pushing as it is difficult to identify the actors responsible. It has been reported that the *farias* are being driven out of the market as the *depots* believe adulteration is done by the *farias.* But according to key informants some *depots* are also engaged in pushing. Building capacity of BFFEA and coordination between BFFEA and the different regional association of the traders can play a key role in policing against adulteration and ensuring traceability in the value chains.

Involvement of women is largely concentrated in informal activities like collection of Wild PL. Formal account is absent but according to different estimates more than 350,000 women are engaged in collection of wild PL in the southern coastal regions. It is also estimated that around 5000 women are engaged in intermediate processing by the farias. Involvement of women is also found in feed preparation, snail crushing and feeding. The project's interventions on policing against adulteration and promotion of HPL may have negative impact on employment of the ultra-poor women in the region if alternative income earning opportunities are not explored for them. Nonetheless, increasing production and expansion of the export market is expected to create formal jobs for the women in the value chain.

Findings and Recommendations on Tilapia Value Chain: Production, consumption and trade of Tilapia experienced a dramatic growth after the introduction of Genetically Improved Farmed Tilapia (GIFT) in 2004. Bangladesh produced approximately 110,000 MT of Tilapia in 2011. Southern region plays a key role in production of Tilapia as it can be estimated that roughly 35% of the total production of Tilapia in the country is produced in Southern region which is around 38,000 MT. A total of 4,000 farmers are cultivating Tilapia in around 10,000 hectares of land.

As Tilapia is relatively new in the region, Value Chain of Tilapia followed the fin fish value chain of the region. This sector is still driven by the strong domestic market. The produce is consumed mostly locally. Sometimes Tilapia from other region also comes to the local market as local demand is high and price is higher than other region. In the short run, demand for Tilapia is likely to be unmet which will ensure market access for the farmers who will produce Tilapia. However, in the long run there is a possibility of saturated market demand which might decrease the price as it happened for Pangus and Koi. Keeping this in mind, the region should look for the export of the Tilapia where unutilized processing plants may play an active role to penetrate in the market of Tilapia fillet. However, a lot of efforts would be needed to enter the export market which includes fundamental research on export competitiveness, establishing support industries to utilize the waste of fillet, market promotion etc. The price of Tilapia in local market is the main obstacle as it is way higher than the international market price.

The region has 30 hatcheries producing 178 million of Tilapia fry. However, this production is not adequate for the region as the demand for fry is still unmet. Consequently, hatcheries located outside southern region are entering the market with high price. Some farmers of the region use recycled fry which originate from the Tilapia they stocked earlier. There is quality and productivity concern for this practice. Factory made ready feed is widely available through the retailer and

distributor of the feed companies. Though most of the farmers are using ready feed, some farmers are still using local feeds. One of the important reasons behind that is increasing price of feeds.

Most of the farmers of the region practice poly-culture of Tilapia with other fin fishes. Productivity is found 3.34 MT per hectares which is low from the other region. These farmers also get roughly 2.5 MT of fin fishes with their Tilapia. Women are found to be engaged mainly as unpaid labour for feeding. Average farm size of the small farmers producing Tilapi was found to be 54 decimal. This reflects that Tilapia is produced in homestead small ponds where women involvement is likely to be high. Farmers usually rely on their own capital and have limited access to finance. Mainly Micro-credit NGOs are providing finance to the farmer with high interest rate whereas banks are usually reluctant to give loan to the farmers. In exceptional cases, large farmers get the loan from the banks if they have adequate property. Commercialization of nurseries, introduction of saline tolerable Tilapia, increase production of fry, improved knowledge of the farmers, export linkage can lead to the sustainable development of the sector through increasing efficiency of Value Chain.

Findings and Recommendations: Feasibility of Sea-Bass Culture in the Brackish Water in the Southern Region: The southern region of Bangladesh is favorable for both brackish and fresh water fish species. *Latescalcarifer,* commonly called the giant sea perch, sea-bass or barramundi, is an important coastal, estuarine and freshwater fish in the Indo-pacific region. Sea-bass, although quite popular in the Southern region of Bangladesh, hasn't yet been cultured commercially and has remained mostly a captured fish from sea. Favorable demand exists for sea-bass in both domestic & international market. In 2011, 502 MT (DoF, 2011) was exported and about 4562 MT (*extrapolated from primary findings*) was consumed by the domestic market.

At present, several freshwater whitefish species are cultured in the southern region of Bangladesh. These include carp (Ruhi, Katla, Silver Carp, Grass Carp, Mrigel etc.), Tilapia, Koi, Pangus and most prominently Shrimp & Prawn. Yet there is still almost 100,000 hectare of potential brackish water area left unused (BFFEA, 2012). Growth in production of white fish in the region has slowed down to 1% in FY 2009-2010 in contrast to 8% in FY 2008-2009 (DoF, 2011). The growth rate has declined because of unavailability of good quality seeds and increase in cost of production along with relatively lower price in the market. Some of the white fish farmers were found switching to commercial culture of Tilapia. This shift is also encouraged by the growing demand of Tilapia in the domestic market. Decline in growth of white fish provides an opportunity for introduction of new species such as sea-bass to increase the profitability of farmers in the southern region.

Findings from this study show that there is latent demand for sea-bass in the market. As a novelty fish, it has untapped demand as gourmet food item, especially in tourist zones like Kuakata in the southern region. Also, the profitability of sea-bass is higher in comparison to whitefish and Tilapia. Farmers who are informally culturing sea-bass have reported satisfactory return. It is estimated that approximately 2500 MT of sea-bass is traded each year in 3 major fish hubs in the southern region which are- (i) Satkhira-Khulna-Bagerhat, (ii) Madaripur-Faridpur-Magura& (iii) Patuakhali-Barisal-Borguna per year. The price of sea-bass is higher in comparison to other brackish water fish species. The farmers sell sea-bass in the local arots for TK 200-250 /Kg for smaller sized sea-bass (1kg or less) and TK 450 – 500 /Kg for larger sized sea-bass (2kg or more). In comparison, average farm gate price of Tilapia is TK 116 /Kg. ROI for sea-bass (594% for extensive culture) was also found to be much higher than that of white fish (56%) and tilapia (70%).

Besides, the south-eastern coastal region of Bangladesh has suitable ecosystem for sea-bass production since natural fries are abundant in the estuaries after breeding season. Another key factor which makes south-eastern coastal region suitable is the inland presence of mildly saline water. Comparative disadvantages include, dependence on wild fry because of unavailability of hatchery produced fry, high initial investment for commercial culture, carnivorous feeding habit of sea-bass and short-breeding season. Two regions were found to be most suitable for culture-(i) Patuakhali-Barguna-Barisal and (ii) Satkhira-Khulna-Bagerhaat. Most successful production was observed in poly-culture with shrimp.

From the analysis it is evident that sea-bass has the market prospect and the region has certain comparative advantages that can make production profitable. Project can concentrate their work in particular areas considering the site suitability like water salinity (0 - 15 ppt), soil condition (abundant clay content), availability of fry (breeding grounds), presence of non-polluted water bodies (canals, small rivers) and other favorable infrastructure facilities. Scientific culture techniques should be provided through project/DoF/BFRI/NGO staff. Support for installation of sea-bass hatchery will be essential for ensuring supply of sea-bass fry round the year. Poly-culture with tilapia, whitefish or shrimp is found to be feasible and can be demonstrated through farmers who have already started production. Promotion of monoculture of sea-bass using cage aquaculture method, as done in various other parts of the world can be trialed to measure its effectiveness in the region.

Abbreviations

ACI	-	Advanced Chemical Industries
BFRI	-	Bangladesh Fisheries Research Institute
BFFEA	-	Bangladesh Frozen Food Exporters' Association
DoF	-	Department of Fisheries
DFQF	-	Duty Free Quota Free
EU	-	European Union
FAO	-	Food and Agriculture Organization
FtF	-	Feed the Future
GIFT	-	Genetically Improved Farmed Tilapia
HPL	-	Hatchery Post Larvae
IMC	-	Integrated Marketing Communications
PL	-	Post Larvae
US	-	United States
USAID	-	United States Agency for International Development
WI	-	Winrock International
WPL	-	Wild Post Larvae

Table of Content

Chapter 1: Introduction

The WorldFish Center is an international, non-profit, non-governmental organization which works with partners to reduce poverty and hunger by developing science based solutions for expanding sustainable aquaculture, ensuring productive and resilient small scale fisheries and strengthening fishers' rights to a decent living. It works in partnership with a wide range of government and non-governmental agencies at regional, national and local levels in the developing world, and with advanced research institutions worldwide.

In collaboration with the Government of Bangladesh and USAID's *Feed the Future* initiative, the world fish center is working to meet the GOB and FtF goals to sustainably reduce poverty and hunger. The FtF Aquaculture project is one of the largest projects in Bangladesh, which is funded by USAID under its Feed the Future (FtF) goal. The project is a 5-year transformative investment in aquaculture focused on 20 southern districts in Barisal, Khulna and Dhaka divisions, Bangladesh. The project has been awarded on October 2011. The project contributes to achieving the 'Feed the Future' goals through four objectives:

- Dissemination of improved quality fish and shrimp seed
- Improving the nutrition and income status of farm households
- Increasing investment, employment and fish production through commercial aquaculture
- Policy and regulatory reform and institutional capacity building to support sustainable aquaculture growth

FtF aquaculture project is working closely with key public and private actors in hatcheries for 2012 breeding season, and will be further supplemented for 2013-14 season. Together with technical support for fish and shrimp and nursery management, this component will lay the foundations for maintaining high quality seed production into the future. The project will benefit more than 900,000 HHs though this mechanism, and is expected to generate an associated increase in fish and shrimp production by 36000 and 24000 metric tons respectively over five years.The project aims to extend impacts to a further direct 150,000 household pond owning families over the duration of the project. This outreach will be achieved through partnerships with USAID programs including the NoboJibon Multi Year Assistance Program (MYAP) implemented by Save the Children, and the Integrate Protected Area Co-management Project (IPAC) implemented through IRG.

WorldFish is focusing on introducing its income enhancing aquaculture technologies, including production of indigenous nutrient dense fish species, into these existing livelihood programs through training, demonstration and communication programs. Nutrition education and promotion of nutritionally rich and income boosting vegetables including Vitamin-A rich orange fleshed sweet potato cultivation will also be part of this component. Household incomes are expected to rise an

average of $100 per year, while improved nutrition, as indicated by number of meals containing fish per month, will double.

The project is working in commercial aquaculture in the southern region to stimulate further investment, employment and increased incomes and productivity. Within the first phase of 18 months, the project will deliver increased production to around 20,000 shrimp farmers and support 5000 entrepreneurs practicing high value commercial fish culture.To ensure long term continuity and impact of investments of USAID Feed the Future, the project will work directly with the Government of Bangladesh, particularly with the Department of Fisheries and Bangladesh Fisheries Research Institute. This will involve institutional capacity building, including expanding linkages between GOB and India, as well as private sector associations and businesses.

Set on this background, the study was commissioned by WorldFish Center with the following objectives:

- Situation Appraisal of Shrimp, Prawn, and Tilapia including commercial brackish water species sea-bass's demand, feasibility and technical knowledge to promote (includes size of the regional and national market, unmet demand, in terms of quality, in the regional and the national market etc.).

- More specifically, production and distribution systems (fish producers and their skills, cost of production and distribution, value added, intermediaries in the distribution systems and their roles in the distribution system, price at different level of the distribution systems, technology and technical knowhow, support services, rules and regulations etc.)

- Value chain wise competitiveness or the strengths, weaknesses, opportunities and threats in the production and distributions systems.

Chapter 2: Methodology

2.1 Secondary Literature Review

Literatures from different secondary sources like value chain reports, journals, government publications, newsletters on Shrimp, Prawn, Tilapia and Sea bass were studied to have a preliminary understanding on the end market, market segments and market potential of the value chains. Besides, the key informants for the value chains, different market actors, regulatory and development stakeholders were also identified through the literature review. The key-informants include stakeholders at different levels of the value chains like government officers, private sectors, researchers, NGOs, and projects who are working directly with these subsectors. A guideline for the PACA workshops and a set of checklists for key informants and different value chain actors were developed at this stage of the study. It's also guided us to identify the production clusters, major markets and hence in designing the field plan for the in-depth interviews.

2.2 In Depth Qualitative Study

The tools used for in-depth qualitative study were PACA (Participatory Appraisal of Competitive Advantage) workshops and in-depth interviews of the different value chain actors of Shrimp, Prawn and Tilapia. The purpose of the PACA workshops and the in-depth interviews were to gather facts and information on the market systems of Prawn, Shrimp and Tilapia.The workshops and the in-depth interviews helped us to develop a general idea about the existing value chainsand also to comprehend the market prospect, the constraints, the strategies to ensure sectoral growth and the potential partners for the project to some extent.

PACA Workshops (PACA) is a proven methodology for collecting qualitative information on value chains. The lead consultant along with the researchers conducted PACA workshopsin Barisal, Jessore and Khulna for each of the three value chains. The workshop participants included OfficialsfromDoF&BFRI, value chain actors of different tiers (input suppliers, farmers, traders, processors, and exporters), and development partners (include staffs from projects). The list of participants in the PACA workshops is provided in Annex 1. The workshops contributed in the development of each value chains' structure, identifying the actors, the existing channels and their strengths and weaknesses. Different aspects of value chain like comparative market advantage, service market status, business enabling environment and regulatory environment assessment was also discussed in the PACA workshops. The PACA workshops were complemented by in-depth interviews with national and regional stakeholders relevant to the value chains.

The in-depth interviews were conducted in the seven districts of the southern region of Bangladesh for the comprehensive situation analysis of the Shrimp, Prawn and Tilapia value chains. There were three teams of six consultants engaged for six days. Team 1 covered Barisal, Barguna and Pirojpur, team 2 covered Jessore and Satkhira and team 3 covered Khulna and Bagerhat districts. To assess the three value chains a set of checklists of different value chain actors was used. Around sixty

respondents of different tier of these three value chains were interviewed through snowball sampling technique. The respondents include tilapia hatcheries, shrimp & prawn hatcheries, PL traders, feed and chemical retailers, shrimp farmers, prawn farmers, tilapia farmers, faria (small traders), bepari (large traders), arotdar (commission agents), depot owners, account holders, export companies and processing plants, association leaders, ice factory owners, government fisheries officers and development projects.

2.3 Quantitative Study

Based on the findings from the in-depth assessment and PACA Workshop, a set of questionnaires for in-depth quantitative and qualitative survey were designed individually for hatcheries, input sellers, farmers, farias, arotdars, baperis and depots to capture the core issues and objectives of the report in more detailed and quantifiable terms for analysis. Most of the account holders, processors and exporters in the region were interviewed during the in-depth qualitative assessment. Therefore, we did not include these actors for the quantitative assessment.

A full day orientation session was facilitated by the research coordinator for the twelve enumerators to brief them about the objectives of the research and the method of data collection. The session included briefing on the specific objectives of the study, client description, presentation on the three value chains, introduction of the different value chain actors, detail field plan, sampling method (snowballing), team composition, and debriefing of the questionnaires and checklists, including rehearsal and mock sessions.

Three hundred and fifty samples (350) of the different value chain actors were selected based on the sampling plan that was agreed with the management of WorldFish Center before commencement of the study. Data collection was conducted with the semi-structured question guides and the prepared check lists by face to face interview method. For acquiring more information form geographically distant locations, 12 Enumerators were divided into three groups and each group covered three districts. The districts that covered by the groups were Faridpur, Madaripur, Magura, Barisal, Borguna, Patuakhali, Khulna, Bagerhat, and Satkhira. The core team directly participated in data collection to facilitate the enumerators and ensured quality of the survey.

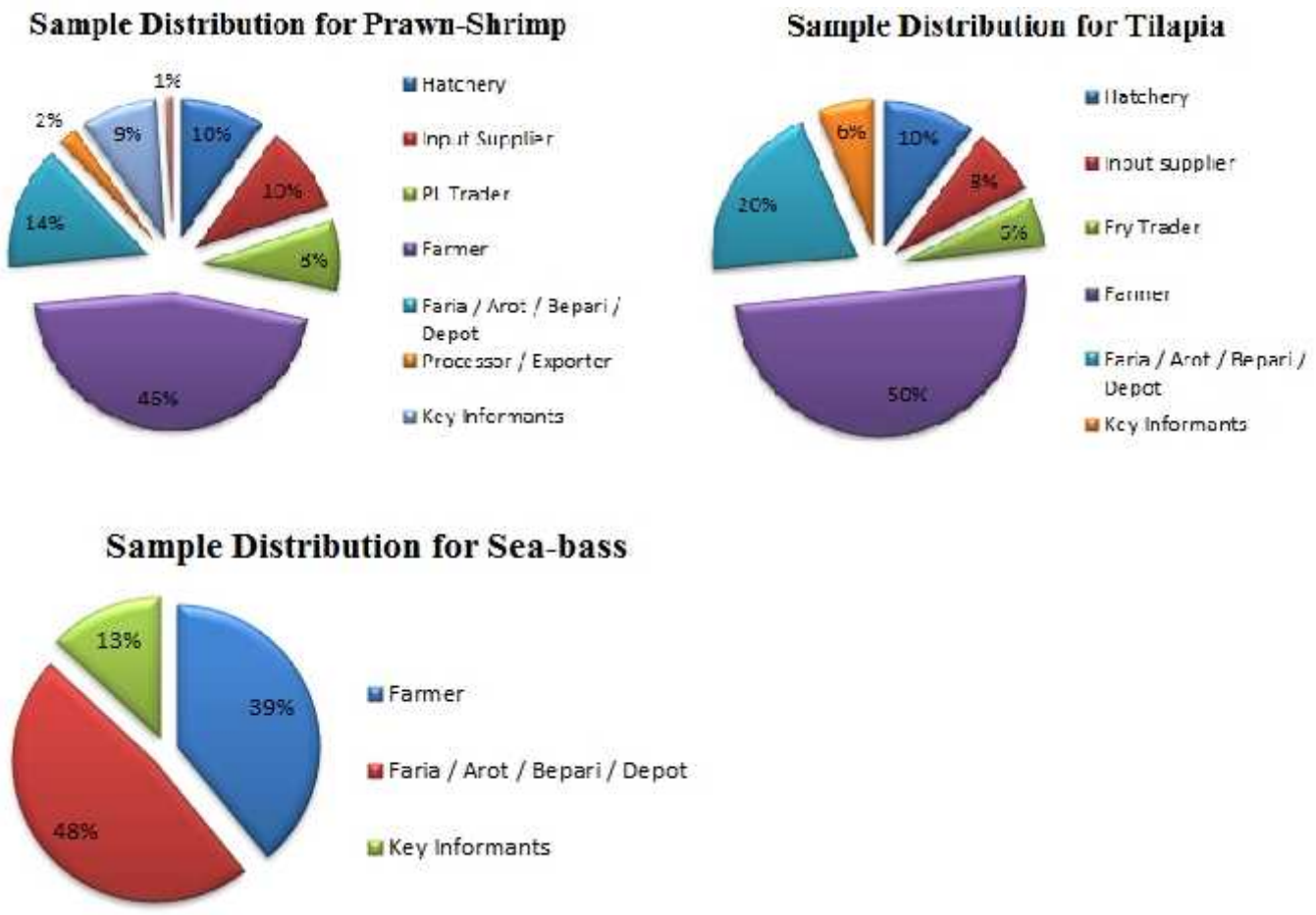
Table 2.1: Study process of Value Chain Analysis

	Step 1	***Step 2***	***Step 3***	***Step 4***	***Step 5***
Process	Literature Review	In-depth Qualitative Survey	PACA Workshop	Quantitative Survey	Data Analysis
Tools	Secondary literature, Key Informant Interview, Project documents review	Key Informant Interview, Field Survey (Semi-structured checklist)	Stakeholders Consultation	Field Survey, Key Informant Interview	Averages, tabular analysis, Extrapolation
Output	Comprehensive checklist of probable bottlenecks, In-depth	In-depth analysis of the value chain, value chain competitiveness, its constraints and	Validation of the findings from in-depth qualitative	Quantitative data on the value chain, production and marketing	Quantify finding as per report objectives

	questionnaire for preliminary assessment	market potential	survey	practices	

The respondents' distributions of the value chains of the study are summarized as below:

Figure 2.1: Value Chain wise sample distribution



2.4 Location of the Study

Eleven districts were covered in the study –Faridpur, Madaripur, Magura, Jessore, Satkhira, Khulna, Bagerhat, Pirojpur, Barisal, Patukhaliand Barguna. These eleven districts were chosen by the presence of all three value chains. Out of these 11 districts, 9 study districts and Kuakata have been surveyed for the feasibility study of sea-bass.

Chapter 3: Shrimp and Prawn Value Chain

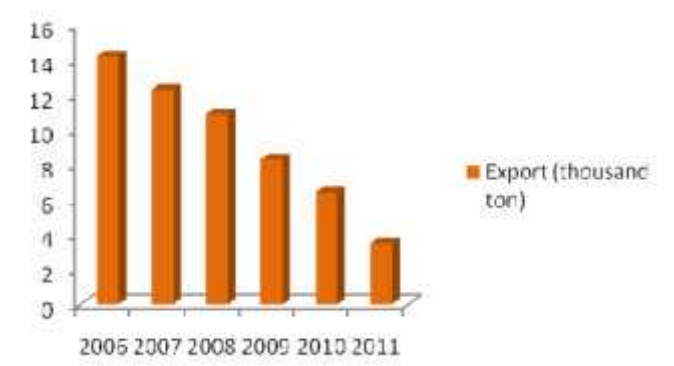
3.1 End Market Analysis

3.1.1 Main markets and market trends

The product and market segments: The market for prawn *(macrobrachium rosenbergii)* has been largely concentrated in the EU where it enjoys a strong niche market. According to industry experts, Bangladesh is the largest exporter of prawn in the world. Statistical evidences are unavailable since shrimp *(penaeus monodon)* and prawn are globally reported as shrimp. However, the two species cater to different market segments and fetch different market price for the same grade where grade is defined by number of pieces per kilogram. Field findings suggest that the price for prawn is usually 40% higher than the price of shrimp for the similar grade. Prawn is marketed mostly as headless while shrimp is marketed as both head-less and head on. Since prawn has high fat percentage in the head, the end consumers do not appreciate it. Consequently, the importers prefer to purchase headless prawn. Unlike prawn, which is primarily exported to EU destinations, shrimp is marketed globally.

Trends in export and export market share: USA dominated among the export market destinations for shrimp from Bangladesh but since 2006 export to USA has consistently declined (figure 1). Over this period the USA market shifted to Vannamei (P. Vannamei) which is a close substitute to the black tiger shrimp produced in Bangladesh but smaller in sizer and cheaper in price. Vannamei is produced under highly intensive culture system in Thailand, Vietnam, China and India which is yet to be tested in Bangladesh. The recent recession in USA further contributed to the decline of export of shrimp from Bangladesh to the USA.

