



Blue Gold Program

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Technical Note 02

Tilapia - Value Chain Analysis Report

June 2015

Blue Gold Program

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List of abbreviations

AIN	Aquaculture for Income and Nutrition
BCUP	Borga Chashi Unnayan Project
BFRI	Bangladesh Fisheries Research Institute
DoF	Department of Fisheries
FGDs	Focus Group Discussions
GIFT	Genetically Improved Farm Tilapia
IAPP	Integrated Agricultural Productivity Project
ICLARM	International Centre for Living Aquatic Resources Management
KIIs	Key informant interviews
MFI	Micro Finance Institute
MFS	Market Oriented Farmer Field Schools
PDP	Polder Development Plan
PUST	Patuakhali University of Science and Technology

1. Introduction

The Blue Gold Program is designed to ensure sustainable water management by forming water management groups in selected polders in Southern Bangladesh. The overall objective of the program is: “To reduce poverty by creating a safe living environment and a sustainable socio-economic development for 150,000 household living on the 160,000 ha of polders.” To achieve this, the Business Development Component of Blue Gold program is working to develop value chains that impact on the sustainable socio-economic development of polder dwellers by improving income and employment.

Blue Gold prepares a Polder Development Plan (PDP) for each polder to define an integrated approach to polder development by its different components. The Business Development Component of Blue Gold has prepared a Value Chain Selection Matrix for the selection of value chains in polders 43/2D & 43/2F. Following an extensive set of criteria in a Value Chain Selection Matrix (Appendix-2) Tilapia was identified as the appropriate fish for value chain development activities in these polders. This matrix facilitated unbiased selection following a scoring system aligned with the project objectives. It complies with the beneficiary focus of Blue Gold and in particular stands to benefit the less food secure households with lower levels of land ownership.

About 60 to 70 percent of the households in these polders have seasonal ponds of around 10 decimal. These ponds are very suitable for Tilapia culture. Tilapia has great potential in terms of food security and nutritional benefit. Tilapia is becoming popular among consumers because of taste and having fewer bones it is easier to eat. Tilapia seems to be accepted by all religious, social and economic groups not only in the polder area or Barisal region but also all over in Bangladesh. The price of Tilapia is comparatively lower than of other fishes, which increases its relevance as a good source of protein for polder dwellers with lower levels of income. Implementing this fish culture will involve the women and has the possibility to empower them as well. Tilapia culture can support small and marginal households to meet their family nutrition and to realize an additional income, contributing to poverty reduction.

Blue Gold selected Polders 43/2D & 43/2F for the implementation of these activities. These polders are part of the SadarUpazilla in the Patuakhali district and partially under the Amtaliupazilla of the Barguna district.

1.1 Methodology

In preparation of this Tilapia Value Chain Analysis report, information was collected from both secondary and primary sources. Information from secondary sources was used to identify key informants on the value chain including relevant researchers, key research organizations, as well as private and public actors. Information collection in the field through key informant interviews (KIIs) and focus group discussions (FGDs) helped us to gather new information and simultaneously validate the information collected from secondary sources. Table 1 below provides an overview of the process and the steps involved in the information gathering for the preparation of the value chain analysis report.

Table 1: Methods of Information Collection for Value Chain Analysis

	Step-1	Step-2	Step-3	Step-4	Step-5
<i>Process</i>	Literature Review	In depth Quality Interview	FGD	Field Validation and primary information and data collection	Information Compilation
<i>Tools</i>	Secondary Literature,	KII with	Guideline	Field visit, Meetings	Rankings in value

	Project document, Research papers	Checklist, Questionnaire			chain selection matrix, deduction, induction
<i>Output</i>	Checklist, guideline, identification KIIs	Analysis of value chain, constraints and opportunities	Validation of information from KIIs	Quantitative data on value chain actors, production and prospects	Analysis of findings for reporting

1.2 Secondary Literature Review

Information collected from different secondary sources like research papers published by research organizations, value chain reports, institutional publications, leaflets, workshop reports, and news items was used to generate preliminary insights and understanding about the end markets, market channels, market demand, quality preferences and market potential of the value chains. Literature reviews and studies helped with the identification of key informants on the value chain and of different market actors as well as different development stakeholders. The studies revealed key informants including researchers, key research organizations, government organizations and officers, private sector, NGOs and projects involved with Tilapia promotion.

1.3 In-depth Qualitative Study

In-depth interviews with key informants and FGDs with stakeholders were conducted for information collection. Besides, extensive field visits were arranged to validate the collected information.