Figure 3.1: Export trend of shrimp and prawn from Bangladesh in the USA (Source: NMFS)

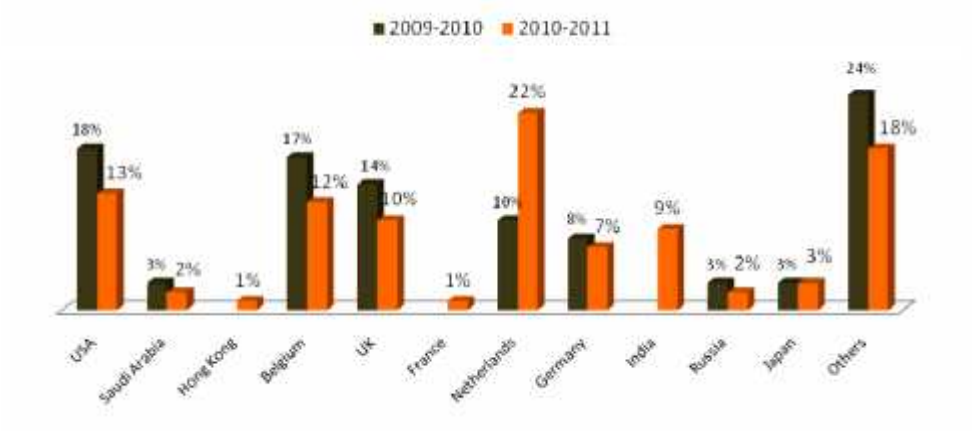


While export of shrimp to USA declined, the market for shrimp further opened up in the EU with the withdrawal of the mandatory screening of 20% of the consignments. Currently EU is the largest

importer of shrimp from Bangladesh accounting for 60% of the total export of shrimp and prawn from Bangladesh (BFFEA, January-April 2012).

Even though the overall share of EU has increased, export to all major EU destinations has declined with the exception of Netherlands where it increased from 10% in 2009-10 to 22% in 2010-2011 (Figure 2). Historically, Belgium has been the gateway for export of shrimp to the EU destinations. However, its position as the trade gateway for shrimp and prawn from Bangladesh to the EU has declined. It accounted for 12% of the total export from Bangladesh in 2010-2011 as opposed to 17% in 2009-2010 (BFFEA). At the same time, Netherland has become the largest buyer of prawn produced in Bangladesh accounting for 22% of the total export from Bangladesh in 2010-2011 as opposed to 10% in 2009-2010 (BFFEA). The shift in the trend has been attributed to the rejection of 55 consignments from Bangladesh by the EU lab in Brussels for traces of Nitrofuron which shifted the exporters from Bangladesh to Netherland. Even though the EU changed the testing procedures in the lab which found Nitrofuron in the consignments from Bangladesh, the exporters from Bangladesh concentrated on Netherland as the gateway to the EU market.

Figure 3.2: Export trends for shrimp and prawn from Bangladesh- Distribution per destination (Source BFFEA)



Overall, both the volume and the value of export of shrimp from Bangladesh has declined in 2011-12 fiscal year as opposed to the 2010-11 fiscal year. On the contrary, the volume and the value of export of prawn in the same period has sustained (figure 3.2 and figure 3.3). Data from the Department of Fisheries (DoF) revealed that the volume of export of shrimp reduced from 40,860 MT in 2010-11 to 35,678 MT in 2011-12. During the same period, total value of shrimp exported declined from USD 365 million to USD 322 million. Total volume of prawn exported in 2011-2012 was about 7060 MT which is slightly less than the previous fiscal year. However, the value of prawn exported increased from USD 97million to USD 107 million (DoF) over the same period. The increase in value of export was due to favorable international market price.

Figure 3.3: Trends in export of Shrimp and Prawn (in MT) from Bangladesh
Source: DoF

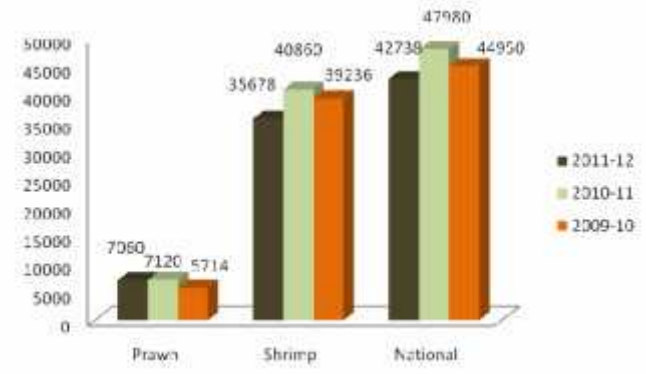
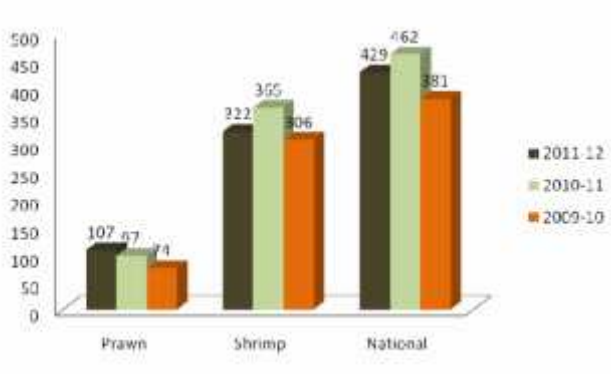


Figure 3.4: Trends in export of shrimp and prawn (in USD) from Bangladesh Source: DoF



3.2.2 Competition, Market Prospects and Challenges

Growth in the EU market for both shrimp and prawn and potential for further expansion: According to GlobeFish, Bangladesh has emerged as a strong competitor in the EU market over the period 2011-12. It states that Bangladesh achieved 26% growth in France alone while most other competing countries have seen decline in supply. Besides, GlobeFish forecasts that the demand for black tiger shrimp will increase in EU in 2012. EU offers incentives like duty free and quota free access to their markets. Even though the EU market is attractive for the exporters from Bangladesh because of DFQF it has several non-tariff barriers in terms of quality standards, testing procedures and tolerance to residuals. In several occasions they stopped import from Bangladesh because of failure to compliance of EU. Currently, Bangladesh faces the threat of embargo if it fails to implement traceability system by end 2014. It is thus essential that the sector is supported to develop capacity for compliance to the EU markets. Also, alternate to the EU need to be explored to reduce market failure risk.

Expansion of shrimp in new markets: In recent years, the processors and exporters from Bangladesh has expanded to new markets which include Russia, India, Saudi Arabia. Japan has reduced import of raw shrimp and increased import of value added shrimp products. Even though the processing plants in Bangladesh have the capacity to diversify into value added products they are yet to embark on it since they still have a ready market for raw shrimp. However, some processors in Bangladesh are outsourced by exporters from Thailand and some other countries to produce value added shrimp products. This is an opportunity that needs to be further explored to diversify the market base for shrimp from Bangladesh.

Potential to position prawn in high value market segments: Furthermore, as market trends suggest, prawn has the prospect to achieve higher market price and export market share as other competing nations are increasingly concentrating on the substituting shrimp with Vannamei. Since prawn is a freshwater species it has lesser ecological concerns than shrimp other than the fact that the farmers still depend largely on wild post larvae (WPL). Besides, it already has a strong niche market which values it for taste. Prawn can thus be positioned in a higher price-quality spectrum in

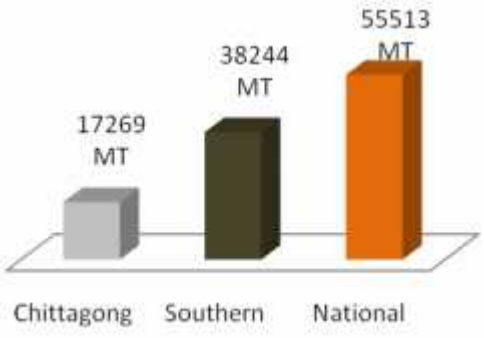
the consumer preference matrix. Integrated Market Communication (IMC) campaigns targeting the EU can help achieve the strategic positioning.

3.2 Production Trends in the Southern Region

3.2.1 Species

Mainly two types of shrimp and prawn species are cultured- *penaeus monodon (black tiger shrimp locally known as bagda)* and *macrobrachium rosenbergii (locally known as golda).* According to BFFEA some other species are also cultured which includes- *Harina, Baghatara, Chaka.* According to industry sources, of the three species *Harina* have received some recognition in the EU markets where it competes with Vannamei. However, the price offered by the Bangladeshi exporters is not competitive to perform in lower value market like that of Vannamei. Besides, lack of specialized hatcheries and dependence on wild larvae makes it further uncompetitive.

Figure 3.5: Shrimp Production in Bangladesh (in MT)- Regional Distribution
Source: (DoF, Fish and Fisheries Export Data July2011-June 2012)

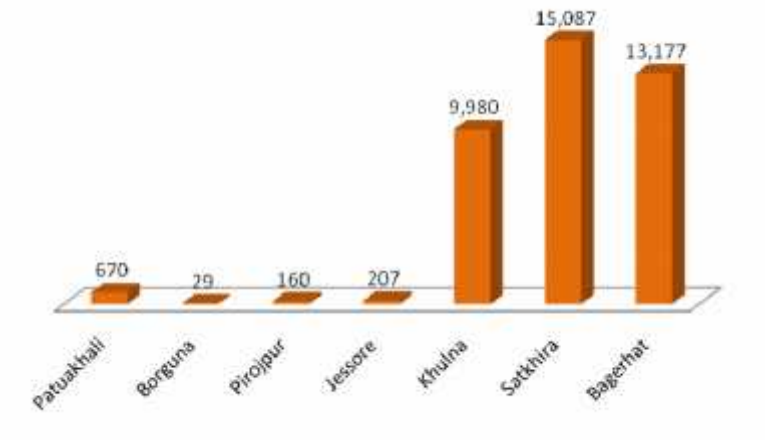


Even though BFFEA has been advocating for the introduction of Vannamei, the Government has restricted it because of fear of environmental effects like spread of virus which might affect other indigenous species. Besides, the climate is not suitable for multiple production cycle which is needed for intensive culture of Vannamei to make it viable. Therefore its introduction will require significant investment in policy advocacy and production trial. The more immediate strategy for Bangladesh and for the southern region should therefore be to increase production, productivity, processing and market capacity for black tiger shrimp and fresh water prawn.

3.2.2 Regional distribution of production, growth trends and opportunities for expansion

Southern region produces around 70% of the total national production for shrimp: There are two production zones for shrimp in Bangladesh- the southern region and the Chittagong region. The southern region contributes to 70% of the total national production of 55,513 MT shrimp (Source: BBS 2010-11). The rest of the production is mostly concentrated in the coastal region in Chittagong and Cox's Bazaar. The total land under shrimp production in the southern region is estimated to be 183,000 ha. This is about 75% of the total land under shrimp and prawn production in the region (WorldFish, 2011). Within the southern region, Satkhira, Bagerhaat and Khulna are the major production hubs.

Figure 3.6: Distribution of shrimp production (in MT) in the southern region in Bangladesh (DoF, Fish and Export Data Source: Fisheries July2011- June 2012)



Favorable ecological conditions contributed to the growth: The region's growth as a shrimp production zone is associated with several comparative advantages which are unique to the region. The following excerpt from the 'Review of Aquaculture and Fish Consumption in Bangladesh' published by WorldFish Center explains can be cited to explain the comparative advantages for production.

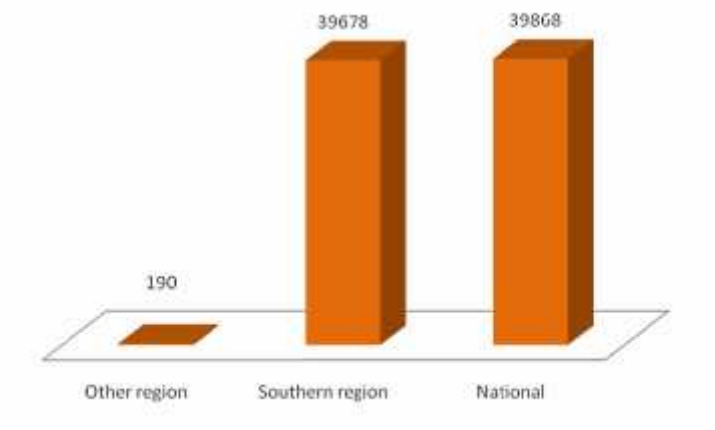
Snapshot: Comparative Advantages of Production of Shrimp in the Southern Region in Bangladesh

Most shrimp culture activities are carried out in ghers located on land protected from the sea by polders (very large dikes). The diked brackish water region is normally suitable for one crop of transplanted aman paddy during August-December, when the water and soil salinities are low. Freshwater for irrigation is not available in coastal areas since both surface water and ground water are saline during the dry months. Agricultural crop production during January-July is difficult and the soil is acidic in many places. When exposed to the sun, the soil acidity increases further, reducing soil productivity. Instead of keeping the land fallow during the high salinity period, many farmers find it profitable to utilize the low-lying and adequately submerged lands for shrimp and fish farming. Thus, many tidal flood plains are used for agriculture during the wet months and aquaculture during the dry months.

Shrimp ghers are usually connected with estuaries and canals by sluice gates which allow farmers to manage the flow of brackish or tidal water. In the months of February to April, tidal waters carry shrimp post larvae (PL) into ghers at high tide. These are trapped inside the gher by bamboo barriers placed at the gates. Trapping wild seed, as practiced in the initial stages of shrimp culture in

Bangladesh, has been largely replaced by artificial stocking of PL, either collected from the wild or produced in hatcheries. *Source: (WorldFish, 2011)*

Figure 3.7: Prawn Production in Bangladesh (in MT)- Regional Distribution
Source: (DoF, Fisheries Statistical Yearbook, 2010-2011)



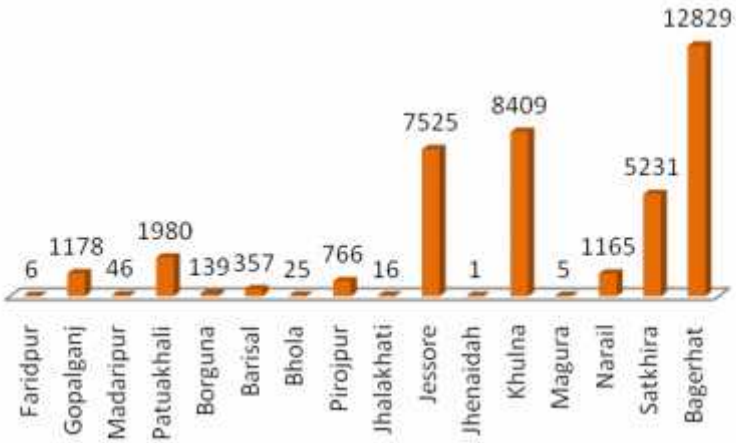
Further horizontal expansion is constrained because of restriction and anti-shrimp movement: Because of increasing salinity, much of the rice producing land in the coastal regions is becoming favorable for shrimp farming. However, because of government restriction on expa nsion and anti-shrimp lobbying by several NGOs, horizontal expansion is constrained. This is further detailed in later section.

Southern region accounts for almost 95% of the total national production of prawn: Production of prawn farming in Bangladesh first started in the Bagerhaat district (WorldFish, 2011) and it later expanded in the south-west districts surrounding Bagerhaat. The region produced almost 100% of the total national production of 39,868 MT (Figure 3.7).

Bagerhaat accounted for almost one third of the total production of prawn in the southern region. The rest of the production is concentrated in Khulna, Jessore and Satkhira districts.

Horizontal expansion of prawn induced by favorable demand and market price: From the field findings it was observed that in recent years, favorable market demand and market price has attracted increasing number of white fish farmers in prawn production. Higher profitability, increase in price of prawn in the farm gate and favorable soil conditions for production of prawn in the region are cited to be the major reasons for this switch from white fish to prawn.

Figure 3.8: Distribution of Prawn Production in the Southern Region in Bangladesh (in MT)
Source: (DoF, Fisheries Statistical Yearbook, 2010-2011)



Expansion of prawn production through shrimp and prawn poly-culture: Besides, our field findings suggest that there is an increase in poly culture of prawn and shrimp in the region, especially in Bagerhaat and Shatkhira where salinity is increasing. Since prawn is suitable for production in mild salinity, some of the shrimp farmers are now opting to produce prawn from May-November when salinity is low. Lower market price for shrimp and overall decline in export is cited as the major reason for which shrimp farmers are switching to prawn farming.

Production of prawn expanding to new areas: Production is also found to be expanding in Madaripur, Magura, Gopalganj region, especially in the territory surrounding Bagerhaat, albeit the volume of production is still insignificant in comparison to the volume of production in Bagerhaat. The aquatic system of these regions is favorable for prawn production and the proximity to Bagerhaat allows for quick access to traders, agents and wholesale markets. However, lack of knowledge about production and market opportunities has obstructed a faster expansion of prawn in the region as opposed to the potential. Besides, the region does not have strong and sustained supply of PL because of unavailability of hatcheries. Most of the hatcheries which began operation responding to the market opportunity have shut down in recent years because of production failure primarily for suspected virus attack.

3.2.3 Productivity/Yield

Productivity/ yield is low for both shrimp and prawn: To determine the prospect for increasing productivity we analyzed the current production from our field data and compared it with the productivity achieved for different types of production practice by competing nations. Our primary data reveals that the average yield of shrimp in the southern region is about 258 kg/ ha. The production practice is primarily extensive. The average stocking density is approximately 54,000 per hectare which is more than twice the standard for extensive culture system. Mortality is about 80% which eventually reduces much of the initial stock to the level of the standard. However, the effect of mortality is severe if it happens in the late stage due to virus attack. According to industry experts the mortality can be brought down to 70% or less by improving production management, improving PL quality and introducing supplementary feeds. Around 68% of the respondents in our primary survey reported that high mortality is a major impediment for shrimp production in the region.

Table 3.1: Performance of Shrimp Farming in Southern Region in Bangladesh
Source: Primary Survey

Criteria	Performance	Standard
Productivity	258 kg/ha	50-500 kg/ ha*
Stocking density	54,000/ ha	Below 25000/ ha**
Mortality	80%	70%***

*www.shrimpnews.com **www.shrimpnews.com *** local experts on shrimp;

Productivity (production per hectare) for prawn was found to be 474 kg/ ha. This has remained almost the same over the last one decade. A study conducted by Katalyst and Winrock International on fresh water prawn in the Greater Jessore region reported that the productivity was around 484 kg/ha (WI, 2006). It was also reported that the productivity is much less than that in Thailand (1500 kg/ha) and India (1000-1100 kg/ha).

Table 3.2: Performance of Prawn Farming in Southern Region in Bangladesh
Source: Primary Survey

Criteria	Performance	Standard
Productivity	474 kg/ha	Around 1500 kg/ha (Thailand)
Stocking density	15,000/ha	15,000/ ha
Mortality	10-15%	10-15%

Potential for stimulating growth lies in increasing productivity for both value chains: To achieve higher yield, the farmers need to upgrade from extensive system to semi-intensive system practiced in countries like Vietnam, Thailand and India. Katalyst and WI intervened in 2008 to promote semi-intensive system by intensifying stocking level by two times, introducing technologies like aerator. The farmers which participated in the pilot reported that the yield increased to around 930 kg/ ha due to the intervention. However, due to uncertainty in the market demand they did not continue the practice. Since the international market for prawn from Bangladesh has started to become favorable, the FtF program can build on that experience for promotion of semi-intensive culture for prawn in the southern region.

3.3 Description of the Value Chain

3.3.1 Functions, Actors and their Roles

Brood Collection: Shrimp broods are collected from the deep sea (Bay of Bengal) and the process is expensive. Only a few large hatcheries which have fishing trawlers/vessels collect it directly from the sea others collect from deep sea fish trawlers which catch shrimp brood with other sea fish. For prawn there is a specialized actor called brood collectors who are primarily poor local fishermen. The hatcheries buy directly from these fishermen.

Hatching & PL supply: The hatcheries are key for supply of quality PL. They hatch eggs from collected brood, produce the PL, package and transport to the buyers. The hatcheries are responsible for ensuring proper packaging and transportation. Shrimp hatcheries are mostly located in coastal region in Cox's bazaar. It is estimated that there are around 60 operational shrimp hatcheries. The water condition in the southern region is not favorable for shrimp hatcheries therefore even though some hatcheries were established these were not successful. In case of prawn most of the hatcheries in the country are located in the southern region. It is estimated that there are 30 operational prawn hatcheries in the region.

Nursing naupli till PL stage: In shrimp life cycle, 3-4 days old eggs are called 'naupli'. Nauplis are transported to the southern region from the Cox's bazaar to reduce transportation cost as they occupy less space than PL. The hatchery representatives in southern region (Satkhira and Khulna mostly) rear nauplis for 20-22 days to produce matured PL.

Collection of Wild PL: Prawn PL supply largely depends on wild PL. Though catching of wild PL is banned by the govt., the law has not been much effective. Reportedly there are around 360,000 PL

collectors (2009) in the coastal belt of southern region. Of those, 50% are women and the rest are children and male. It is a seasonal occupation lasting for around 3 months from April- June. Most of these people are landless and work as agricultural day labors rest of the year. The women usually do not have any other occupation over the rest of the year.

PL Trading: Wild PL collectors sell their collected PL to the local accumulators mainly in Bhola, Patuakhali and Borguna. These accumulators send Wild PL to the Paikers located in Bagerhat, Satkhira and Khulna districts. Some of the largest arots or wholesalers of wild PL are located in Morolganj, Koira, Chuknagar upazilas. PL Traders buy in bulk from these Arots and then sell to the farmers. In case of shrimp, the function of PL trading is performed by the hatchery itself through their designated agents who are established in the southern region, mainly in Satkhira and in Khulna. The PL traders provide embedded information on stocking density and feeding practice. Besides, they also provide technical advise to the farmers in cases of virus attack or production failure.

Input Supply: Ready feed, locally crushed feed, aqua-chemical, fertilizer, lime are the major inputs required for land preparation and for production of shrimp and prawn. From our field findings we estimate that there are around 3200 input retailers in the region. The highest concentration of input retailers was found in Bagerhaat and Satkhira districts. Apart from supplying inputs, the input retailers also provide information on use of feed and aqua-chemicals as embedded service. Some of the branded input companies like Mega feed organize training for their input retailers to promote their products and also to provide information on use of feed.

Grow-out: The PL is stocked and grown upto the marketable size by the grow-out farmers. It takes about 3 months for shrimp and 6-7 months for prawn. These farmers are not exclusively engaged in prawn and shrimp farming. 60-70% shrimp farmers usually produce BORO and Aman after harvesting shrimp .However all the prawn farmers engage in production of rice after harvesting of prawn, they also stock small amount of other fin fish with prawn . The farmer who has less than 1 hectare land are considered to be small farmer and more than 1 hectare is considered to be large or medium farmer. There are 5200 large and 4300 small farmers in that region who are involved in shrimp culture whereas prawn large farmers are 23300 and small are 64900 in numbers. Farmers usually acquire lands from others and make a large area to culture shrimp and prawn, the area is locally known as ‘gher’.

Trading: There are several actors performing the role of trading; they are ‘faria’, ‘bepari’, ‘arotdar’ and depots. Farias are small traders who collect shrimp and prawn in small scale from the small and remote farmers and sell them to bepari, arot or depots. Beparis usually buy fish in larger volume and sell them to arots or depots. However arots trade through auction. Farmers bring their products to the arot and sell their products in auction; arotdars get 3-5% commission from farmers. Large farmers prefer to sell shrimp and prawn in arots or depots. Depots, in collaboration with account holders sell their products to processing plants. Depots are responsible for cleaning, icing & preserving shrimp in plastic container then transport them to company via a/c holder.

Processing and Exporting: Nationwide there are 149 functional factories/processing plants in the region. Processors are responsible for collecting shrimp & prawn from depots or arots, cleaning, beheading, packaging, processing and ship to the international markets. Processing plants set the grade and price according to the requirements of the foreign buyers.

Table 3.3: Actors, functions and roles in the shrimp and prawn value chains in the southern region
Source: Primary Study

Actors	Functions	Roles
Brood Collector	Brood Collection	Sea fishermen collect shrimp broods from deep sea (Bay of Bengal) while prawn broods are collected from river by local fishermen.
Hatchery	Brood Collection	Some hatcheries which have own trawler collect brood by themselves.
	Hatching	Hatching eggs from shrimp broods and keeping it up to naupli stage.
Hatchery Agent	PL trading	Nursing of naupli up to PL stage, package and sell to the farmers.
Wild PL Collector	PL Collection	Collects wild PL from the coastal belt of the southern region. Most of them are women and children.
Wild PL Paiker	Wild PL trader	Wild PL collectors sell prawn PL to the paikers. Paikers transport wild prawn PL in bulk amount to the mokam.
Wild PL Mokam (wholesaler)	Wholesale of Wild PL	Wholesaler of those mokam wholesales prawn PL to the PL trader
PL Traders	PL Trading	Trades PL to farmers, in case of shrimp trading is mostly done by hatchery representative. However prawn PL traders are individual traders. PL traders disseminate technical knowledge to the farmers.
Farmer	Grow-out	Nursing of PL, and stocking PLs upto marketable size of prawn and shrimp.
Inputs suppliers	Supplying feed and aqua chemical	Selling ready or local feed, also selling aqua chemicals like lime, uncoated calcium carbonate etc.
Faria	Trading	Buying prawn and shrimp in small volume from the small and remote farmers and trade it to the Arots or Depots.
Arotdar	Trading	Collecting shrimps from farmers and selling it to the Beparis/Depots. Takes 3%-5% commission from the selling price.
Bepari	Trading	Buying products from the Arot and trading to the Depot. They specially buy in bulk volume.
Depot	Trading, cleaning, Icing, preserving.	Bulk buying specially from large farmers, faria and beparis, and selling them to factory or processing plants through a/c holders. They are responsible for cleaning, icing & preserving shrimp in plastic container then transport them to company via a/c holder.
A/C Holder	Trading	Acts as guarantors. Maintains the transaction record for both company and depots. Also ensures the regular supply of products to the companies.

Processor	Processing and Exporting	Collects the fish from different sources, processes, packages and ships it to the international markets.

3.3.2 Vertical and Horizontal Integration

Degree of vertical and horizontal integration in the value chains is limited: The actors are mostly specialized and perform only one function in the value chain. Some of the large scale shrimp hatcheries in Cox's Bazaar collect brood through their own sea vessels. But most depend on fishing trawlers in the sea for the supply of brood. The task of nursing is shared between the hatcheries and the shrimp farmers since the PL is supplied to the southern region as Naupli rather than matured PL. This function is not observed in the prawn value chain as the task of nursing is combined with grow-out. Most of the depots in both shrimp and prawn value chains have their own ghers for grow-out. However, their contribution to the overall production is insignificant. Horizontal integration is much less in the value chain and is mostly concentrated with depots. Some of the depots have ice factory and their own transport which they also rent out to others. Apart from this no other horizontal integration was observed in the value chains.

Informal vertical integration in trading and processing threatens quality assurance and therefore sustainable export market: The most significant vertical integration is observed in the prawn value chain where the depots perform the task of beheading even though they are not authorized to do it as they usually do not have the processing facility. The task is supposed to be performed by the processors in hygienic facilities. Nevertheless, most processors prefer to purchase headless prawn from the depots because of two reasons- (i) this reduces labor cost for the processors and (ii) it decreases the chance of perishability of the raw prawn as the head of prawn, which is highly perishable, is taken out before transportation to the processors. Besides, the depots earn extra cash by marketing the head to the local market. They thus have an incentive to conduct the process. The practice increases the threat to sustainable export as it may lead to ban from sophisticated market like EU which is sensitive to quality assurance.

Value added by integrating grow-out and trading functions might be risky: Value added at the farmers level could be increased if the farmers themselves performed the trading function. This could also ensure traceability in production and distribution system. However, this would require collective approach as found in countries like Vietnam where the farmers market directly to the processors through CBOs and have contract system established with the processors. Such collective initiatives in Bangladesh has been proven to be risky because of several reasons which include- (i) low trust among the farmers, (ii) low trust between the farmers and the contractors, in this case the processors, (iii) lack of willingness among the processors to trade on cash which attracts significant number of trading intermediaries whose primary purpose is to de-bulk the product and the need for working capital for trading and (iv) the intermediaries in the value chains are powerful local elites who are often found creating syndicates and therefore restricting the farmers from having access to markets.

3.3.3 Involvement of Women

Involvement of women is limited to informal processes and functions like wild PL collection, crushing snails, informal processing for the depots and farias to increase grade etc. Consequently, interventions on ensuring traceability, promoting HPL, awareness against adulteration etc. are expected to have negative impact on the employment of women in the shrimp and prawn value chains. Table 4, cited in 'Review of Aquaculture and Fish Consumption in Bangladesh' by the WorldFish Center provides a summary of involvement of women in the shrimp and prawn value chains in the region. Our analysis on involvement of women in the shrimp and prawn value chains and its implication on the FtF programme are illustrated in the snapshot: Involvement of Women in the Shrimp and Prawn Value Chains and its Implication on FtF Programme.

Table 3.4: Proportion of female employment in different key nodes of shrimp aquaculture
Source: (Islam, 2008)*, cited in* (WorldFish, 2011)

Value Chain Node	Women's Involvement (% of total)
Collection of wild PL	70 %
Labor in shrimp ponds (e.g; embankment, weeding	40 %
Management in processing centers	1%
Casual jobs in processing factories (e.g.; beheading, cleaning, counting, pealing)	80%
Food processing, snail collection, snail breaking for freshwater prawn	80%
Shrimp pond owners/ farmers	1-2%
Shrimp business (e.g; trading, contractors, middlemen)	3-4%

SNAPSHOT: INVOLVEMENT OF WOMEN IN THE SHRIMP AND PRAWN VALUE CHAINS AND ITS IMPLICATION ON FTF PROGRAM

Moderate involvement in prawn farming for feed preparation and feeding; unpaid if female members from the household are engaged: The task of feed preparation and feeding is mostly handled by women in prawn production. While small farmers mostly engaged female members from their own household, the large farmers are found employing female labors especially for crushing snails. Payment is made on cash and about TK 40-50 is paid per day. The employment is seasonal lasting for five months from July to November. Women who are engaged as labors for crushing snails usually reside in the same farming locality.

Each farm employs around 4-5 women for around 4 days per month. Each women works for around 3-4 farms a month. On these accounts, a female labor is usually employed for around 12 days a month earning her around TK 480 per month or around TK 2500 over 5 months. The involvement of women in feed preparation and feeding in the shrimp value chain is low and insignificant since farmers rely on natural feed. Scope for increasing employment of women is low in farming. It is expected to decline with the reduction in use of snails for feeding. However, promotion and increase in use of feed supplements in prawn and shrimp farming might induce involvement of women in the future.

High involvement of women in collection of wild PL for prawn: It has been estimated that around 350,000 women are engaged in the southern coastal regions in collection of wild PL (WI). The employment is seasonal and lasts for three months from April to June. The concentration of this seasonal and informal employment is reported to be much higher in Bhola district which is beyond the FtF program area. Within the FtF programme area the women are involved in wild PL collection

in Patuakhali, Barisal, Khulna and Shatikhira districts, especially in the estuaries. Since collection of wild PL is illegal the employment is informal and is not officially recorded.

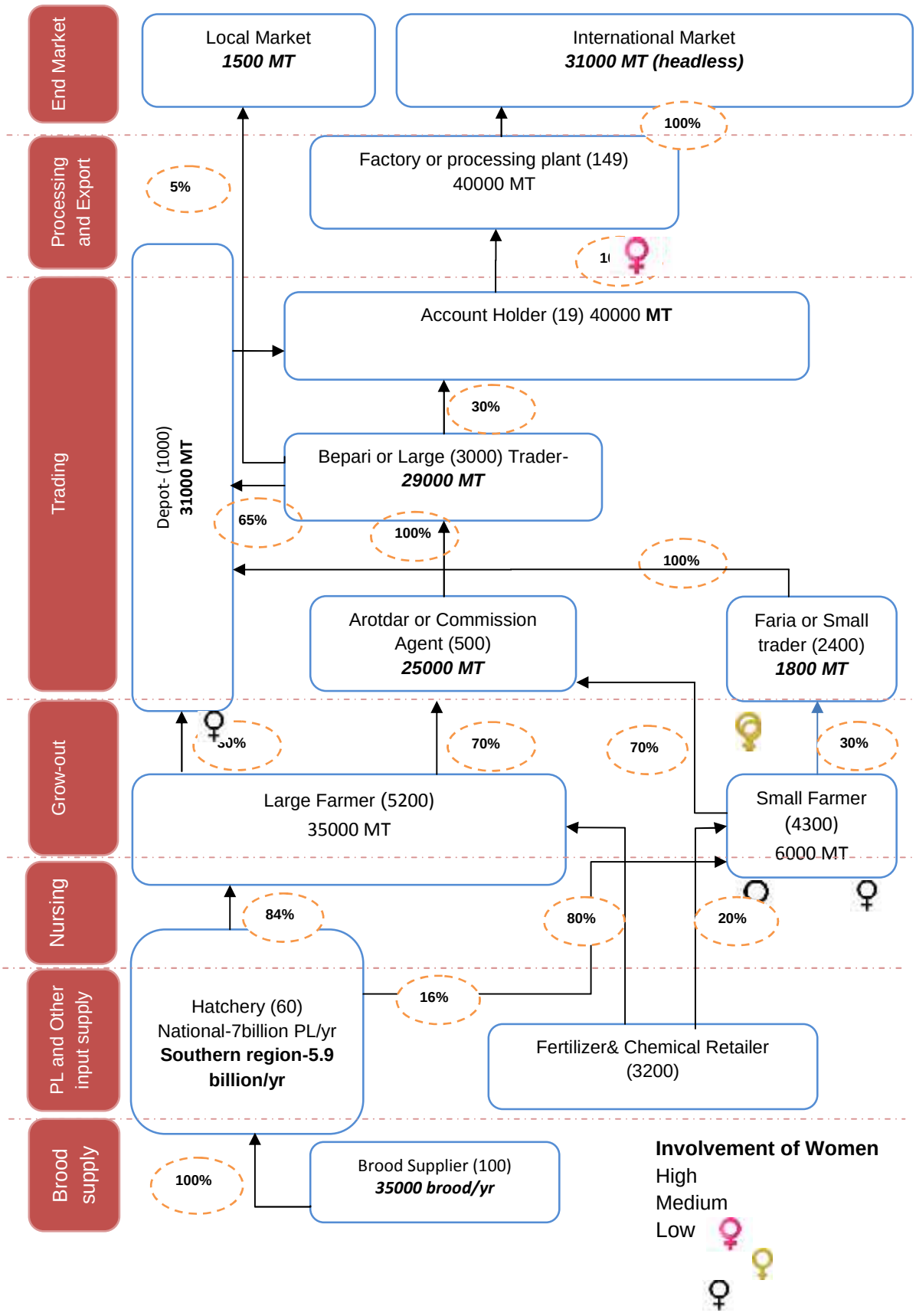
Because of lack of alternative livelihoods to the vulnerable landless poor in the coastal areas in the region, collection of wild PL is deemed as a lucrative and alternative source of income. It requires no/low investment and the income is instant. Besides, the women find it convenient and non-laborious. However it has been reported that the women engaged in collecting wild PL suffer from various skin diseases for being in the water for a long time. Increase in supply and demand for hatchery produced PL or HPL has a direct and negative correlation with the employment of women in collection of wild PL. This should be assessed and investigated by the FtF programme. The findings can be used to design alternative livelihood development programmes for the women involved in the collection of wild PL and to advocate for policies that could ensure rehabilitation of the women involved in wild PL collection.

High involvement of women in processing in both value chains: Women are formally employed in the processing facilities in both value chains. It has been estimated that around 20,000 women are employed in shrimp and prawn processing factories in the southern region (Islam, 2008). The employment is seasonal, lasting for 6 months per year. Wage rate is TK 100/ day which is much less than the regular wage rate of TK 150-200/ day in the region for other agricultural occupations. The work is deemed as light and therefore the wage rate is low. Also, opportunity for agricultural labor is much less than the opportunity in shrimp and prawn processing in Khulna where the processing factories are located. These increases the bargaining power of the processing factories to dictate wage rate for women labors.

On average each processing plant employs around 400 women per season. The processing factories are running mostly under capacity and therefore, expansion in production and market will have direct and positive impact on increasing employment opportunities for women in the region. Besides, employment by the processing factories will increase if beheading is conducted by the processing factories rather than the depots which lack the capacity for processing. Promotion of value added shrimp products will also have positive impact on the employment of women.

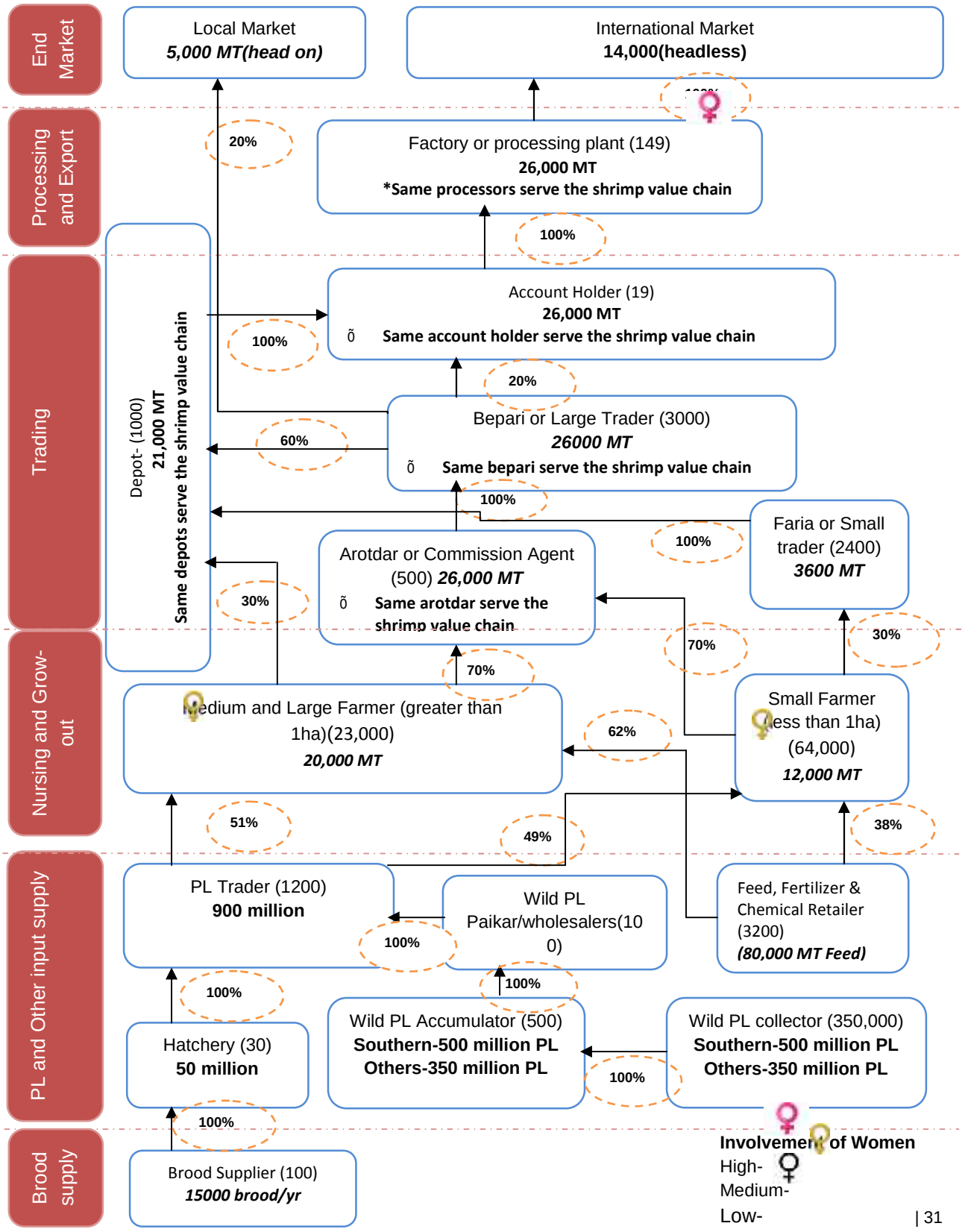
Moderate and informal involvement of women in intermediate processing: The farias in both value chains reportedly practice an informal intermediate processing to increase weight and achieve higher grade. The process, which is called pushing, is done through both hired and household female members. Since, the farias account for limited percentage of the total trade, the significance of this employment is low. Women are also employed by depots for cleaning and beheading. Reportedly, an additional 5000 women are employed by the depots for processing. In contrast to the processing plants where the women are employed for 6 months, the depots employ the women for around 4 months. Interventions on traceability and increasing restriction on adulteration etc. will have negative impact on the employment of women in informal processes. However, the interventions are expected to increase the market and increase use of productive capacity of the processing factories which would in-turn increase scope for formal employment of women in the value chains.

Figure 3.9: Shrimp Value Chain in the Southern Region in Bangladesh
Source: Primary Study


End Market
Processing and Export
Trading
Grow-out
Nursing
PL and Other input supply
Brood supply
Local Market
1500 MT
International Market
31000 MT (headless)
100%
5%
Factory or processing plant (149)
40000 MT
Account Holder (19) 40000 MT
30%
Depot- (1000)
31000 MT
Bepari or Large (3000) Trader-
29000 MT
65%
100%
100%
Arotdar or Commission Agent (500)
25000 MT
Faria or Small trader (2400)
1800 MT
70%
70%
30%
Large Farmer (5200)
35000 MT
Small Farmer (4300)
6000 MT
84%
80%
20%
16%
Hatchery (60)
National-7billion PL/yr
Southern region-5.9 billion/yr
Fertilizer& Chemical Retailer (3200)
100%
Brood Supplier (100)
35000 brood/yr
Involvement of Women
High
Medium
Low

Prawn Value Chain in the Southern Region in Bangladesh

Source: Primary Study

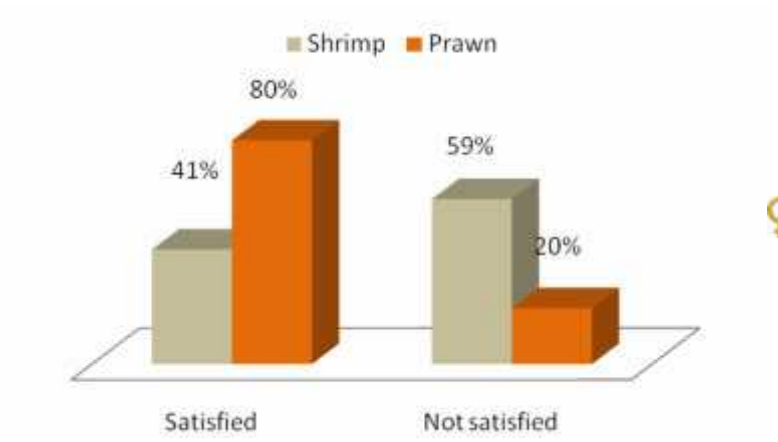


3.4 Value Chain Performance and Scope for Upgrading

3.3.1 Brood Collection, PL Supply and Nursing

Virus in shrimp brood; poor quality of PL: Price of brood for shrimp varies heavily from TK 2000-12,000 depending on size and availability. It has been reported that virus in the brood is a major threat for shrimp farming. Even though there are five PCR labs in the country, testing is not common. Importantly, there is no premium for viruses free PL. Thus it is not commercially viable for the hatcheries to destroy the brood which are tested positive for virus. Eventually the farmers overstock PL as a strategy to compensate for high mortality. Fifty nine percent of our respondent shrimp farmers reported dissatisfaction about the quality of shrimp PL.

Figure 3.11: Farmers' perception about the quality of shrimp and prawn PL
Source: Primary study



There are around 61 hatcheries in the country supplying shrimp PL. The total capacity of these hatcheries is estimated to be around 7 billion. Of the total production about 90% (about 7960 million PL) is supplied to the southern region (source: primary study). Around 84% of it is supplied to the large farmers (average land size 2.6 ha) and the rest 14% is supplied to the small farmers (average land size 0.5 ha). In 2012, due to attack of an unknown virus, the hatcheries have been largely affected and the supply has severely declined. As a result the production and export of shrimp is forecasted to decline heavily in the 2012-13 fiscal year.

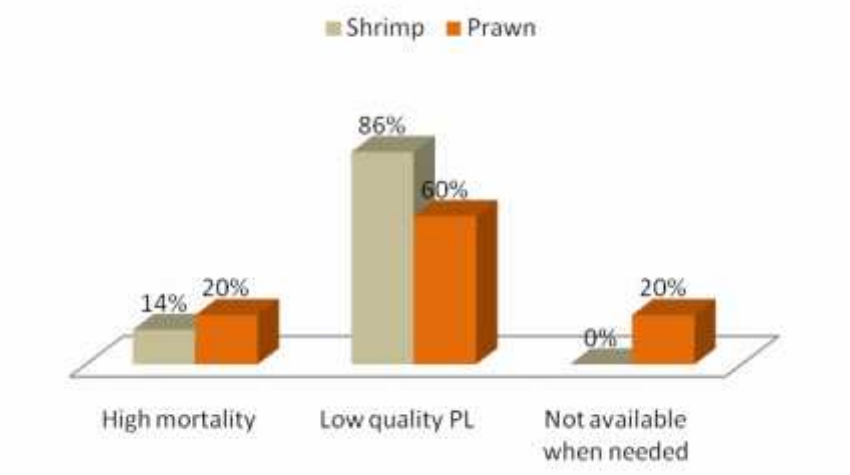
Dependence on wild PL for prawn: The PL for prawn is mostly collected from river sources through-out the coastal regions- from Sundarban to Cox's Bazar. Barisal is the hub for the catch and supply of wild PL for prawn. Our findings suggest that the supply of PL for prawn has remained

heavily dependent on the catch from natural resources. Even though several projects, which include Katalyst, has been supporting hatcheries to create demand for PL and to increase supply both the demand and the supply of hatchery produced PL (HPL) has remained insignificant. The reasons are as follows:

- ***Low capacity of the prawn hatcheries:*** Around 796 million prawn PL is consumed in the southern region (source: primary study). This is around 9 times of the combined capacity of all the operational hatcheries. There are around 80 prawn hatcheries in the country. Of them only 30 are functional and all of these hatcheries are located in the southern region. On average each hatchery has the capacity to produce 30 lakhs PL per annum (source: WI). Given this, the current capacity is about 9 crores. However, from field findings we estimate that these hatcheries produced around 5 crores prawn PL in 2010-11, which is roughly about 50% of their capacity. The reasons for low performance was reported to be unknown by the hatcheries as well as the key informants who were interviewed.

- ***Low demand for HPL:*** Even though the price of HPL (around TK 1500-TK 2000/ thousand) is much less than the price for WPL (around TK 3000-4500/ thousand) the demand for HPL is much less than WPL. Farmers were found to have a negative perception about hatchery produced PL. They complained of low growth and high mortality. They also complained about high proportion of female in HPL. Since wild PL is largely available prawn farmers does not find the problem with PL as much as the shrimp farmers. More than 95% of the total supply is reported to be from wild PL. It should be noted in this context that some of the HPL are supplied as WPL and therefore the percentage of supply of wild PL might be lower. But given the current capacity of the hatcheries it is plausible that the supply of WPL dominates the supply and demand for HPL.

Figure 3.11: Reasons for dissatisfaction about quality of PL
Source: Primary Study



The supply chain for PL for prawn and shrimp is distinctive: The supply chain of PL is completely different for prawn and shrimp value chains. In case of shrimp, the PL is directly supplied by the hatcheries through their regional distributors to the farmers. In case of prawn the PL is traded through PL traders. Since supply of shrimp PL is driven by the hatcheries the distribution channel is

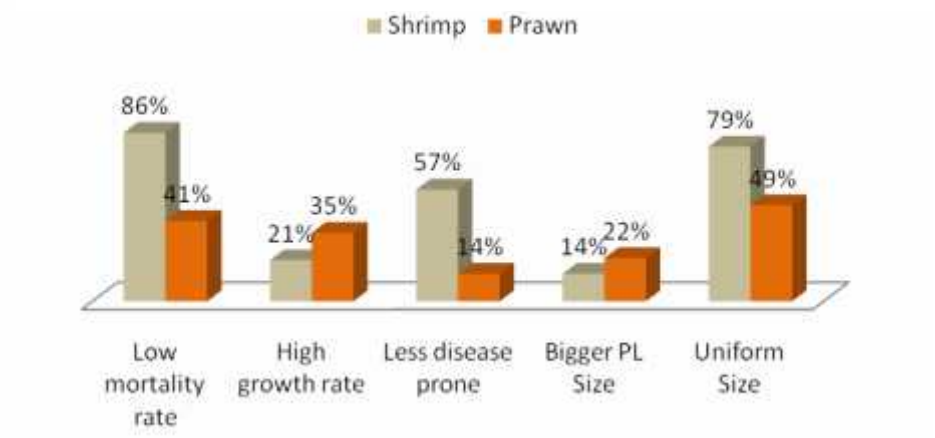
direct and organized. On the other hand, since Wild PL dominates the supply of prawn PL the channel is dependent exclusively on PL traders. The prawn hatcheries in turn depend on the PL traders to market the PL to the farmers. There are as many as 1200 PL traders in the region. Since the shrimp hatcheries are located mostly in Cox's Bazaar the hatcheries supply the PL in an intermediate stage called Naupli. The hatchery representatives located in Shatkhira than nurse it for around 10 days and then supply to the farmers.

In case of prawn the nursing period is distributed between the hatcheries and the farmers. The farmers usually stock the PL before the rainy season in a small confined space of their gher. Later, once the rain falls, the gher becomes inundated and the nursed PL walk out from the confined space to the grow-out gher. This practice is dependent on favorable weather conditions and therefore is prone to the risk of longer production period which reduces the profitability of the farmers. Katalyst and WI intervened to promote specialized nursing for prawn in areas where prawn farming has been expanding in recent times. This includes Chittagong, Comilla and Barisal. Even though the results were good, most nurseries failed to sustain because of lack of supply of PL from the hatcheries. It is said that specialized

Increase in price of WPL and the reduction in catch have increased the scope to promote HPL: It has been reported that the price of Wild PL has increased from TK 1000-1500/ thousand in 2007-08 to TK 3000-3500/ thousand in 2011-12. According to the respondents catch from wild resources has declined in recent years because of the ban on catch and increasing pressure from the law enforcing bodies. This has attracted informal supply of PL from India even though it is said to be still insignificant. It is not known whether the PL sourced from India is wild or hatchery produced.

From the analysis it can be concluded that given the increase in price of wild PL and the decline in catch, there is a scope to create market for HPL. But the challenge of increasing capacity of the hatcheries, productive performance of the hatcheries and quality of HPL is significant. This might require extensive investment on research on quality issues, capacity building support and marketing of HPL and awareness raising campaign. The results however might be slow unless and until the catch of wild PL has significantly dropped or the price has gone beyond the scope of profitable business for the farmers.

Figure 3.12: Quality parameters for shrimp and prawn PL for the farmers



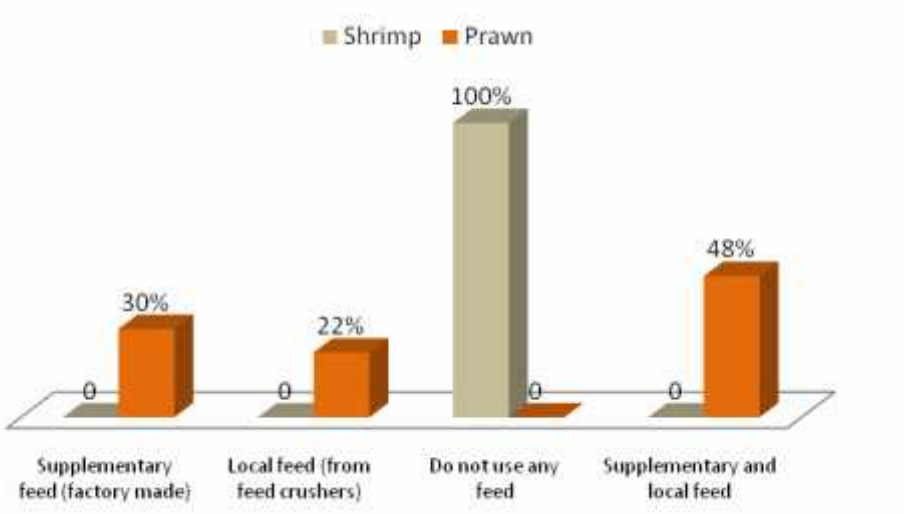
Consequently the success of the FtF program will depend heavily on external environment on which the program will have little or no control.

It should be noted in this context that low mortality rate and uniformity in size are the two parameters observed as the most important quality perimeter for the shrimp farmers while for prawn the uniformity in size is said to be the most important quality perimeter for prawn farming. The other two quality parameters for prawn are high growth rate and larger size of the PL. The capacity building and market promotion support for the hatcheries thus need to ensure these three attributes for HPL.

3.3.2 Supply and Use of Feed and Aqua-chemical

Trends in feed usage reveals lack of knowledge and sub-standard practices: Supplementary feed is not used for shrimp farming. It is dependent solely on the natural feed. For prawn, 95% of the respondent farmers reported that they use supplementary feed. The rest 5% of the prawn farmers usually use homemade loose feed. In our workshops, the farmers shared that the quality of home-made (includes feed supplied by local crushers) feed is better than the ready feed. Since it is more labor intensive the farmers now prefer ready feed supplied by national companies. Around 30% of the respondent shrimp farmers use only supplementary feed while 48% use both supplementary feed and local feed supplied by feed crushers. The standard is to use only supplementary feed based on body weight. The findings thus reveal lack of knowledge of the farmers on the proper application of feed.

Figure 3.13: Trends in feed usage by shrimp and prawn farmers in the southern region
Source: Primary Study



Presence of a vibrant private sector for aquachemicals and supplementary feed provides opportunity to upgrade knowledge of the farmers: The presence of the private sector feed companies in the prawn value chain is significant. Most of the national aqua feed manufacturers are active in the region and have organized distribution channels reaching out to the prawn farmers. According to our field findings there are as many as 3200 retailers of feed and aqua-chemical in the region.

Aqua chemical is a critical issue for shrimp farmers as shrimps are sensitive to water salinity and ph. Aqua chemicals which are widely used include uncoated calcium carbonate, zeolite, lime etc. It is very essential to manage water quality to keep shrimps virus free and reduce mortality. During

excessive sunny day or heavy rainfall water quality changes drastically which necessitates the use of aqua-chemical. According to the dealers of aqua chemical farmers use aqua chemical based on their prescription however farmer's knowledge on use of aqua-chemical is negligible.

3.3.3 Grow-out

Large farmers dominate production: According to our estimate there are around 52,000 large farmers (gher size 1 ha or larger) in the region producing shrimp. Number of small farmers (gher size less than 1 ha) is relatively less (approximately 42,000) (source: primary study). Because of land ownership and leasing patterns, the shrimp value chain attracted local elites and people having networks with the public administration. Total production is estimated to be around 40,000 MT per annum. Large farmers account for more than 85% of the total production in the shrimp value chain.

Figure 3.14: Distribution of farmers based on farm size
Source: Primary Study

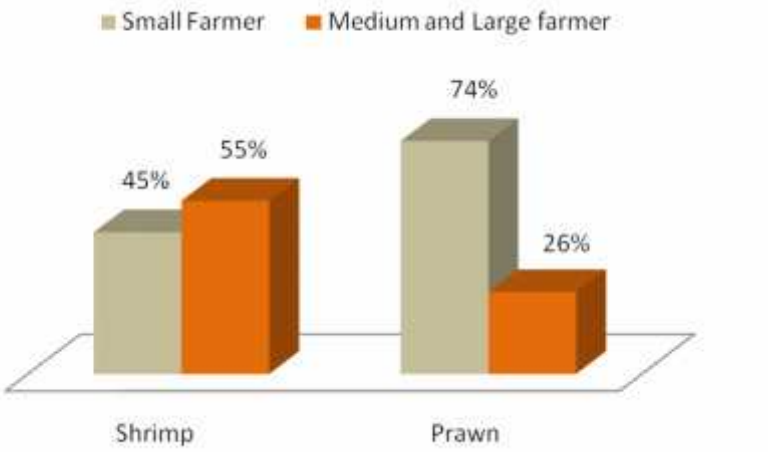
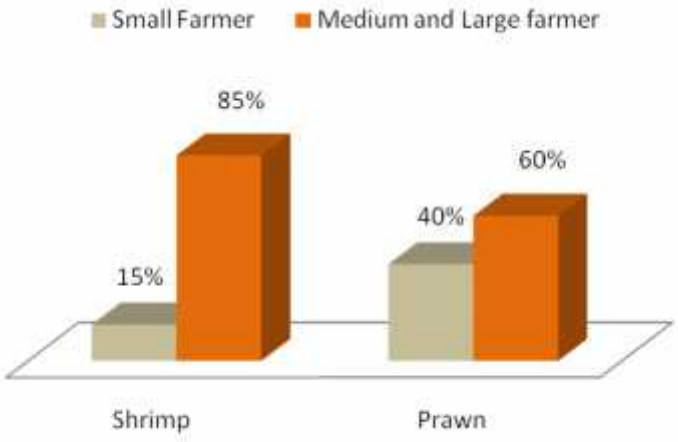


Figure 3.15: Distribution of production between small farms and large farms
Source: Primary Study



In contrast to the shrimp value chain, number of small farmers (approximately 64,000) in the prawn value chain is almost three times than the number of large and medium farmers (approximately 23,000) (source: primary study). However, large farmers (around 20,213 MT) in the prawn value chain produce 60% of the total production in the region.

Scope for upgrading lies on increasing productivity rather on controlling cost of production: Analysis of cost of production reveals high gross profit for both the large farms and the small farms in the shrimp value chain. Total cost of production (direct cost) was found to be TK 86,822/ ha per annum. Apart from land, other indirect costs (like electricity) are not recorded by the farmers and therefore could not be reported. At the time the study was conducted the farm gate price for shrimp was at the range of TK 525/ kg. Given these accounts, gross profit of the farmers is about TK 28,627/ha per annum. Gross profit margin is around 21%.

Cost of PL accounts for 30% of the direct cost. Price for PL has remained static over the last few years. It was being traded in the range of TK 400-500 at the time the study was conducted. Another 28% of the direct cost is spent on leasing land. Labor cost is about 17% of the total cost. Cost of inputs accounts for another 16%. The rest is spent on transportation.

The analysis of cost of production at grow-out stage suggests that the FtF program will not have much impact on value creation by reducing cost of production. Land, labor, cost of inputs are subject to external factors and are expected to rise in response to macro-economic conditions. Cost of PL for shrimp will fluctuate depending on availability and size. The program's focus should thus be on increasing yield (currently 258 kg/ha) to increase value at the grow-out stage for shrimp. Furthermore, value can be added if mortality is contained. The scope for increasing productivity and reducing mortality was discussed in section 3.2.3.

Figure 3.16: Distribution of cost of production in shrimp farming
Source: Primary Study

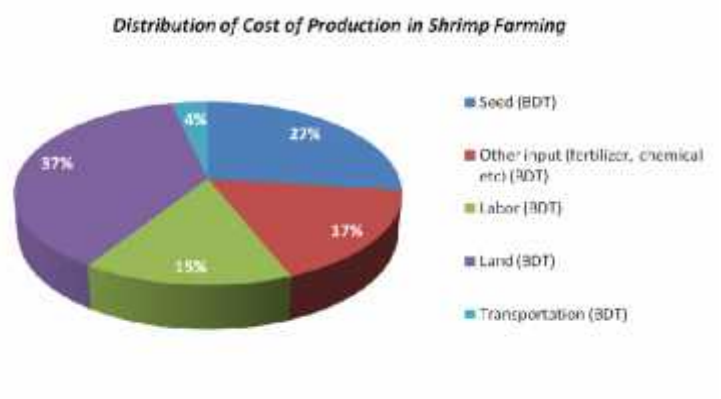
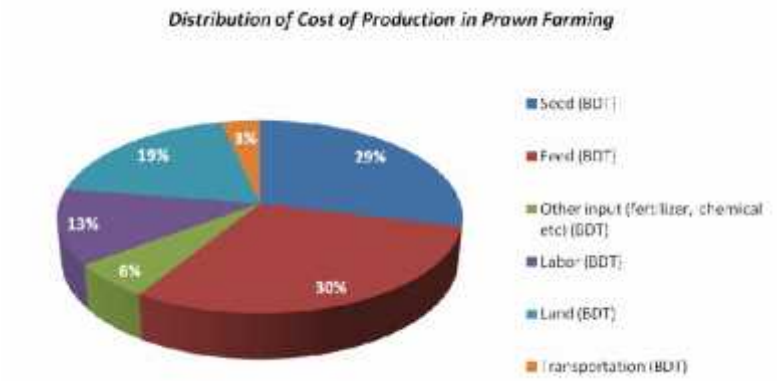


Figure 3.17: Distribution of cost of production in prawn farming



Prawn is more expensive to produce than shrimp. Costs of PL, land preparation, transportation are much higher than that of shrimp. Additionally the prawn farmers have to spend on feed. However, costs of aqua-chemical and other inputs are much less in prawn farming if compared to shrimp. The high cost of production in prawn is offset by higher yield (474 kg/ha) and higher market price (TK 700/ kg). Gross profit for prawn is about TK 161,609/ ha per annum. Gross profit margin is 49%.

The cost of production in prawn can be lowered to certain degree if HPL is used instead of WPL. Other costs are expected to increase. Similar to shrimp, the scope for value addition lies mostly on increasing productivity which was detailed in section 3.2.3. Table 3.5 summarizes the revenue, cost of production and gross margin in shrimp and prawn production in the southern region.

Table 3.5: Revenue, Cost of Production and Gross Margin in Shrimp and Prawn Production in the Southern Region
Source: Primary Study

	Shrimp	Prawn
Yield (kg)	258	474
Price (TK)	525	700
Total Revenue (TK)	135450	331800
Total Cost of production (TK)	99127	156051
Seed (TK)	*26793*	*44912*
Feed (TK)	-	*46996*
Other input (fertilizer, chemical etc) (TK)	*16784*	*9232*
Labor (TK)	*15000*	*19760*
Land (TK)	*37050*	*29640*
Transportation (TK)	*3500*	*5511*
Marketing Cost	7696.14	14139.42
Gross Profit (TK)	28626.86	161609.58
Gross Profit Margin (%)	21.1	48.7

3.3.4 Trading, Processing and Exporting

Need for high working capital induces large number of trading intermediaries: Trading, processing and export functions for shrimp and prawn require large working capital. According to industry experts, in countries like Vietnam and Thailand the processors usually inject the working capital for trade in the value chain. In contrast, in Bangladesh, a different intermediary called account holder (also called agent) takes the responsibility for injecting cash in the shrimp and prawn value chains. As a result the account holders have become the key financer in the value chain. As can be seen in the value chain maps illustrated in figure 8 and figure 9, there are only 19 account holders in the shrimp and prawn value chains catering to around 149 processors. The number of processing plants is unusually high which is attributed to incentive for tax free income. Most of these processing plants did not have the capacity to invest in supply chain management. As a result, the account holders evolved in response to the need for a specialized agent for accumulation and for micro cash management in the value chains.

Similarly, further down the trading channels the role of bulking and de-bulking is split between several other intermediaries which include-depots, arots or wholesalers and farias. The functions performed by these different intermediaries are summarized in table 3.6.

Table 3.6: Trading intermediaries and their significance in the shrimp and prawn value chains in the southern region in Bangladesh
Source: Primary Study

Trader	Significance in the value chain
Faria	*Farias* trading in small volume serve exclusively the small farmers who do not have easy access to the arotders of the commissioning agents. Extrapolation from field

	finding suggest that there are around 2400 *farias* in the region trading around 1800 MT shrimp and 3600 MT prawn. Many value chain actors claimed that to achieve higher grade the farias practice an adulteration method called 'push' which involves injecting barley, injecting water as well soaking for increasing weight. The *depots*, to whom the *farias* directly sell to are thus found less interested to buy from the *farias.* The *farias* are seen as a constraint in ensuring traceability in the value chain.
Arotdar	The *arotders* are foremost intermediary connecting the farmers, both large and small, with the other intermediaries in the value chain. According to our estimate, there are around 500 arotdars in the region trading around 26,000 MT prawn which is about 80% of the total production. Seventy percent of the produce of both the small farmers and the large and medium farmers are traded through the arotdars. The arotdars collect 3-5% commission on the market price from the farmers. The *arotdars* act as informal source of credit to the farmers. In return the farmers are required to trade through the *arotdar* providing the credit. Usually, the arotdars directly procure the PL and feed and supply to the farmers at a price higher than the market rate. They deduct the cost for PL and feed and the commission on sales and pay the balance to the farmers. This reduces the value for the farmers. However, the farmers prefer this informal mechanism for credit as it can be easily availed. The farmers have the choice to skip the *arotdars* and sell directly to the depots. Nevertheless, they prefer to trade with the *arotdars* since the payment is instant. The depots pay around 50-70% in cash and the rest are paid after 3-5 days once the payment from the *account holders* is received by the *depots*. Besides, the price at the *depots* is based on formal grading procedure which increases the risk of lower price for the farmers. Therefore, the farmers who do not get uniform grading prefer to sell directly to the *arotdars.*
Bepari	*Arotdars* do not buy from the farmers. They rather facilitate sales for a commission. There are as many as 3000 *beparis* who are mostly seasonal floating traders collecting shrimp and prawn from different arots across the region. *Depots* are the primary buyers from the *beparis*. Around 60% of the sales for prawn and 65% for shrimp is estimated to be made to the *depots*. Approximately another 20% of prawn and 30% of shrimp is sold directly to the *account holders*. Usually the *beparis* which are located in areas proximate to *account holders* having storage, icing and grading facility sell directly to the account holders. The *beparis* are the primary supplier to the local market. Shrimp and prawn which are partially damaged and rejected are supplied to the local markets. Around 20% of prawn and 5% of shrimp is sold to the local market. Besides, some grades for prawn (like 50/ kilo and 30/kilo) are more preferred in the local market and therefore supply of prawn in the local market is high.
Depot	The *depots* are the primary source of supply for the *account holders*. Intermediate processing like grading, cleaning, icing etc. are conducted by the depots. The *beparis* are the primary source of supply for the depots. Apart from the *beparis* the *depots* also collect directly from the *large farmers*. To ensure supply, the *depots* provide credit to the farmers usually in cash. Most of the *depots* are found to follow the mandatory rules and regulations imposed by government, such as registration, carrying fish in plastic container, cleanliness of the depot itself etc. Most of the *depot owners* have been in the industry for long time and are influential. Besides, most of the depots are directly involved in culture of shrimp and prawn. They have a functional regional association which is working on issues like pushing, traceability etc. They get year ending bonus in cash from a/c holders depending on the trading

	volume.
Account holder	The *account holders* are the financers in the prawn and shrimp value chain. There are only 19 *account holders* in the country catering to as many as 149 *processors and* thousands of *depots and beparis* lower down the value chain. The bargaining capacity of *the account holders* is thus very strong. Information on buyer requirements and prices are transferred to the value chain actors lower down the chain by the *account holders*. Usually they do not have any storage and preservation facility. They collect directly from the *depots* and the *beparis* through their own transports.
Processor and exporters	Processing companies clean, behead, process, package and ship fish to the international markets. Their primary investment is on the processing facilities which have sophisticated equipments for cleaning, beheading, icing and packaging. They mostly employ women for 6 months for processing fish. The processors have a functional association, Bangladesh Frozen Food Export Association (BFFEA), which acts as the spokesperson for the shrimp and processing industry.

The market price is fixed by the processors based on international rates; the price is then reduced by the account holders and depots to allow for their commission: The price is set by the processors and exporters based on international market price. This is then channeled lower down the value chain by the *account holders* who reduce the price to top up their commission before supplying to the processors at the pre-fixed rate. The price is further reduced by the depots to account for their commission and intermediate processing. The beparis, farmers and farias, thus do not have the bargaining power on price. Farmers, who sell their produce through the arotdars, sell through an open auction method. In this method the price is set through bidding and the price is dictated by the demand and the volume of supply. As has been explained in previous sections, the arotdars deducts their commission (usually 3-5%) and the pre-fixed cost for the inputs (PL and feed) that they supply to the farmers for credit.

Market price is high for better grades; the shrimp farmers are affected by lower market price resulting from lower grades of shrimp: Grading is based on the number of shrimp/prawn per kg. Low number of shrimp or prawn per kilo indicates at higher grade. Highest grade of shrimp is 12 and lowest grade is up to 100. Whereas for prawn, highest grade is 6 and lowest grade is 30. Table 3.7 shows the range of current market price for different grades of shrimp and prawn:

Table 3.7: Current market price for the different grades of shrimp and prawn
Source: Primary Study

Species	Grade (Number of shrimp/prawn per kg)	Price (TK/KG)
Shrimp	12-15	700-800
	18-22	575-695
	30-35	430-500
	35+	250-350
Prawn	5-8	1600-1700
	12-15	830-1250
	18-30	530-750

Field survey revealed that around 52% of the shrimp farmers sold their shrimp in the price range of TK 451-500 /Kg which corresponds to the grade of 30-35. It has been reported that because of high mortality the shrimp farmers are currently selling their produce within 2 months in grow-out stage to avert the risk. Furthermore, price decreases if the produce marketed by the farmers is not of uniform size. Since the formal grading is done by the depots at their facilities the farmers usually do not prefer to sell directly to the depots. The arotdars and farias are more preferred by the farmers since the grading is done very loosely based on judgments rather than on formal sorting and grading process. Consequently, the price for shrimp at farm gate decreases further. Figure 3.19 shows the farm gate distribution of price for shrimp.

Figure 3.18: Distribution of farm gate price of shrimp
Source: Primary Study

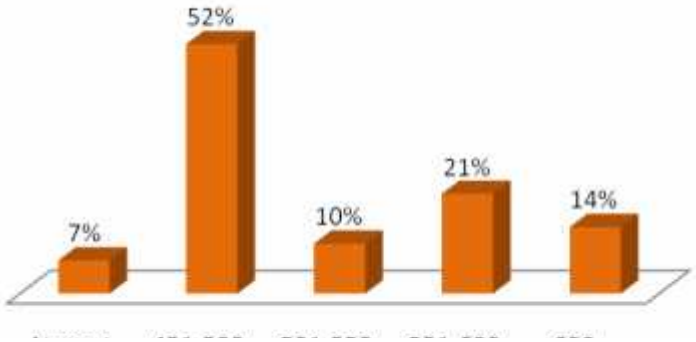
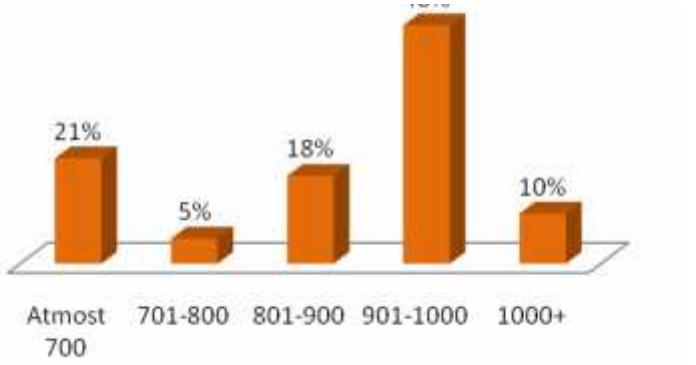


Figure 3.19: Distribution of farm gate price of prawn
Source: Primary Study



In contrast to shrimp, the prawn farmers are achieving better grade and better market price: Around 48% of the respondent prawn farmers reported that they sold their produce in the price range of TK 900-1000/kg which corresponds to the grade of 12-15. Around 39% of the farmers sold at the rate of less than TK 900/kg which co rresponds to the grade of 18-30. This reveals that the prawn farmers have better control on their production and are achieving higher grades and higher market price.

3.3.4 Margins and Value Added

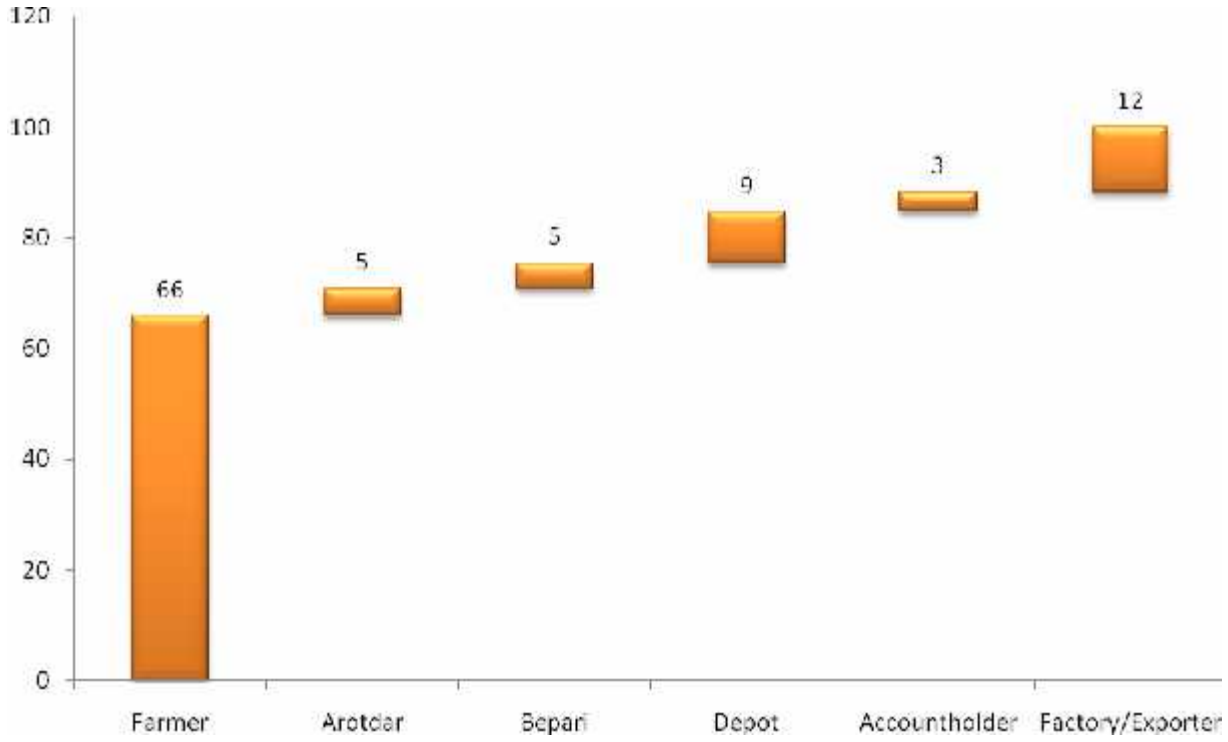
The analysis shows that the highest level of value addition (66% of the total) takes place at the grow-out stage as the direct input cost for the farmers (cost of PL, fertilizer and chemical) is very low for shrimp. Of the trading intermediaries, value addition is highest for the depot owners (9%). This is because unlike other trading intermediaries, the depots conduct an intermediate processing before they supply to the account holders. Value addition by the factory and exporters is about 12% of the total. It should be noted that the export market price is not based on primary data since the exporters and processors did not reveal the price. Therefore, the price is derived from extrapolation of total export volume and total export revenue reported by DoF.

Table 3.8: Value addition and gross profit margin for the actors in the shrimp value chain
Source: Primary Study

	Farmer	Arotdar	Bepari	Depot Owner	Accountholder	Factory/Exporter
Market Price (TK/kg)	525.00	551.25	576.25	626.25	645.04	709.00
Direct Input Cost (TK/Kg)	169.00	525.00	551.25	576.25	626.25	645.04
Value Addition (TK/Kg)	356.00	26.25	25.00	50.00	18.79	63.96
Value Addition (% of total)	66%	5%	5%	9%	3%	12%
Marketing Cost* (TK/Kg)	29.83	6.36	6.99	17.53	4.33	26.26
Production Cost (TK/Kg)	384.21	-	-	-	-	-
Gross Profit (TK/Kg)	110.96	19.89	18.01	32.47	14.46	37.70
Gross Profit Margin (%)	21.13	3.61	3.13	5.18	2.24	5.32

* Source: (Alam & Md. Salahuddin Palash, 2012)

Figure 3.20: Waterfall diagram of value added in the shrimp value chain
Source: Primary Study

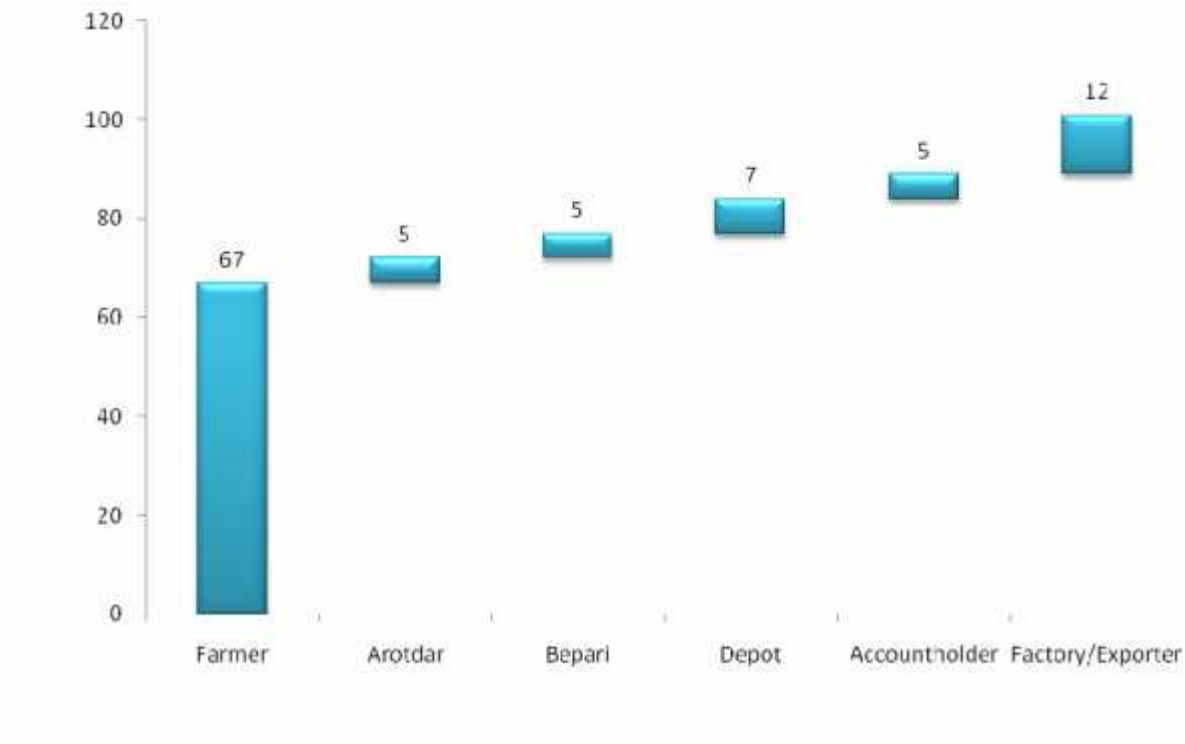


The distribution of value added in the prawn value chain is almost similar to that in the shrimp value chain (Table 3.9). However, gross profit margin in prawn (48%) is higher than that in shrimp (21%). This is because cost of production per Kg for shrimp is higher than prawn. Gross profit margin for the other actors is almost similar.

Table 3.9: Value addition and gross profit margin for the actors in the prawn value chain
Source: Primary Study

	Farmer	Arotdar	Bepari	Depot Owner	Accountholder	Factory/Exporter
Market Price (TK/Kg)	700.00	735.00	771.75	821.75	854.62	939.62
Direct Input Cost (TK/Kg)	213.38	700.00	735.00	771.75	821.75	854.62
Value Addition (TK/Kg)	486.62	35.00	36.75	50.00	32.87	85.00
Value Addition (% of total)	67%	5%	5%	7%	5%	12%
Marketing cost (TK/Kg)	29.83	6.36	6.99	17.53	4.33	26.26
Production cost (TK/Kg)	329.22	-	-	-	-	-
Gross Profit (TK/Kg)	340.95	28.64	29.76	32.47	28.54	58.74
Gross Profit Margin (%)	48.71	3.90	3.86	3.95	3.34	6.25

Figure 3.21: *Waterfall diagram of value added in the prawn value chain*
Source: Primary Study



3.4 Assessment of Business and Financial Services

3.4.1 Research

A new research station of BFRI has been recently established at Sadar upazilla under Bagerhat district. The mandate of the station is to research on enhancing shrimp production, shrimp health management, shrimp feed & nutrition, post harvest handling & quality control of shrimp and shrimp products. The station is established with the financial assistance of a GoB funded project entitled "Establishment of Shrimp Research Center in Bagerhat". Khulna University

3.4.2 Quality assurance and certification

Even though quality assurance and certification is key to sustaining the export market, especially the EU market, the process is mostly overlooked. The DoF is the formal authority for quality assurance. Each shipment is certified by DoF before being exported. Besides, they carry out periodic quality audit at various level of the value chain. Because of weak quality control system, practices like pushing are usually unaccounted for. Besides, it fosters non-compliance as is evident from the fact that most farmers are not registered with DoF even though they know about the requirement. It has been reported that the farmers are never asked for proof of registration while selling. Consequently, the incentive for registration is missing. Supporting the industry to develop a sustainable quality assurance and certification system thus needs to be a major intervention area for the FtF program.

3.4.3 Training and Information on Technical Issues

Efficiency and effectiveness is very low for the hatcheries in terms of reducing mortality rate for shrimp and producing PL for prawn. On the other hand farmers have been found inefficient in dealing with natural changes in the eco-system (change of salinity, PH level etc.), feed etc. Thus around 75% of the respondent shrimp farmers reported that they would like to have access technical advices on improved culture techniques of shrimp. Currently, only few NGOs in the region are providing some training supports to the producers. The reach is very low as only 20% of the respondent farmers reported that they received training from NGOs.

Aqua chemicals retailers are reported to be major source of information on use of aqua-chemical. But they generally lack the knowledge. The DoF is mandated to provide training but their reach is limited and is driven by project support. Besides, it is usually the large farmers or the lead farmers who have access to training and extension support from the DoF. Developing capacity of the associations for training can be an alternative option for sustainable provision of training and information on technical issues.

3.4.4 Cooperative, group and associations

Cooperatives, groups and associations are present at different tiers of the value chain. The actors understand the fact that united they can work better. Both vertical and horizontal cooperation exists between the actors. However, there is scope for improving the functionality of the associations. For instance, data shared by the National Shrimp Farmers' Association shows information on Satkhira, Bagerhat and Khulna districts. Information on other districts was unavailable with them which indicate that the association is not reaching out to regions where shrimp and prawn farming is expanding. Eighty Seven (87%) of the respondent farmers reported that they are not members of any group or association (source: primary study) which further reveals that the association is yet to benefit most of the farmers. Besides, participation of the small farmers is also found to be low in the association. Nevertheless, it was found that the association has capable leadership and with facilitation from the program they can expand their capacities.

BFFEA (Bangladesh Frozen Foods Export Association), the association of the shrimp processors and exporters is very active and have operational relationship with several development programs and the government. They are thus in a position to support the program identify most pressing needs in the shrimp and prawn value chains which can be leveraged by the FtF program to determine development priorities based on the experience from the previous programs. Most of the executive committee members in BFFEA are from the southern region as the region holds the major share of the total national production and supply. This works as an advantage for the region.

Associations for depots and arots are usually regional. National forum for the traders do not exist. Although in terms of production, Bagerhat is much larger than Khulna, Khulna serves as the nodal point for the regional trade. The groups and associations in Khulna are therefore stronger than other regions and are also much more active.

3.4.5 Market/ business information

Market or business information in the industry is not accessible for all the actors. As the market is totally demand driven, it is very important that there is a smooth flow of information within the value chain. Producers are often unaware about any changes in price or quality from the buyer's side. Farmers do not always know what specific size or species of shrimp can make them more profitable. Also Bangladeshi shrimp is losing some markets, but the farmers do not have clear idea about why the markets are being lost.

3.4.6 Transportation and Packaging

Quality of shrimp and prawn deteriorates as it passes through several intermediaries who bulk and de-bulk and conduct some intermediate processing before the product reaches the processors. The process takes about 24 hours. Several modes of packaging and transportation are used as shown in table 10. Use of *chill kill* process is recommended to avoid quality deterioration. This would require large volume of supply of ice which is not feasible because of lack of uninterrupted electricity supply. Besides, the process will increase cost of price. The processors are not interested to pay the premium as according to them they don't face difficulty in selling the produce even though the quality of the exported product is not compliant to the standard. Since the pressure for ensuring compliance

and traceability is increasing, the need to ensure better transportation and packaging for quality control during transportation is expected to grow.

The mortality in transportation of shrimp PL (20-30%) is very high. Around 60% of the shrimp PL from Cox's Bazaar is transported by air while the rest 40% is transported by truck. Mortality is high with the PL transported by truck. Besides, significant percentage of the PL that survives becomes weak and this leads to high mortality upon release of the PL in the gher. Knowing this, the farmers usually over-stock to compensate for the loss.

Table 3.10: Mode of transportation and packaging for shrimp and prawn in the southern region in Bangladesh; Source: Primary Study

Actor	Mode of Transportation	Product	Packaging Materials
Brood Collector	*Trawler*	Brood	Container
Hatchery (Shrimp)	Truck or Cargo plane	Naupli	Container
Hatchery Agent (Shrimp)	Sales centre	PL	Oxygenated polybag
Hatchery (Prawn)	Sales centre	PL	Oxygenated polybag
Wild PL Trader	Van	PL	Oxygenated polybag
Farmer	Head load, Rickshaw/Van (Three wheel non-mechanized man-driven carrier)	Raw shrimp/prawn	Basket
Faria	Head load, Rickshaw/Van (Three wheel non-mechanized man-driven carrier)	Raw shrimp/prawn	Patil/Basket
Bepari	Truck: Cargo carrier (Non-refrigerated) Pickup: Small lorry	Raw shrimp/prawn	Container
Depot	Truck: Cargo carrier (refrigerated) Pickup: Small lorry	Raw shrimp/prawn	Plastic Container
A/C Holder	Truck: Cargo carrier (refrigerated)	Raw shrimp/prawn	Container
Processor	Ship/ Cargo plane	Processed shrimp/ prawn	Specialized Container

3.6.7 Access to Finance

Need for loan / financial support is higher for prawn, as the initial investment in prawn farming is higher than shrimp farming because of high price of feed and PL. Credit is usually availed by the farmers informally from the *arotdars* and the *depots.* The credit is provided as a conditional loan to ensure supply. Usually, the arotdars directly procure the PL and feed and supply to the farmers at a price higher than the market rate. They deduct the cost for PL and feed and the commission on sales and pay the balance to the farmers. This reduces the value for the farmers. Nevertheless, the

farmers prefer this informal mechanism for credit as it can be easily availed. Farmers are usually reluctant to avail bank loans because of high interest rate (around 18%). Banks are also found reluctant to provide loans because of high risk of production failure. The credit requirement is higher than the cap for loan used by the micro-finance institutions (MFIs). Flow of cash in the backward and forward linkages is governed by the account holders. Since the processors do not pay on cash, much of the trade between the intermediaries is based on credit rather than on cash payment. Farmers usually sell on cash to the arotdars. However, if sold directly to the depots, as much as 50% is sold on credit.

3.5 Assessment of Business Enabling Environment (BEE)

Government subsidy on export, support from several development programs, leadership of BFFEA and the National Shrimp Farmers' Association are some of the key factors that are conducive for the business environment. However, anti-shrimp movement and the recent policing of the government against expansion of shrimp production, dysfunctional PCR labs, lack of traceability system and weak quality control system etc. are hindering growth. Table 3.11 summarizes the factors that are facilitating growth and factors that are hindering growth of the shrimp and prawn value chains. The anti-shrimp movement and its effect on the shrimp industry is summarized in the snapshot.

Table 3.11: Business Enabling Environment in the Shrimp and Prawn Value Chains in the Southern Region in Bangladesh

Facilitating	Hindering
• ***10% subsidy by the Government:*** The government provides 10% subsidy on export of processed shrimp and prawn. The policy insulates the industry to certain degree from global meltdown of markets for shrimp and prawn.	• ***Anti Shrimp movement:*** The anti-shrimp movement which has been going on for several decades has gathered momentum in recent times as the NGOs driving the movement recently won a law-suit against expansion of shrimp production in the region.
• ***Presence of organized associations:*** BFFEA and the National Shrimp Farmers' Association are organized and have capable leadership. The associations are driving growth of the industry through policy advocacy and partnership with development partners and projects for compliance.	• ***Govt. policy undefined with Vannamei:*** Even though BFFEA has been advocating for introduction of Vannamei, the government's stance on Vannamei is unfavorable. Introduction of Vannamei could foster growth in export. However, there are concerns on its impact on the eco-system.
• ***Support from several ongoing development programs:*** The DfID funded Katalyst project has been facilitating growth of the prawn value chain since 2006 through Winrock International. The project has piloted several interventions on improving quality of PL, promoting HPL, introducing semi-intensive culture for prawn etc. The USAID funded PRICE project has worked extensively on issues like Nitrofuron. Coordination with	• ***Dysfunctional PCR labs:*** Functional PCR labs are required to control virus attack especially in production of PL of shrimp. It is recommended that the hatcheries test the brood for virus before collecting egg. It is also recommended that the *naupli* is tested for virus before it is nursed to produce PL. There are five PCR labs in the country of which 3 are managed by DoF in Cox's Bazaar, Satkhira and Khulna districts, one is managed by ICDDRB in Dhaka and the

these programs could provide leverage for the FtF program to deepen impact on the shrimp and prawn value chains.

- ***Presence of strong clusters:*** Bagerhaat, Satkhira and Khulna have strong shrimp and prawn clusters characterized by large number of producers, traders, collection points and markets. There are several local associations of traders and producers in these clusters and all associated services like transportation, packaging materials, labor contractors etc. have evolved in the clusters. This provides opportunity to increase competitiveness of the shrimp and prawn value chains by strengthening network between the actors in the clusters.

other one is in Khulna University. Of the five, only the one in Cox's Bazaar is said to be used occasionally especially with support from WorldFish Center. Lack of demand from the hatcheries for PCR lab test is said to be the major constraint for operationalizing and sustaining the PCR labs. Besides, there is no premium for virus free PL which reduces the demand from the hatcheries to conduct lab test of the brood and the PL.

- ***Adulteration during intermediate processing:*** Adulteration practices like *pushing* is a major threat for the shrimp and prawn exported from Bangladesh. The issue is recognized by the processors and exporters as well as the other value chain intermediaries and it has been reported that the *depots* are reluctant to procure from the *farias* as they believe the adulteration is usually done by the *farias.* According to the respondents, adulteration takes place at various level and are usually unaccounted for because of lack of policing and quality control.

Snapshot: Anti shrimp movement and its effect on the shrimp industry in Bangladesh:

According to key informants, as gher culture became popular for shrimp production the gher owners started occupying land from other small farmers. In the 1980s some influential local elites started to cut embankments developed by the water development board in 1960s in order to run the saline water to the land used for producing rice. These triggered conflict between the rice farmers and gher owners in three coastal districts- Satkhira, Khulna and Bagerhat. On November 7, 1990 some armed men led by an industrialist headed to cut an embankment situated in Horinkhola, Khulna. The local people of that area gathered to prevent them. A lady named Korunamoyee Sardar died on the spot in the middle of shoot-out. After the murder of Korunamoyee the people of that area promised that they would never let the shrimp farmers cut their embankments. Later different NGOs like "Nijera Kori", "Uttaran" etc. raised their voice against the murderers of Korunamoyee and helped to foster anti shrimp movement.

The situation improved in late 90's when different associations like BFFEA, National shrimp farmers association started advocacy on policies and created awareness to diminish the 'land grabbing' practice. Besides, because of increasing salinity, it became difficult for the farmers to cultivate rice especially in the coastal areas in Satkhira and Khulna. Farmers thus started to culture shrimp willingly.

Recently 'BELA', an NGO, filed a law-suite for ban of shrimp in rice producing lands and the high court gave verdict in favor of the plaintiff. On its note the high court said ***"Having given our anxious consideration to the facts & circumstances of the case we are inclined to direct the respondent to take effective measures to prevent the forced flow of saline water in the***

existing agricultural lands, of the coastal districts by the shrimp cultivators till disposal of the rule."

The policy thus does not dictate ban of shrimp production. It rather bans forced flow of saline water in the existing agricultural lands for shrimp production. Reportedly, the verdict is being used to restrict shrimp production in general and there is confusion and collision between the NGOs leading the anti-shrimp movement and the organizations and actors involved in shrimp production. If the verdict is used to restrict shrimp production in areas which are being naturally saline, the farmers will be left vulnerable to economic shocks and the level of poverty will increase since these farmers will not have options for engagement in productive economic opportunities. It is thus essential to facilitate collaboration between the NGOs, the associations and the key stakeholders in the shrimp industry to promote 'Sustainable Environment Friendly and Economically Viable' culture practice which has recently been coined by BFFEA as a strategy to counter the anti-shrimp movement.

3.6 SWOT Analysis

3.6.1 SWOT for Shrimp Value Chain

Strengths	**Opportunities**
- Bangladesh is globally recognized for shrimp production; currently 12th in terms of volume of export - Seventy percent (70%) of the total national production comes from the southern region; the region holds the key to sustainable export of Shrimp for Bangladesh - Favorable ecological conditions for production - Actors are mostly specialized performing a single function in the value chain - Involvement of large number of women (about 20,000) in formal processing activities - High value addition and gross profit margin at grow-out and processing level - The association of the processors and the shrimp farmers is active and functional; they played the key role in sustaining the industry during crisis like ban of export in EU because of traces of nitrofuron - The government provides 10% subsidy on shrimp export; this insulates the industry from short term meltdowns in global markets - Several development programs are engaged in development of the industry; coordination and collaboration among the development programs can help foster development - Presence of strong clusters provide opportunity to increase competitiveness of	- Withdrawal of the mandatory screening of 20% of the consignments in the EU market - Increase in export in EU - Netherland replacing Belgium as the trade gateway to the EU - Increasing export to new markets like Russia, India, Saudi Arabia - Potential to export value added shrimp products to Japan - Rice farmers in the coastal regions of Satkhira and Khulna are being displaced because of increase in salinity; shrimp production can be an alternative in areas that are being unsuitable for rice cultivation - Potential to increase productivity through introduction of semi-intensive culture - Potential to create more jobs for women if the capacity of the processing factories are properly utilized - Potential to create more jobs for women by promoting value added shrimp products - Low value added and gross profit margin at the intermediary level; intermediaries like *farias* are expected to grow out of business; this can potentially reduce adulteration, increase spread of value added and improve traceability

the industry by strengthening networks among the actors in the clusters in Bagerhaat, Shatkhira and Khulna districts	
Weaknesses - Productivity is low and has remained stagnant for a long time - Low trust between the value chain actors restrict collecting bargaining and cooperation - Government subsidy on export and favorable market attracted larger number of processors in the value chain in contrast to the number of trading intermediaries; 19 account holders (commissioning agents) serving 149 processors and around 1000 depots has created an imbalance in power system which restricts quality control, flow of market information and pricing and fosters adulteration - Poor quality of shrimp PL - Scope for involving small scale farmers is low; production is dominated by large farmers - Despite being threatened by EU; quality assurance and certification has remained weak and dysfunctional due to lack of policing - Dependence on NGOs and projects for training and information on technical issues; reach of DoF, BFRI and other project activities is largely concentrated in major production pockets in Satkhira, Khulna and Bagerhaat; farmers in other regions hardly have access to training and extension support - Information on market price, quality etc. do not reach out to the small farmers - Lack of interest to do lab test for brood and PL as the hatcheries are not sure whether the farmers are willing to pay premium for virus free PL - High mortality of shrimp PL during transportation and poor quality of PL results overstocking of shrimp PL - Intermediate processing like *chill kill* at the farm gate is not practiced because of lack of uninterrupted electricity supply; besides, the processors still do not feel the incentive to strengthen quality control mechanism at the farm gate since it has not been a cause of market failure for the processors	**Threats** - Decline in export in USA because of recession and failure to compete in price against Vannamei - Overall decline in volume (12%) and value of export (11%) - Restriction in horizontal expansion because of anti-shrimp movement - Confusion on high-court verdict on shrimp production is restricting production in areas that are unsuitable for cultivation of rice but suitable for shrimp - Virus attack in shrimp PL; reasons unknown - Virus attack has forced shrimp farmers to shorten the production cycle to 2 months and sell low graded shrimp for low market price - Threat of ban from EU if quality control processes and traceability system is not established by 2014 - Women involved in informal intermediate trading might be displaced once quality control system is established - Anti-shrimp movement has gathered momentum because of high-court directive on ban of shrimp in rice cultivation land; the actors in the value chain as well as the NGOs driving the movement have conflicting interpretation of the verdict and have hostile attitude towards each other; this has aggravated the tension and threatened production of shrimp in general

3.6.2 SWOT for Prawn Value Chain

Strengths	Opportunities
- Approximately 95% of the total national production comes from the southern region; the region holds the key to sustainable export of prawn for Bangladesh - Strong and sustained niche market for prawn in EU - Horizontal expansion of prawn triggered by favorable market price and demand - Actors are mostly specialized performing a single function in the value chain - Presence of relatively larger number of small farmers increases the scope for the project to contribute to poverty alleviation - Involvement of large number of women (about 20,000) in formal processing activities - High value addition and gross profit margin at grow-out and processing level - The association of the processors and the shrimp farmers is active and functional; they played the key role in sustaining the industry during crisis like ban of export in EU because of traces of nitrofuron - The government provides 10% subsidy on prawn export; this insulates the industry from short term meltdowns in global markets - Several development programs are engaged in development of the industry; coordination and collaboration among the development programs can help foster development - Presence of strong clusters provide opportunity to increase competitiveness of the industry by strengthening networks among the actors in the clusters; especially in Bagerhaat	- Withdrawal of the mandatory screening of 20% of the consignments in the EU market - Increase in export in EU - Netherland replacing Belgium as the trade gateway to the EU - Increasing export to new markets like Russia, India, Saudi Arabia - Potential to export value added prawn products to Japan - Market for prawn has opened up further in the EU market since competing countries like Thailand and Vietnam are focusing more on Vannamei to cater to the US market - Potential to position prawn as high price-high quality product in EU - Potential to increase productivity through introduction of semi-intensive culture - Potential to expand production through shrimp-prawn polyculture - Potential to create more jobs for women if the capacity of the processing factories are properly utilized - Potential to create more jobs for women by promoting value added shrimp products - Increase in price of WPL, reduction in catch and increasing policing has increased the market potential for HPL - Low value added and gross profit margin at the intermediary level; intermediaries like *farias* are expected to grow out of business; this can potentially reduce adulteration, increase spread of value added and improve traceability
Weaknesses	**Threats**
- Poor quality and low volume of supply of HPL because of lack of capacity of the hatcheries - Low demand for HPL triggered by low quality of HPL and lack of trust on HPL - Productivity is low and has remained stagnant for a long time - Low trust between the value chain actors restrict collecting bargaining and	- Dependence on EU for market share increases market failure risk if EU instruction for compliance is not adhered to by 2014 - Threat of ban from EU if quality control processes and traceability system is not established by 2014 - Overall decline in volume (12%) and value of export (11%) - Dependence on wild PL - Informal intermediate processing, like

cooperation - Government subsidy on export and favorable market attracted larger number of processors in the value chain in contrast to the number of trading intermediaries; 19 account holders (commissioning agents) serving 149 processors and around 1000 depots has created an imbalance in power system which restricts quality control, flow of market information and pricing and fosters adulteration - Despite being threatened by EU; quality assurance and certification has remained weak and dysfunctional due to lack of policing - Dependence on NGOs and projects for training and information on technical issues; reach of DoF, BFRI and other project activities is largely concentrated in major production pockets in Satkhira, Khulna and Bagerhaat; farmers in other regions hardly have access to training and extension support - Dependence on the value chain intermediaries like depots and arotdars for credit - Information on market price, quality etc. do not reach out to the small farmers - Intermediate processing like *chill kill* at the farm gate is not practiced because of lack of uninterrupted electricity supply; besides, the processors still do not feel the incentive to strengthen quality control mechanism at the farm gate since it has not been a cause of market failure for the processors	beheading by the depots, increases the risk of non-compliance - Large number of women involved in collection of WPL; program intervention on promoting HPL might create unemployment for the landless ultra-poor, especially the women, if alternative income earning opportunities are not promoted

3.7 Summary of Constraints

3.7.1 Constraints in the Shrimp Value Chain

Value Chain Function	Constraint
Brood Collection, PL supply and Nursing	• Lack of demand for virus free PL reduces the incentive of the hatcheries to conduct lab test • Lack of skill training services and refresher courses has resulted weak capacity of the hatchery technicians to produce quality PL • High mortality resulting from inappropriate transportation practices
Grow-out	• Lack of incentive among the farmers to adopt improved farming practices because of high gross profit margin and high value added at grow-out stage

	• Hostility between the NGOs advocating ban on shrimp and the key stakeholders in the shrimp industry has resulted collision and restricted horizontal expansion of shrimp production in the region • Lack of formal sources for credit has fostered dependence on informal sources like arotdars
Trading, Processing and Export	• Lack of policing for quality control across the value chain has fostered adulteration practices like pushing • Lack of awareness among the processors about long term threats of ban has weakened incentive for quality control and compliance • Presence of large number of intermediaries between the farmers and the processors makes it difficult to ensure a traceable distribution system • Dependence on EU for market share has increased risk of market failure because of non-compliance

3.7.2 Constraints in the Prawn Value Chain

Value Chain Function	Constraint
Brood Collection, PL supply and Nursing	• Dependence on wild PL is a long term threat to the sustainability of prawn production • Poor quality and low volume of supply of HPL because of lack of capacity of the hatcheries
Grow-out	• Lack of incentive among the farmers to adopt improved farming practices because of high gross profit margin and high value added at grow-out stage • Low demand for HPL triggered by low quality of HPL and lack of trust on HPL • Lack of formal sources for credit has fostered dependence on informal sources like arotdars
Trading, Processing and Export	• Lack of policing for quality control across the value chain has fostered adulteration practices like pushing • Lack of awareness among the processors about long term threats of ban has weakened incentive for quality control and compliance • Presence of large number of intermediaries between the farmers and the processors makes it difficult to ensure a traceable distribution system • Dependence on EU for market share has increased risk of market failure because of non-compliance

3.8 Recommendations

3.8.1 Value Chain Upgrading Strategy for Shrimp Value Chain

Addressing Constraints

- Supporting hatcheries to create demand for virus free PL
- Partnership with DoF and BFRI to introduce training programs and refresher courses for hatchery technicians
- Action research on improved transportation in partnership with BFFEA and in collaboration with international organizations having relevant expertise
- Demonstrating benefit of improved production practices in partnership with National Shrimp Farmers' Association and in collaboration with DoF and BFRI
- Facilitating coordination and collaboration between DoF, NGOs working for anti-shrimp movement, BFFEA and National Shrimp Farmers' Association
- Action research on credit schemes for shrimp farmers
- Building capacity of BFFEA to develop a sustainable system for traceability to reduce adulteration
- Supporting BFFEA to create awareness amongst the processors and trading intermediaries about the need for quality control and compliance

Availing Opportunities

- Fostering cluster development by strengthening networks between the different actors within the clusters in Bagerhaat, Satkhira and Khulna districts

- Collaboration with other development programs (Katalyst, PRICE) in partnership with BFFEA and the National Shrimp Farmers' Association to develop a five year action plan for the development of the shrimp industry in Bangladesh
- Action research on value added shrimp products to diversify market
- Promoting shrimp from Bangladesh in new markets like Russia, Saudia Arabia and India to diversify market

3.8.1 Value Chain Upgrading Strategy for Prawn Value Chain

Addressing Constraints

- Partnership with BFRI to improve capacity of hatcheries to produce quality HPL
- Linking hatcheries with international organizations like AIT and NACA to develop their capacity to produce quality HPL
- Supporting hatcheries to create demand for HPL through demonstration and mass media campaign
- Partnership with DoF and BFRI to introduce training programs and refresher courses for hatchery technicians
- Action research on improved transportation in partnership with BFFEA and in collaboration with international organizations having relevant expertise
- Demonstrating benefit of improved production practices in partnership with National Shrimp Farmers' Association and in collaboration with DoF and BFRI
- Facilitating coordination and collaboration between DoF, NGOs working for anti-shrimp movement, BFFEA and National Shrimp Farmers' Association
- Action research on credit schemes for shrimp farmers
- Building capacity of BFFEA to develop a sustainable system for traceability to reduce adulteration
- Supporting BFFEA to create awareness amongst the processors and trading intermediaries about the need for quality control and compliance

Availing Opportunities

- Fostering cluster development by strengthening networks between the different actors within the clusters in Bagerhaat, Satkhira and Khulna districts
- Collaboration with other development programs (Katalyst, PRICE) in partnership with BFFEA and the National Shrimp Farmers' Association to develop a five year action plan for the development of the prawn industry in Bangladesh
- Action research on value added prawn products to diversify market
- Branding and promoting prawn from Bangladesh as high price-high quality commodity targeting the EU market

Chapter 4: Tilapia Value Chain

4.1 End Market Analysis

4.1.1 Main markets and buyers

Unlike shrimp and prawn, the main market for Tilapia practically refers to the domestic market in Bangladesh. Tilapia is now a widely accepted species which is consumed by people across almost all the income groups. The trend of Tilapia consumption reflects its popularity over other fish species. Tilapia is sold at a maximum price of BDT 120 per kg at farm-gate in the Southern region of Bangladesh. Local retailers buy Tilapia from Arots, where farmers sell their produces in a competitive bidding process. Buyers, who buy from Arot, sometimes send to the regional Arots where urban retailers buy for the urban markets. Due to the high prices of Tilapia in local markets and regional markets, it is not suitable for the Arots to sell outside the respective region such as in Dhaka. In Karwan Bazar, the biggest Arot of Dhaka city, Tilapia mainly comes from Mymensingh, Comilla and Bogra. And the average price of Tilapia ranges from BDT 100 to 110 per kg at the Arots of Dhaka. Therefore, local and regional Arots find better price in their regional markets and consequently they remain reluctant to sell their Tilapia in the markets of Dhaka.

End market buyers in this region usually pay a higher price for Tilapia (BDT 140-150 per kg) and it is higher than the same in some producing districts and Dhaka. Yet the price of Tilapia is still lower compared to other available species in local market. Only few species like Carps and Pangus are sold at lower price than Tilapia. However, as consumers find Tilapia tastier than Pangus and do not usually get any bad smell, they prefer Tilapia to other species. The popular size of Tilapia makes up a kilogram in weight with 6-7 pieces in number. In local markets, live Tilapia is sold at a bit higher price adding at least extra BDT 10 per kilogram. Larger Tilapia gets more price than the regular sized Tilapia. The study found that most of the farmers produce Tilapia of the popular size, which requires 6-7 pieces to make a kilogram i.e. the average weight of each Tilapia ranges from 140-170 gram approximately. Some large farmers produce even larger sized Tilapia weighing 250 gram or above in average. This type of Tilapia is sold at further higher price ranging from BDT 160-180 per KG in the end market. Usually large farmers try for a larger sized Tilapia that requires a lengthy cultivation period of 6-7 months, while small and medium farmers opt for popular market sized Tilapia mentioned earlier.

In Barisal region, everyday two trucks of Tilapia come from Mymensingh carrying 1.6 MT each (Innovision Field Observation 2012). This Tilapia arrival seems to be rational as the region has more price than the mainstream markets of Dhaka and its vicinity. However, the study team did not find any other district that has this type of linkage with distant markets.

4.1.2 Market Prospect

In the short-run i.e. in next five years, increase in production of Tilapia may increase the income of the farmers as demand of Tilapia is getting higher in the local markets. Field study found that more

than 50% of Tilapia is sold in the rural markets and the retailers sell it to the rural buyers. This reflects strong demand in the rural markets for Tilapia. Moreover, during the lean period of capture fishes, price of Tilapia goes higher than the present market rate. In Urban markets, Tilapia has external market linkage with some other producing region like Mymensingh. Price of Tilapia in the Southern region attracts producer of remote location. Increasing trend of consumption of Tilapia shows strong domestic demand in the region.

Though, in near future, there is an ensured access to the domestic market (more specifically regional markets) for Tilapia producers considering population growth, decreasing supply of marine and capture fishes and high price of other fishes, there is a possibility of saturated market demand in the long run. In recent years, Pangus and Thai Koi faced this type of saturated market demand which eventually resulted in lower price of the species and caused loss of the producers. Some Pangus and Thai Koi producers switched to Tilapia production after incurring loss in Pangus and Koi culture. Price of Tilapia also decreased significantly in top producing areas like Mymensingh, Comilla and Bogra that poses a great threat for the future market of Tilapia.

Export of Tilapia remains a far cry in Bangladesh due to the high production cost and high local price compared to its efficient rivals - China and Thailand. In spite of noncompetitive price in global market, an insignificant amount of whole Tilapia is exported from Bangladesh. Sometimes, processors afford Tilapia in the container just to make it full while their prime targets are shrimp and prawn export. Some processing plants sell a small amount of whole Tilapia to some ethnic markets in abroad (Anwar 2010).

Asian countries play a significant role in Tilapia export all over the world as 72% of export of Tilapia originated from the Asia (FAO 2012). China is the leader in the world to export Tilapia and US is the main market. Around 45% of the export of Tilapia of China is in fillet form (FAO 2012). Competiveness of China in Tilapia export can be inferred from the recent whole Tilapia export to African countries like Cameroon, Ghana and Namibia whereas African regions started cultivation of Tilapia and exporting it as well. However, whole Tilapia is exported at a market price of USD 1 to 1.2 (source: Alibaba.com) which is far below the price of Tilapia in domestic markets of Bangladesh. Again, Tilapia fillets are sold at USD 3.2 to 3.6 (source: Alibaba.com). In order to make one kg of fillet, a total of 3 kg Tilapia weighing 300-500 gram each will be required as only 40-50% of the bio-mass of Tilapia can be used for the Tilapia production. Rest amount of bones, guts and heads have to be removed. In Bangladesh, there is no other support industry which may utilize the bio-product for fish meal production. Processing plants may also think for new value added product using the bio-products of the fillet. Unless and until these supports industries are in place, Bangladesh will not achieve the competitiveness to enter the market of the Tilapia fillet.

4.2 Production Trends

4.2.1 Species

There is a long history of different species of tilapia farming in Bangladesh. The Mozambique tilapia (*Oreochromis mossambicus*) was introduced to Bangladesh from Thailand in 1954 (Ahmed1996). However, this species was not widely accepted for aquaculture because of its early maturation and industriously breeding resulting in overcrowd in ponds. The Chitralada strain of Nile tilapia (*O.*

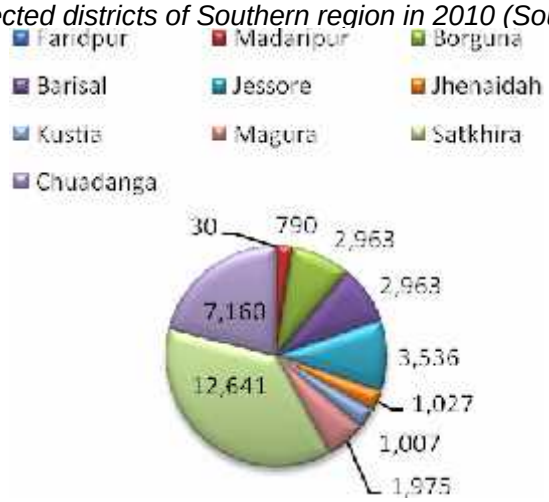
niloticus), a far superior farmed tilapia (faster growing and more manageable than the Mozambique tilapia) was introduced to Bangladesh from Thailand by the UNICEF (United Nations International Children's Emergency Fund) in 1974 (Ahmed 2009). Nevertheless, Nile tilapia farming was slow to develop as most farmers were interested to grow-out carps. Gradually, the red tilapia (hybrid of *O. mossambicus* x *O. niloticus*) was imported to Bangladesh from Thailand. The Bangladesh Fisheries Research Institute reintroduced Nile tilapia and Red tilapia from Thailand in1987 and 1988 (Gupta et al., 1992). Genetically Improved Farmed Tilapia (GIFT) was introduced to Bangladesh by ICLARM (now WorldFish Centre) in 1994, which was further improved by BFRI (Hussain et al., 2004).

Performance of GIFT was found to be significantly superior to that of tilapia previously introduced. Technology was developed to produce all male tilapia or sex-reversed GIFT locally known as mono-sex tilapia to avoid the unwanted reproduction. Male Tilapia grows faster than female which is also another important reason. Introduction of GIFT and its subsequent strains contributed to the dramatic increase of Tilapia in Bangladesh (Hussain 2009). GIFT and Mono-Sex are now widely cultivated species of Tilapia in Southern Bangladesh. In addition, some other species of Tilapia can be found in the natural sources which have the origin with the different species that Bangladesh imported since 1954 (Anwar 2010).

4.2.2 Regional distribution, growth trends, and opportunities for expansion

It can be estimated from the Department of Fisheries data that nearly 35% of the total production of Tilapia is coming from the 20 districts i.e. project area of WorldFish Centre "Feed The Future" project. These 20 districts have the pond area of 99,615 ha (estimated from the DOF Fisheries Statistical Yearbook 2010-11). As Tilapia is relatively new for the cultivation in the region, value chain of Tilapia followed the fin fish Value Chain and it is the fin fish farmers who are replacing their carps and/or starting mix culture of Tilapia and Carps. Primary data revealed that 80% of the farmers cultivate Tilapia with other species and the rest 20% are doing mono-culture of Tilapia. From the data available at Department of Fisheries Statistics Yearbook 2010-2011, it can be estimated that Satkhira is the top producer of Tilapia in Southern region followed by Chudanga and Jessore. Approximately, 10,000 hectares of land are used for Tilapia production in the region. Increase in number of hatcheries and their sales to local farmers reflect the expansion of Tilapia farming in the region. Unfortunately statistics of Tilapia was not calculated and kept properly in the past which made it difficult to estimate the growth the sector. However, field observation found that most of the farmers of Barisal region started Tilapia cultivation in last 2-3 years whereas farmers of Khulna region started in last 5-6 years.

Figure 4.1: Estimated Tilapia production (MT) in selected districts of Southern region in 2010 (Source:



Increase in production of Tilapia has an important implication for the Southern region in terms of fish intake. Unlike Shrimp and Prawn, farmers are used to consume a 5-10% (Field observation September 2012) of their produced Tilapia in households. As shrimp and Prawn have high market price, farmers want to sell it as cash crop and usually do not eat Prawn and Shrimp from their ponds/ghers. In addition, Tilapia farming gives farmers a guaranteed return of their investment due to the ensured market access, low mortality and resistance to diseases. The main area of expansion of Tilapia would be cultivation of Tilapia with other species. As most of the farmers of the Southern region are practicing Polyculture of Prawn and/or Shrimp with White Fishes, there is opportunity to include Tilapia in their cultivation pattern to ensure maximum utilization of all layers of their ponds/ghers. Moreover, the region is producing Tilapia only in 10,000 hectare of land whereas the region has nearly 90,000 hectares more hectares of water areas where Tilapia can be expanded.

4.2.3 Productivity/Yield

Productivity of Tilapia is found 3.34 MT per hectare which is low compared to other efficient producing areas like Mymensingh, Comilla and Bogra where productivity is much higher. A market study done by USAID PRICE project found that intensive farming of Tilapia may bring above 15 MT productions per hectare.

Table 4.1: Comparison of Productivity/ Yield of Tilapia

Intensive Farming, 15 ton or above/ha	Semi Intensive Farming roughly 10-14 ton/ha	High Density Farming roughly 8-9 ton/ha
Bogra	Joypurhat	Pabna
Norshindi	Brahmanbaria	Feni
Jhenaidah	Jessore	Noakhali
Kishoregongj	Dinajpur	Chaudanga
Naogaon	Satkhira	Gaibandha
Kustia	Jessore	Hobigonj
Netrokona	Mymensingh	Shariatpur
Jamalpur	Sherpur	Madaripur
	Tangail	

Source: Anwar 2010

Table 4.1 shows different level of productivity in different regions. However, these productivity figures are for the individual farms which do not represent the average production of the region. A standard farm may produce around 8 MT of Tilapia in one hectare of lands using semi-intensive method of farming with an average stocking of 200 fry in per decimal lands. However, 80% of the farmers of the Southern region produce Tilapia with other fin fishes and their average production of Tilapia is low. But they get an average of 2.5 MT other fin fishes (mainly carps) in their ponds along with the Tilapia.

4.3 Description of the Value Chain

4.3.1 Functions, Actors and their Roles

Brood Supply: Unlike Shrimp and Prawn, broods are supplied by BFRI and other hatcheries through personal collection. Hatcheries maintain their own brood stock. Sometimes hatcheries collect broods from other Tilapia producing countries like Philippines, Thailand and Vietnam. WorldFish is also playing a key role to develop brood stock of the country.

Hatching: A total of 30 hatcheries are located in Southern region. Hatchery is the key value chain actor that contributes to expansion of Tilapia farming in the region. Hatcheries produce fry from the eggs of the broods. Then they apply hormone in the new born fries for making them mono-sex i.e. all male. After the hormone treatment, hatcheries sell the fries to farmers and fry traders.

Fry Trading: Primary data suggests that roughly 160 fry traders are selling Tilapia fry to the farmers of the Southern region. Fry Traders also play a key role in providing information to the farmers on farming of Tilapia. Fry traders buy from the hatcheries in bulk and sell those to the farmers. Sometimes, fry traders buy fry from the small farmers who stocked GIFT Tilapia and produced some fries in their ponds.

Input Supply: Input suppliers are the retailers of the Feed companies and Aqua-chemical companies. They sell essential inputs of fish farming, which include Factory made feed, Ingredients of homemade feed, different aqua-chemicals and pesticides, to the farmers. It can be estimated that around 3,200 retailers are there in the region. These input suppliers are the important channel for the dissemination of information. Private sector companies provide different types of technical information and supports through their retailers and distributors. These supports include training sessions, demonstrations, field days, water and soil test, farmers' gathering etc. Business incentives of the private sectors motivate them to do this type of activities.

Grow out farming: From the primary data it can be estimated that roughly 10,000 farmers are producing Tilapia in the 13,000 hectares of land in Southern region. However, around 80% of them produce Tilapia with other fin fishes whereas the rest 20% farmers practice mono culture of Tilapia. Farmers buy fry from the hatcheries, fry traders and fellow farmers and produce marketable sized Tilapia. It takes 4-6 months for the farmer to get marketable size of Tilapia. Usually farmers start to sell Tilapia when they become above 140 gram. Farmers sell their produced Tilapia to Paikers and Retailers through Arots.

Wholesaling: Arots work as the wholesale marketplace where farmers sell their produced Tilapia to the Paikers and Retailers. Arotdars usually keep a Table in the rural markets and farmers place their produces on the table. Then, an auction takes place and highest bidder gets the products. Arotdars take a commission of TK. 2-5/ kg for their facilitation.

Retailing: Retailers buy Tilapia from the Paikers and sell it to the end consumers. Retailers usually sell Tilapia in kg to the consumers.

Table 4.2: Actors, their functions and roles in Tilapia value chain in the southern region

Actors	Functions	Roles
Hatchery	Brood Collection and Management	Collection of broods from BFRI and other hatcheries and maintain the broodstock.
	Hatching	Hatching eggs from brood and keeping it in the tanks to complete initial nursing of newly born fries
Fry Trader	Fry trading	Buying fries from Hatcheries and small farmers and selling to the farmers. Fry traders also provide embedded information of farming knowledge for their own business incentive
Input Supply	Input retailing	Work as an intermediaries for the feed and other aqua-chemical companies. Farmers buy Feed and other inputs from the retailer.
Farmers	Production of Tilapia	Farmers stock fry in their ponds and produce marketable size (roughly above 140 gram) Tilapia. Later they sell Tilapia to the Paikers and Retailers through Arots
Arot	Wholesales facilitation	Arots act as a marketplace to facilitate bidding process and commission for their task.
Paikers	Trading	Paikers are the buyers in Arots and sell it in bulk (Usually in *Maunds*)to the retailers. Sometimes, rural Paikers sell to the Urban Paikers.
Retailers	Retailing	Retailers sell to the consumers. Usually, they have specific location in the markets and consumer buy in kg from them.

4.3 Value Chain performance

4.3.1 Hatchery, Nursery and Fry Traders

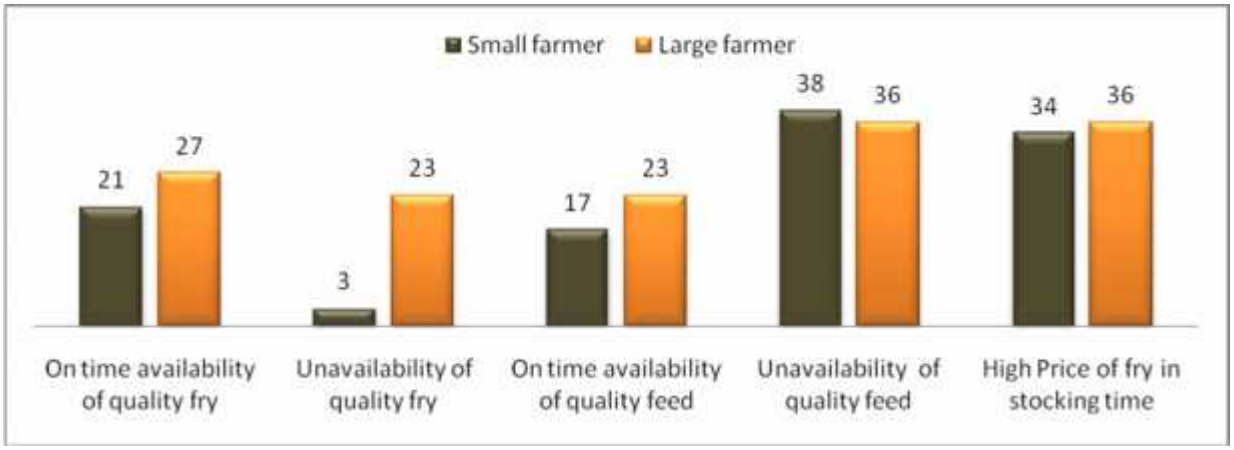
A total of 30 hatcheries are operational in the Southern region. Around 178 million of fry are produced in the region (WorldFish Centre 2011) of which 164 million (Field Survey estimation) are consumed locally. Hatcheries are collecting broods from BFRI, Mymensingh and from other hatcheries through personal connection. However, WorldFish Centre is playing a key role for the development of brood stock along with other initiatives of the different projects. Hatcheries are continuously trying to increase production of fry as they are running behind the demand of the fry in the region. Hatcheries would need skilled manpower and upgraded technology to increase their production.

Some regional hatcheries sell Tilapia outside the regional whereas some large farmers collect fry from reputed hatcheries located outside the region. Buying fry from the hatcheries outside the region significantly increases the cost of fry. Usually large farmers collect this type of fry through the agent at an average price of TK. 1,200 to TK. 1,600 per thousand. On the contrary, local hatcheries sell to the farmers at TK. 700 to TK. 1000 for every thousand of fry. Despite the price difference, large farmers are loyal to the reputed hatcheries as they always look for maximum possible percentage of all male (Mono-sex) Tilapia.

Small farmers cultivate GIFT Tilapia disregarding the sex ratio as they opt for the breeding of Tilapia in their pond which has resale value and also decrease their cost of seed. Thus they stock Tilapia which continues to breed in their ponds and they sell the residual fry to the fry traders and other fellow farmers. In addition, these farmers also apply partial harvesting method and use the new born fry for the next cultivation cycle. Quality of this type of fry is poor which may result poor output at the end of the production period.

Large farmers are very concerned about the quality of the fry they are getting. Primary data suggests that 3% of small farmers and 23% of the large and medium farmers believe that unavailability of quality fry of Tilapia is the main obstacle for the development of Tilapia farming in Southern region. Main objection about the quality of the fry is the female percentage in the lot of fry. Most of the hatcheries claim that the female ratio of their mono-sex Tilapia is 95% male whereas farmers claim they get only 80% male. Female of these Tilapias have great fecundity which overpopulates the ponds with newborn fries and make it difficult for the farmers to manage commercial culture. These fries also compete for the feeds with stocked Tilapias and reduce the growth rate. Eventually farmers incur loss.

Figure 4.2: Obstacles faced by farmers in Tilapia production
Source: Primary Study



But small farmers are not concerned about this as they want to reduce their seed cost from the fry reproduced in their ponds. They also sell this residual fry to the fellow farmers.

According to the primary data, a total of 160 fry traders were found in the region, where the traders sell fry to the farmers. Mostly, small farmers buy from the Fry Traders whereas most of the large farmers buy directly from the hatcheries. There is very insignificant portion of commercial nursery in

the region which is a matter of concern. Farmers stock fry directly to their ponds which is also an important concern.

Traditional Patilwala is endangered by the activities of the different project as new nurseries are backed by the projects and hatcheries eventually removing this important actor from the Value Chain. However, there are opportunities for the Patilwala to become a commercial nursery owner and to get engaged effectively in the Value Chain of Tilapia.

4.3.2 Feeding practice, Aqua-Chemicals and other Inputs

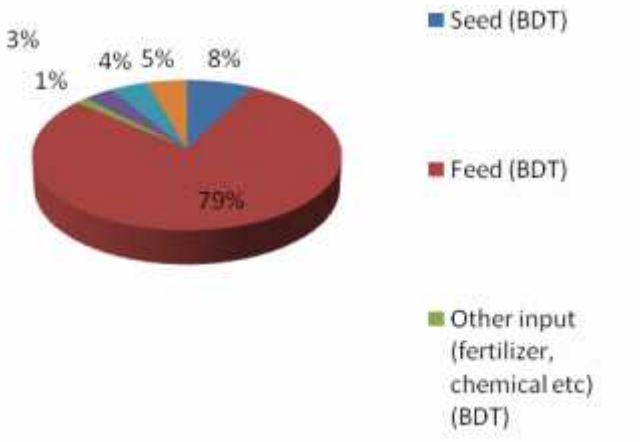
Feed is considered as the most important input after fry. Quality grade factory made feed are available in the Southern region. Almost all rural and urban markets of the Southern Bangladesh have feed retail shops. It can be estimated from the primary data that approximately 3,200 of Feed Retailers are selling feed, aqua-chemicals and other necessary inputs to the farmers. The available popular feeds are Mega Feeds, Quality Feed, ACI-Godrej etc.

However, around 38% of the small farmers and 36% of the large farmers do not have access to quality grade feed. Floating feed is most popular feed among the farmer followed by locally produced feed and homemade feed. 71% of the farmers use floating feed for their Tilapia. But some farmers use homemade feed along with the factory made feed. This homemade feed includes Rice bran, Boiled Rice, Oilcake even cow dung. Lack of knowledge of the farmers about feeding can be identified as the important concern as feeding practice has significant impact on productivity and profitability. But increasing cost of seed is a serious concern for the farmers which may have negative impact on overall usage of feed by the farmers. It was also found that small farmers fear to adopt technology as upgraded technologies lead to more costly production system. At the same time, feed companies are bound to increase the price of feed as some important ingredients of feeds are imported. Price of these ingredients is increasing over the time.

4.3.3 Grow out

Near about 13,000 farmers are found in the region who are cultivating Tilapia in roughly 10,000 hectares of land. Primary data suggests that among the farmers of Tilapia 56% farmers are small farmers having average 54 decimal of land whereas 45% are medium and large farmers having an average of 379 decimal of ponds/water areas. Value addition at the farm level is found 50% of the total Value addition which is relatively low compared to Shrimp and Prawn that have 68% and 66% value addition respectively. But a profitability figure as described earlier is much lower for Tilapia than Shrimp and Prawn as cost of feed is high. Stocking density seems to be low for the region as it was found farmers stock only 60 fry in a

Figure 4 3: Cost Composition of Tilapia Farming in Southern Region
Source: Primary study



decimal of land. Most of the farmers are cultivating Tilapia with other fin fishes. Cost of production is found TK. 283,236 per hectare which is low compared to the standard cost of production TK. 391,495 per hectare (Katalyst-Innovision training manual for Tilapia cultivation). Feed cost of Tilapia seems to be the highest portion of the total cost of production constitutes around 79% of the total cost of production.

Table 4.3: Revenue, Cost of Production and Gross Margin of Tilapia Production in the Southern Region Source: Primary Study

Particulars	Cost
Yield (kg)	3,337
Price (BDT)	116
Total Revenue (BDT)	387,089
Total Cost of production (BDT)	286,236
Seed (BDT)	21,840
Feed (BDT)	225,247
Other input (fertilizer, chemical etc) (BDT)	4,076
Labor (BDT)	9,640
Land (BDT)	12,350
Transportation (BDT)	13,084
Gross Profit (BDT)	*100,853*
Gross Profit Margin (%)	*26.1*

4.3.4 Trading

As most of the Tilapia produced in Southern region is consumed locally, the trading of Tilapia is confined in the region. Value addition of the different levels of forward market shows efficiency and competition due to the high market demand. Only a small amount of Value Additions are added in this level. Arots add 4% value whereas Paikers add 20% value. Retailers add 26% value which is higher than the Paikers but far away lower than the value addition of the farmers. Due to the consumption pattern of the people of Bangladesh, whole Tilapia is sold in the market which has limited scope of value addition for the traders. It was found in the primary data that farmers sell to Arot on an average at TK. 116 per KG and Paikers sell to the retailer on an average at TK. 130 KG. Retailers then sell at TK. 150 KG to the consumers.

4.4.5 Channels

Tilapia reaches the domestic markets through several channels. Most of the channels found were rather long involving lots of actors at different levels of the value chain. A total of 5 channels have been identified. Each channel has its district-wise dominancy. Among them the most prominent channels are:

The regular channel of Tilapia Value Chain involves *rural arots*, *paikers* and *retailers* who eventually sell to the consumers. The Arotdars get a commission of BDT 2/kg. Rural Paiker buys from Arots

and resell it rural retailers who eventually sell the same to the consumers. Paikers usually have a margin of BDT 10-12 /kg whereas rural retailers have a margin of BDT 20/ kg. Consumers of this region usually pay more than the consumers in other region. Average retail price was found to be BDT 140-150/kg.

Rural paikers sometimes send their produce to the urban area for almost the same margin that they get from *rural retailers*. *Urban paikers* sell the fish to *urban retailers*. Price of Tilapia in the urban market is not significantly different than that in the rural market and the *rural paikers* are usually indifferent about selling their products to urban or rural markets.

4.4.6 Margins and Value Added

As shown in the figure maximum value addition was done by the farmers, which is around 50% of the total value addition and TK 40 for per kg Tilapia produced in the ponds. Arot add a small portion of the value addition which is only 4% of the total value addition. Paiker add 20% and finally retailer add another 26% value.

Figure 4.4: Waterfall diagram of value added in the tilapia value chain in the southern region
Source: Primary Study

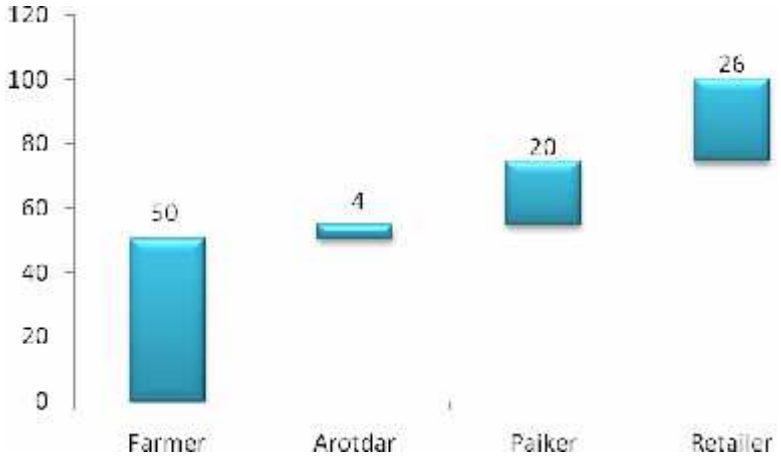
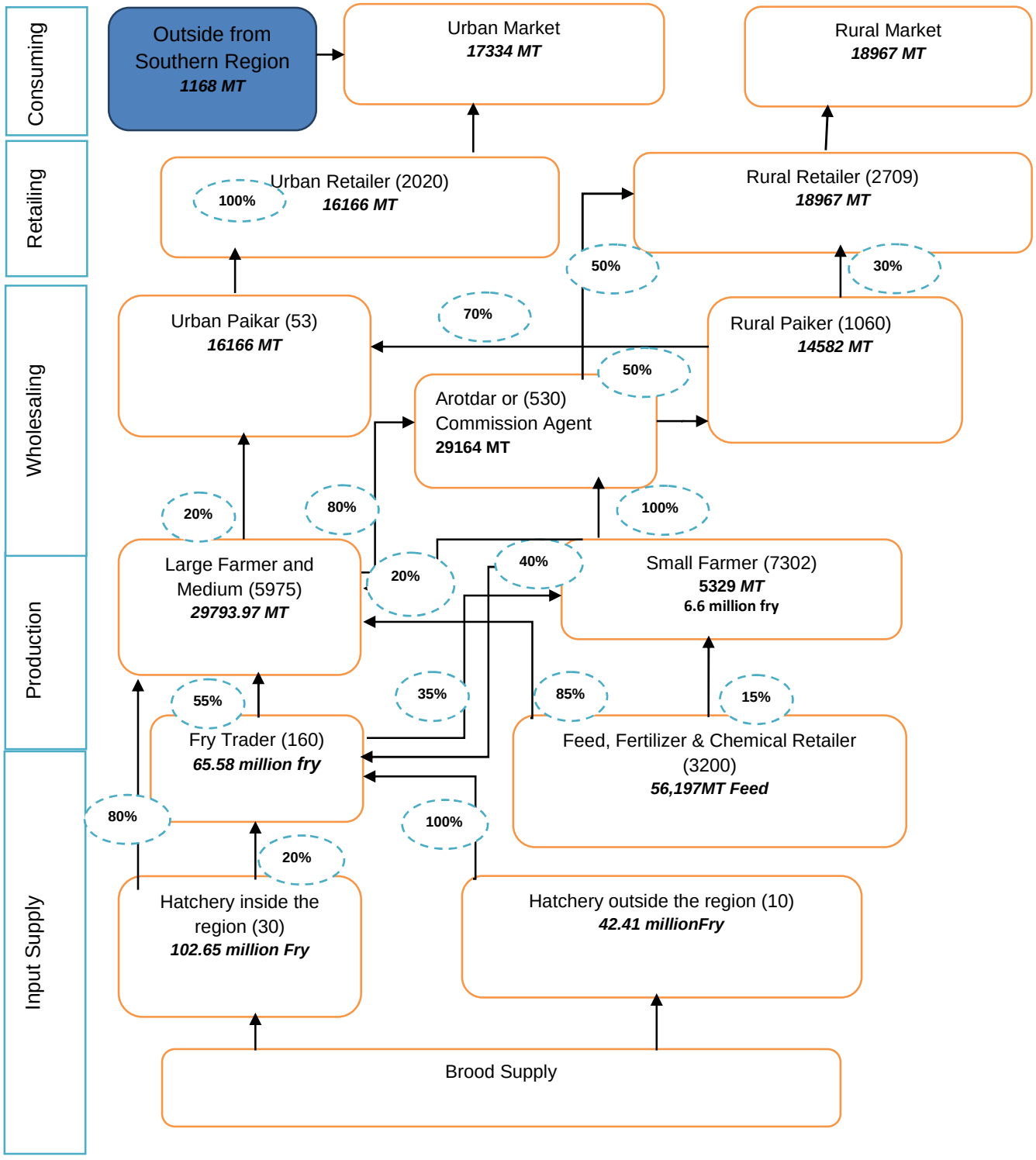


Table 4.4 Value added and gross profit margin at various level of the tilapia value chain
Source: Primary Study

	Farmer	Arotdar	Paiker	Retailer
Market price	116	119	130	150
Value addition/Gross marketing margin	40	3	16	20
Marketing cost	3	1	8	5
Profit margin	19	2	8	15
%	50	4	20	26


Consuming
Retailing
Wholesaling
Production
Input Supply
Outside from Southern Region
1168 MT
Urban Market
17334 MT
Rural Market
18967 MT
Urban Retailer (2020)
16166 MT
100%
Rural Retailer (2709)
18967 MT
50%
30%
Urban Paikar (53)
16166 MT
70%
Rural Paiker (1060)
14582 MT
50%
Arotdar or (530)
Commission Agent
29164 MT
20%
80%
100%
Large Farmer and Medium (5975)
29793.97 MT
20%
40%
Small Farmer (7302)
5329 MT
6.6 million fry
55%
35%
85%
15%
Fry Trader (160)
65.58 million fry
Feed, Fertilizer & Chemical Retailer (3200)
56,197MT Feed
80%
100%
20%
Hatchery inside the region (30)
102.65 million Fry
Hatchery outside the region (10)
42.41 millionFry
Brood Supply

4.4 Assessment of Business and Financial Services

4.4.1 Research

Serving as an important thrust sector for Bangladesh, some research has been done into the Tilapia industry. Most of the researches of Tilapia were dedicated to the backward linkages of the sector which include brood stock development, genetic improvement and increase hatchery production. World Fish Centre is one of the leading research organizations for Tilapia research in Bangladesh followed by BFRI. Department of Fisheries is also doing some research works on Tilapia. However, there is almost no research for the forward market. Innovision is currently working with the feasibility of Tilapia export to international market. But this Katalyst funded project has the limitation to conduct fundamental research for market penetration.

4.6.2 Quality assurance and certification

At the input level, hatcheries and feed companies need to be registered through Department of Fisheries. There is hatchery law and feed law in place but both laws are not strictly imposed. Quality of the product is determined by the size, color and physical condition of the marketed Tilapia by the buyers. Price of the product differs slightly with these indicators. However, more rigid quality control will be required in case of export to other countries. One of the most important challenges of the exports is to implement traceability. As farmer size is small in the country, implementation of traceability will be a tough task.

4.6.3 Training

The main sources of training or knowledge-sharing for the producers are the different NGO-based projects in those regions. The NGOs who usually work in Tilapia / Shrimp sector provide formal training to the producers. Among them, the most prominent actor found is the World Fish center. Local NGOs were also found as source of training which are originated from their different sub-contract from the different development project. As for the other actors, only the input sellers were found getting trainings from companies. Hatcheries are playing an active role in providing farming knowledge to the farmer for their own interest. In every upazilla there is small set up with one fisheries officer and one Assistant Fisheries Officer. This is inadequate to provide service to the all farmers of the region. In addition to Public sector and NGOs, some Private Companies also provide training and other technical support to the farmers through their technical personnel recruited in the field level. These supports include soil and water test, training, demonstrations, information about the appropriate feed application. However, usually large farmers get this type of support from the reputed companies as they are important client of the feed companies.

Among the respondents only 15% of the small farmers feel the need of training whereas 50% of the large farmers feel the same. One of the important reasons behind the unwillingness of the small farmers is that they feel the technological up-gradation would need more capital incentive technology which is true in many cases

4.6.4 Cooperative, group and associations

Unlike Shrimp and Prawn, Tilapia producers do not have any form of Group or Association. There is no presence of Cooperatives in the region. Without association it will not be possible for the farmers to raise their voice collectively for their betterment. In Bangladesh, there are bad examples of the associations which demotivate farmers to form association. Though there is active exporter association namely "Bangladesh Frozen Food Exporters Association (BFFEA)" is present in the region. BFFEA is the apex body of the exporters which regional office is Khulna. The office of BFFEA is known as BFFEA Khulna Chapter which is headed by a Senior Vice President. However, BFFEA has no functional relation with Tilapia producers.

4.6.5 Market/ business information

The flow of market / business information along the value chain seems to be open compared to shrimp and prawn. In most of the cases farmers respond quickly with the prices as they use their mobile phone to know the areas where they can get better price. Largefarmers usually have a good relationship with Paikers and they do not harvest without knowing market price.

4.6.6 Transportation and Packaging

In most of the cases, farmers use different traditional vehicles. When they transport their products to the Arot, they usually transport by three wheel auto-rickshaws and local public transport called *Nosimon*. Paikers use relatively better transport mainly use drum and plastic cover after icing. They use local transport system like rooftop of the local buses, pick-up vans and three wheel auto rickshaws. In the regional markets, retailers also use almost all type of vehicles to transport Tilapia to their retail outlet. However, some improved packaging systems were found at the hatchery level as they pack the fries in "Oxygen bags" (oxygenated polythene bag) and then send those using different available vehicles to different destinations.

4.5 Assessment of Business Enabling Environment

Government emphasis on Tilapia farming, Brood supply from BFRI and Different projects, Implantation of different project in Southern region are conducive for the business environment. However, restricted brood import, inadequate access to finance, dependency on the development projects etc. are hindering growth. Table 4.5 summarizes the factors that are facilitating growth and factors that are hindering growth of the Tilapia value chains.

Table 4.5: Business Enabling Environment in the Tilapia Value Chains in the Southern Region in Bangladesh

Facilitating	Hindering
• ***Brood supply from the BFRI, WorldFish Centre and Innovision-Katalyst:*** High quality broods are supplied by BFRI, WorldFish Centre and Innovision-Katalyst project to the hatcheries which helped them to maintain an improved broodstock.	• ***Restricted brood import:*** Hatchery law restrict the import of broods from abroad which hinders the growth of the sector. As BFRI cannot meet the demand of broods which is hindering growth of the hatcheries and may result regeneration of poor quality fry. However, import is should come in

	screened process to maintain the purity of the generation.
• ***Different development projects working in the region:*** A significant number of development projects are working in the region. This includes different projects of WorldFish Centre, Katalyst project (through Innovision and Winrock), USAID Price, World Bank (IAPP project) and ACDI VOCA etc. Presence of the development projects is facilitating the development of Tilapia farming in the region. Almost all projects are providing training, demonstration and technical support.	• ***Dependency on the projects:*** There is a concern of sustainability in some cases. Like some nurseries are established in the farmers ponds which lack the commercial viability. These farmers may not continue after the end of the projects. At the same time, traditional important actors Patilwala are about to extinct due to these nurseries. Projects would need to adopt a market based approach to ensure sustainability.
• ***Presence of financial institute:*** Banks and other non-bank financial institutes including leasing companies are active in the region to provide credit. However, institutional credits are going to large farmers and hatcheries which are facilitating development of the Tilapia farming in the region.	• ***Inadequate access to finance for the farmers:*** Banks and leasing companies are not providing credits to the farmers especially to the small farmers. Finding no other ways, farmers depend on the micro-credit and other informal sources of credits eventually paying higher interests.

4.6 Involvement of Women

Though women are not effectively engaged in production, they play a key role in applying feed to fish. It is usually the responsibility of the women as the male family members are engaged in different types of economic activities outside the house. In the field survey, it was found that around one fourth of the farmers engage their female family members in cultivation. However, most of the women who are engaged in fish farming are not paid for their work since it is regarded as a household work.

Southern region has some pockets where the minority communities live. Involvement of women in fish production was found to be high in these pockets. These areas include Monirampur Upazilla of Jessore, Narail Sadar Upazilla of Narail, Batighata Upazilla of Khulna and Chitalmari of Bagerhat (Katalyst-Winrock 2012). Introduction of Tilapia at small scale homestead ponds can help improve the livelihood of the female led minority households in these areas.

4.7 SWOT Analysis

Strengths	Opportunities
- Southern region has favourable ecological condition for Tilapia farming. - Tilapia is cultivable in any size of lands which has important implication as Small farmers can cultivate it in their homestead ponds where women can play an effective role. - Tilapia has short production period (3-4 months) compared to other fish and prawn. - Tilapia can be cultivated with other fin fish and prawn which is an added advantage for the farmers. - Tilapia has strong market demand in the local market due to its taste. - Almost all income group people buy Tilapia which has an important implication on animal protein intake of the poor farmers. - Tilapia is famous for its disease resistance eventually gives farmer a guaranteed return on their investment. - Feed companies are producing high quality Tilapia floating feed which gives farmers high production. - Price of Tilapia is high compared to carps and Pangus. - Tilapia can be cultivated in high density. - It can be cultivated in multiple cycle in a year which gives farmers more production. - Productivity of Tilapia is also high compared to the carps. - Hatcheries of Tilapia are increasing rapidly in the region and giving more access to fry in the Southern region. - Tolerance of salinity to some extent (up to 8 ppt)	- There is an opportunity to increase productivity in the region which far below the standard productivity in another efficient Tilapia producing region. - Stocking density of the region is also low which can be increased to get more production. - The demand for Tilapia fry is still unmet in the region which reflects that more farmers are interested to cultivate Tilapia. Hatcheries have the opportunity to increase their production and sell to the regional markets. - There is an opportunity to cultivate Tilapia with Prawn which has an important implication for the farmers of Southern region as most of the prawn farmers of Bangladesh are in the Southern region. - Salinity of the Southern region is increasing due to the climate change. Introduction of saline resistance Tilapia will help the farmers who are affected by the salinity. - There is an unmet demand for the Tilapia in the local markets as well as regional markets. So farmers can easily increase their production as they have an ensured market access for their products. - There is a demand for whole and fillets of Tilapia in the international markets which is yet to be explored by Bangladeshi exporters. - Small size of the farms of Tilapia reflects involvement of small and marginal farmers in the Value Chain along with their women as these small ponds are near to their house.
Weaknesses	**Threats**
- Inadequate supply of Tilapia fry in the region which restricted the growth of the sector. - Quality of the fry is questionable due to the inappropriate and inadequate usage of hormone for sex-reversal of Tilapia fry. - Irregular supply of quality brood which restricting production of hatcheries. - Tilapia production needs relatively high	- Increasing cost of feed is serious threat to the production and cultivation of Tilapia which will eventually increasing the cost of production of the farmers. - All production of Tilapia destined to local market which may lead to saturated market demand in the long run. - Salinity of the Southern region are

investment as it requires quality grade feeds. - Farmers lack the appropriate farming knowledge for Tilapia production as the species is relatively new in the region. - Dependence on NGOs and projects for training and information on technical issues	increasing which is a threat for the existing species of Tilapia as they die in case of high salinity. - Domestic markets price are high than the international markets of Tilapia which is leading to export in-competitiveness of Tilapia.

4.8 Summary of Constraints

Value Chain Function	Constraint
Broodstock Management, Fry Supply and Nursery	• Brood import is restricted which is restricting quality production of the hatcheries • Hatcheries lack skilled technician • Inefficient and inadequate use of hormone at hatchery level • Farmers use recycled fry originated from the breeding of fry in the ponds of the farmers • Number of hatcheries is still low to meet the demand of the fry in the region. • Absence of commercial nursery in the region
Grow-out	• Lack of farming knowledge among the farmers • Inappropriate use of feed in ponds • Increasing cost of feed price • Small farmers are reluctant to adopt technology • Lack of formal sources for credit has fostered dependence on informal sources
Trading, Processing and Export	• Export in-competitiveness due to the high price of Tilapia in domestic market than the price of export market

4.9 Recommendations

Addressing Constraints

- Ensure brood supply to the hatcheries in line with the demand for broods. Capacity of the local BFRI stations (Jessore, Khulna and Patuakhali) can be built in order to ensure high quality brood supply. In addition there is a need to change in the policy which will facilitate brood import without compromising the quality of brood.
- Ensuring training for the hatchery technician which WorldFish Centre is doing now. Inadequate use of hormone may be address through the hatchery technician training.
- Availability of quality mono-sex fry will reduce the use of recycled fry. Therefore, no immediate intervention is needed for this constraint.
- Working with potential entrepreneurs to increase the number of the hatcheries.
- Establishing commercial nursery as a viable business. Traditional fry supplier Patilwala can be an entry point for commercial nursery.
- Working with the feed companies, their retailers and distributors to establish an efficient information channel on appropriate use of feeds.
- Details study needed to find out the alternatives to reduce the cost of feed which WorldFish Centre has already started.
- Innovation and promotion of cost effective technology for the poor farmers.
- Work with banks and other financial institute to come up with a credit service targeting small farmers to ensure institutional access to finance.
- Explore niche market for exporting Tilapia from Bangladesh. This niche can be Organic Tilapia or Hand Processed Tilapia where Bangladesh may have some advantage.

Availing Opportunities

- One of the important opportunities which is not explored is introduction of saline resistant Tilapia that will benefit the farmers who are struggling because of gradual increase of salinity in their region. Hatcheries of saline prone area can be an entry point for this type of species.
- Introduction of Prawn-Tilapia mix culture will benefit the farmers who are cultivating prawn. This mix-culture will ensure more utilization of land.

Chapter 5: Feasibility of Commercial Culture of Brackish Water Sea-Bass

5.1 Overview

The southern region of Bangladesh is favorable for both brackish and fresh water fish species. *Latescalcarifer,* commonly called the giant sea perch, sea-bass or barramundi, is an important coastal, estuarine and freshwater fish in the Indo-pacific region. Sea-bass, although quite popular in the Southern region of Bangladesh, hasn't yet been cultured commercially and has remained mostly a captured fish from sea. Favorable demand exists for sea-bass in both domestic & international market. In 2011, 502 MT (DoF, 2011) was exported and about 4562 MT (*extrapolated from primary findings*) was consumed by the domestic market.

At present, several freshwater whitefish species are cultured in the southern region of Bangladesh. These include carp (Ruhi, Katla, Silver Carp, Grass Carp, Mrigel etc.), Tilapia, Koi, Pangus and most prominently Shrimp & Prawn. Shrimp & Prawn are high value export oriented products, earning USD 477.83 mil in FY 2010-2011 and USD 348.28 mil in FY 2009-2010. Yet there is still almost 100,000 hectare of potential brackish water area left unused (BFFEA, 2012). Demand of Tilapia is high in domestic markets, since it's a low priced fish. Production of Tilapia in FY 2010-2011 was 38,500 MT.

In FY 2010-2011 2,59,783 MT of white fish was produced in the southern region which has increased by respectively 1% & 8% from FY 2009-2010 and FY 2008-2009 (DoF, 2011). The growth rate has declined because of unavailability of good quality seeds and increase in cost of production along with relatively lower price in the market. As a result white fish farmers were found switching to commercial culture of Tilapia. This shift is also encouraged by the growing demand of Tilapia in the domestic market. Decline in growth of white fish provides an opportunity for introduction of new species such as sea-bass to increase the profitability of farmers in the southern region.

Findings from this study show that there is latent demand for sea-bass in the market. As a novelty fish, it has untapped demand as gourmet food item, especially in tourist zones like Kuakata in the southern region. Also, the profitability of sea-bass is higher in comparison to whitefish and Tilapia. Farmers who are informally culturing sea-bass have reported satisfactory return. Thus sea-bass shows potential for horizontal expansion in the study region.

5.2 Market Prospect

5.2.1 Favorable demand in the domestic market

Sea-bass has good demand in domestic market. Demand is particularly high in the institutional market (hotels and restaurants). Demand for household consumption is low. It's very popular food item in the tourist zones of Cox's bazar & Kuakata. The taste of sea-bass as marine fish is different from other freshwater fishes and it has almost boneless biomass which makes it attractive as a gourmet food. The larger fishes are considered tastier. In urban markets, especially in Chittagong the demand is comparatively higher than other divisional centers. Tourist locations in Cox's bazar

and Chittagong in the south-east and Kuakata in the south-west, are mainly served by the captured sea-bass. It is estimated that approximately 2500 MT of sea-bass is traded each year in 3 major fish hubs in the southern region which are- (i) Satkhira-Khulna-Bagerhat, (ii) Madaripur-Faridpur-Magura& (iii) Patuakhali-Barisal-Borguna per year. Percentage distribution of cultured and captured sea-bass is unknown. The traders in the regional bazars and arots expressed that they are able to sell whatever volume of sea-bass is supplied in the market.

5.2.2 Higher market price

The price of sea-bass is higher in comparison to other brackish water fish species. The farmers sell sea-bass in the local arots for TK 200-250 /Kg for smaller sized sea-bass (1kg or less) and TK 450 – 500 /Kg for larger sized sea-bass (2kg or more). Clearly the price is much higher for larger sea-bass. Arots make a profit of TK 50 – 100 /Kg when they sell to the Beparis and Depots. The margin fluctuates by 10% - 15% depending on size. The Beparis distribute the sea-bass to the larger wholesale markets in the country like Karwan Bazar and in other tourist zones.

In comparison, average farm gate price of Tilapia is TK 116 /Kg. Price in the end market is TK 140 /Kg. In response to high demand of Tilapia for household consumption, it's production increased manifold in last few years but the price has declined because of increase in supply. The price of white fish varies heavily for the different species. Like Tilapia, price of white fish has fallen as production volume increased. The retail price of different cultured whitefish species are like, Ruhi (TK 200 /Kg), Koi (TK 180 /Kg), Pangush (TK 110/Kg) and carp species (avg. TK 150 /Kg) is much less than the market price for sea-bass.

5.3 Production prospect

5.3.1 Higher profitability than whitefish and Tilapia

Profit per hectare for Tilapia is higher mainly due to the higher production volume. Yield of Tilapia is almost triple than whitefish. While in case of sea-bass, 3 types of culture method is presented. The highest ROI is observed from extensive sea-bass mono-culture with shrimp PL used as live feed. Though traditional non-formal poly-culture of sea-bass has better ROI than intensive care, it is mainly because no extra care is taken by the farmers. Only cost incurred is for feeding, which in traditional practice exceeds 5%-10% of the cost for the basic feed. But for all cases, ROI of sea-bass is much higher than that of whitefish and Tilapia.

Table 5.1: Cost-benefit analysis of Whitefish & Tilapia

	White Fish	Tilapia
Volume of Spawn/Fry (Kg/ha)	89	133
Spawn/Fry Cost (Tk./ha)	9505	21556
Feeding Cost(Tk./ha)	31567	99418
Aqua-chemicals Cost(Tk./ha)	5963	12903
Manpower Cost(Tk./ha)	4068	49400
Other Cost(Tk./ha)	30065	34580
Total Cost(Tk./ha)	81167	217856
Volume of Sales(Kg/ha)	1057	3310
Total Revenue(Tk./ha)	126358	370500
Gross Profit(Tk./ha)	45191	152644

ROI	56%	70%

Table 5.2: Cost-benefit analysis of brackish water sea-bass under different culture methods
Source: Primary Study

	Sea-Bass Extensive[1]	Sea-Bass Poly culture[2]	Sea-bass Intensive[3]
Spawn/Fry (pieces/ ha)	988	-	5138
Spawn/Fry Cost (Tk./ha)	4940	-	25688
Feeding Cost(Tk./ha)	19760	9880	118560
Manpower Cost(Tk./ha)	12350	11115	64220
Other Cost(Tk./ha)	7410	3705	70190
Total Cost(Tk./ha)	44460	24700	278658
Volume of Sales(Kg/ha)	1976	247	6718
Total Revenue(Tk./ha)	308750	61750	637260
Gross Profit(Tk./ha)	264290	37050	358602
ROI	594%	150%	129%

1. *Case: Extensive mono-culture of sea-bass by Mr. Shahjahan Akand, Kuakata.*
2. *Case: Traditional poly-culture with Tilapia in Faridpur*
3. *Case: Intensive Sea-bass cage culture method (Dr. Nani Gopal Das)*

5.3.2 Suitable ecosystem for sea-bass production in South-Eastern region

South-Eastern coastal region of Bangladesh has suitable ecosystem for sea-bass production. Sea-bass is a marine species, which comes to the estuaries in times of breeding where saline water from sea unites with fresh water from rivers. Natural fries are abundant in the estuaries after breeding season. Districts located in this region (Patuakhali, Barisal, Barguna, Pirojpur, Kuakata) has availability of wild fries. Another key factor which makes south-eastern coastal region suitable is the inland presence of mildly saline water. Salinity level of ~15ppt is suitable for better growth of sea-bass. Also, in far southern regions like Satkhira, marine sea-bass fries & juveniles are available. Satkhira is particularly dominated with Shrimp culture, so saline water is dispersed in most of the area. This saline water environment is supportive for nursing and growth of juveniles.

5.4 Comparative advantage / disadvantage

Comparative advantage	Comparative disadvantage
Domestic Market Demand There is a niche domestic market for sea-bass in the southern region as well as in the national market. Market prospect is particularly high for institutional markets (hotels and restaurants) and for the tourist markets in Chittagong, Cox's Bazaar and Kuakata.	***Lack of knowledge on culture*** In the absence of any Govt. or Non-Govt. programs in the southern region addressing sea-bass culture, most of the farmers do not have any formal knowledge. If they occasionally desire to culture in their farm they have to do it from their traditional knowledge.

Higher Profitability
The market price of sea-bass is favorable and much higher than white fish and Tilapia. Price increases disproportionately and heavily with the increase in size/weight. Return on Investment (ROI) under extensive culture is almost 10% than that of white fish and Tilapia.

Lack of supply of hatchery fry
There is only one hatchery in this region that has the capacity to produce and market fry for sea-bass. The farmers are exclusively dependent on natural sources for fry. Fry is available for short time from March-June in a year. Catch from wild sources is detrimental to the environment as the fry catchers destroy other shrimp and fish fries in course of catching sea-bass fries.

Potential for poly-culture with tilapia and white fish
Extensive poly-culture of sea-bass with tilapia / whitefish is possible without using any extra feed where main fish is used as forage fish in the pond.

Sea-bass is carnivorous
Since sea-bass is a carnivorous fish it's not feasible for culture with shrimp or with any other fishes. Due to cannibalistic habit, size variation in growth of juveniles seriously hampers the culture of the fish. As spawning period is short, availability of sufficient uniform size of wild juveniles for pond/cage culture is very difficult.

Supplementary feed for Intensive Monoculture
Only in case of intensive monoculture of sea-bass either in pond/net cage, supplementary feed as trash/balance feed is essential with proper maintenance and size uniformity.

High initial investment for commercial culture: Culture of sea-bass needs high capital investment if intensive cultivation technique is followed. For example, if feeding with trash/supplementary feed or other tilapia fry is practiced, large volume of working capital will be needed to initiate culture

Suitability of culture in both brackish water and fresh water
The growth of sea-bass is favorable in salinity range of 10–15‰. Except the coastal districts, majority of the southern region has suitable range of salinity throughout the year which is particularly good for sea-bass growth and culture.

Short Breeding Season
Due to short spawning period and long period of sexual maturation, sea-bass culture is very difficult throughout the year and also high risk of sufficient quantity and uniform fry size for commercial culture.

5.5 Farmers' capacity for sea-bass culture

5.5.1 Affordability

Demand in domestic market and higher price makes the return on sea-bass very lucrative. Farmers who rely on natural fries that are randomly flooded into the pond/gher are able to get good profit without taking any extra care. This type of informal culture of sea-bass does not require special feeding. Farmers who sell average 150Kg – 200Kg sea-bass year round reported a mere 3% - 5% increase of feed cost along with the existing culture fishes.

Apart from being a very profitable fish, intensive culture of sea-bass needs significantly high volume of investment than Tilapia/Whitefish. As sea-bass is a carnivorous fish, it needs to be fed fries of live fishes to retain full growth. This can be achieved by stocking of fries for feeding sea-bass. Also, intensive culture needs restructuring of existing pond system used for Tilapia / Whitefish. Thus sea-bass seems affordable to farmers if extensive culture method is practiced.

5.5.2 Knowledge about culture

Farmers in all three studied region are found unaware of culture practices. No projects or programs regarding sea-bass culture have been piloted in these regions. Farmers apply their traditional extensive non-formal practice, which is mix-culture with Tilapia/Whitefish. This practice depends on natural fries that randomly move in to the pond/gher mostly in times of high tide/flood. No particular feeding practice is used for sea-bass.

5.5.3 Site suitability

Madaripur-Faridpur-Magura: This region mostly depends on natural sea-bass fry which enters in pond/gher naturally. In absence of any estuaries; there are no breeding of sea-bass in the region. So, availability of fry is totally random and no fry catching is observed. Thus, this region may not be suitable for culture of sea-bass unless fry supply is ensured. Apart from this, there is opportunity for poly-culture as Tilapia & whitefish is being cultured in this region.

Satkhira-Khulna-Bagerhat: This region has access to both brackish & fresh water. The lower part (Satkhira) is mostly brackish water zone and the upper part (Khulna-Bagerhat) is mostly fresh water zone. Satkhira is suitable for sea-bass culture because of presence of saline water. Sea-bass fry & juvenile is easily available from marine sources. On the other hand, suitability of Khulna-Bagerhat is lesser as there's no breeding zone in the perimeter. Presence of mildly saline water is the advantage of this region.

Patuakhali-Barisal-Barguna: Two key factors that make this region suitable for sea-bass farming / culture are presence of brackish water and the estuaries. These estuaries are breeding ground of sea-bass and large source of natural fry. Commercial fry catchers are also located in these regions, particularly in Kuakata. Also, due to the existence of suitable level (0-15 ppt) of brackish water in major part of the region, both sea-bass and Tilapia culture is found to be favorable and suitable for sea-bass- tilapia poly culture.

5.6 Current Practices for Culture

Sea-bass has a fast growth rate which makes it suitable for poly-culture. Sea-bass monoculture system has a disadvantage because of dependence on supplementary feeding. The use of supplementary feed reduces the profit. Poly-culture shows great promise in reducing the price if not totally eliminating the farmers' dependence on trash fish as food source. The method is achieved by simply incorporating a species of forage fish with the main species in the pond. The choice of forage fish will depend on its ability to reproduce continuously in quantity sufficient to sustain the growth of sea-bass throughout the culture period. The following non-formal traditional poly-culture methods are practiced in the study regions:

- ***Sea-bass with Tilapia in mild saline water:*** No significant extra feeding or maintenance is observed. Suitable for culture in mildly saline environment that is favorable for better growth rate of both Sea-bass and Tilapia.

- ***Sea-bass with whitefish in fresh Water:*** Practiced mostly in fresh-water regions. No significant feeding or maintenance is observed. This practice is also found in freshwater pockets of Satkhira, The reason for this poly-culture method in those areas is, in times of flood if saline water enters the Ghers whitefishes usually dies but sea-bass survives. This way the farmers can retain some profits.

- ***Sea-bass with Shrimp:*** Located mostly in the shrimp farming brackish water places in Satkhira. The advantages for this practice are that no feeding is needed for sea-bass culture and culture in saline water is particularly suitable for sea-bass. The major disadvantage of this method is that shrimp PL is one of the prime food for sea-bass. So if the number of sea-bass is high, it is ideal to partition the space of sea-bass culture inside the Gher. In this way farmers protect their shrimp from becoming the food for sea-bass.

Case: Mixed culture of Sea-bass and Shrimp at Kuakata

Mr. Shahjahan Akand has been farming sea-bass commercially for second year in a row. He cultures sea-bass in 10 acres. Kuakata is in brackish water zone where salinity ranges from 0-15%. Last year he cultured 400 fries and made good profit. This year he has increased the fry stock by 10 times. He applied his traditional knowledge for culture. He collected the fries from the fry catchers from Kauar char, fatrar char and Ganga moti near Kuakata in Patuakhali area. He stocked 4000 sea-bass fries with 50,000 shrimp PL. Initially the Sea-bass fed on the Shrimp PLs. Later on Mr. Shahjahan fed them with the food wastages from nearby hotels. Apart from the PLs he doesn't have any other feeding cost. He started selling sea-bass after 4-5 months, when it reached average size of ~1 kg while the maximum size was in the range of 2 – 2.5 Kg. Total volume of production was 8 MT. Within this period the sea-bass consumed about 55%-60% of the shrimp. He sold rest of the shrimps to the market.

He sold sea-bass mainly to the hotels (80%) in Kuakata and the rest (20%) was sold in the local market. Mr. Shahjahan earned around TK 1.2 million in profit from selling sea-bass. Even with his traditional practice the mortality rate of sea-bass was quite low (2%-3%). His major investment was in buying 50,000 Shrimp PL (costing around TK 30,000) and 4000 sea-bass fry (costing around TK 20,000). Mr. Shahjahan plans to expand his culture area since the profit is high.

5.7 Recommendation

Since the operation of marine capture fisheries has become more crowded and difficult for the local fishermen, the Government of Bangladesh has emphasized to convert them from capture to culture fisheries. Sea-bass culture development program will certainly be helpful in support of this objective. Findings suggest good prospect for introduction of sea-bass. However, following interventions are recommended to make it feasible:

- Project can concentrate their work in particular areas considering the site suitability like water salinity(0 - 15 ppt), soil condition (abundant clay content), availability of fry (breeding grounds), presence of non-polluted water bodies (canals, small rivers) and other favorable infrastructure facilities.
- Scientific culture techniques should be provided through project/DoF/BFRI/NGO staff.
- Support for installation of sea-bass hatcheries will be essential to ensure supply of Sea-bass fry round the year.
- Poly-culture with tilapia, whitefish or shrimp is found to be feasible and can be demonstrated through farmers who have already started production. Promotion of monoculture of sea-bass using cage aquaculture method, as done in various other parts of the world can be trialed to measure its effectiveness in the region.