Key Informant Interviews (KIIs) with relevant stakeholders were organized involving Tilapia farmers (including female farmers), researchers and extension service providers (DoF) in and outside the selected polders. Through these KIIs, information was collected about problems and constraints in the Tilapia Value Chain and how to address these issues as part of Value Chain Analysis.

Focus Group Discussions (FGDs) a series of FGDs were conducted involving Tilapia farmers (including female farmers) of polders 43/2F & 43/2D. Through the FGDs, information was collected about cultivation practices, problems and constraints in the Tilapia Value Chain and how to address these issues.

2. Tilapia Value Chain and Market System

2.1 End Market and Market Level Analysis

Market for Tilapia

The end-market of Tilapia can be local, regional and national. The main market for Tilapia practically refers to the local markets in the polders (Gozkhali, Kalagachia, Khekuani, Gulishakhali and Mohishkataetc in polder 43/2F and Hetalbunia, Hazikhali hat, Basak Bazar, Pakhia/Fatulla Bazar, Auliapur Officer hat, Khaserhat, Patukhali hat in polder 43/2D). The tilapia produced in polders 43/2D & 43/2F is mostly consumed by polder dwellers themselves. The economic status of the polder dwellers as well as most other people in the south-east coastal region is very poor. As the price of Tilapia is comparatively low, it has a great demand in the whole of this region. Only about 10% of the local demand of Tilapia in polders 43/2F and 43/2D is met from within the polder, the remaining 90% is supplied from outside the Patuakhali and Barguna districts. As a result only the local market for tilapia is considered as end-market.

2.2 Production

Availability of Ponds

About 90% of the HH in the polders have ponds which are mainly incidental ponds. These ponds are mainly created by digging ditches to collect soil for improving homestead structures. Originally these ponds are not meant for fish culture but Tilapia cultivation is possible and feasible in these small ponds. Of the total number of ponds 60-70% are seasonal ponds usually smaller than ten decimal. Tilapia culture is possible in any size of pond, which is important as small farmers can cultivate Tilapia in their homestead ponds. Moreover, the Southern region has favourable ecological conditions for Tilapia farming. Tilapia has a short production period (3-4 months) compared to other fish. It can be cultivated with other carp fish which is an added advantage for the farmers. Tilapia is famous for its disease resistance and as a result gives a farmer a guaranteed return on his/her investment. Tilapia can be cultivated in high density.

Production Potential

Polder 43/2F has a total wetland area of 625 hectare of which 243 hectare under aquaculture. Aquaculture comprises 217 hectare as homestead fish culture, 21 hectare as commercial fish culture and 5 hectare of land used for prawn culture. The open water fisheries consist of river, canal and floodplain with a water area of 382 hectare. Similarly, in polder 43/2D, total wetland area is 953 ha, where 502 hectare are in aquaculture and 451 hectare are under capture/open water fisheries. On the other hand aquaculture comprises 464 ha as a homestead aquaculture, 29 ha as commercial fish culture and only 9 ha area are used for prawn aquaculture¹

Table 2: Area Coverage under Different Types of Aquaculture - Hectares

Polder	Wetland Area (Ha)	Area Under Aquaculture	Area Under Homestead fish culture	Area under Commercial fish culture	Area Under Prawn Culture
43/2F	625	243	217	21	5
43/2D	953	502	464	29	9

¹As mentioned in Land Zoning report

The land under homestead fish culture, a combined 681 hectare for both polders, can be considered as potential area for promoting Genetically Improved Farm Tilapia (GIFT) culture. It consists mainly of ponds. These polders at present can produce about 1 MT of Tilapia with a value of BDT 10 lac². If improved cultural practice can be introduced then it has the potential to produce 3.3.64 MT of Tilapia with a value of BDT 33.64 lac³.

Species/Variety

Tilapia has become the world's second most important cultured fish after carp. There is a long history of Tilapia farming in Bangladesh. The Mozambique Tilapia (*Oreochromismossambicus*) was introduced to Bangladesh from Thailand in 1954. However, this species was not widely accepted for aquaculture because of its early maturation and prolific breeding leading to overcrowded ponds.

GIFT was introduced to Bangladesh by ICLARM (International Centre for Living Aquatic Resources Management, now known as the WorldFish Centre) and BFRI (Bangladesh Fisheries Research Institute) in 1994. In addition the technology of Sex-reversed male Tilapia (i.e. mono-sex Tilapia) was introduced to avoid unwanted reproduction and to promote faster growth. The culture of mono-sex tilapia requires extensive feeding though, making it not a viable proposition for small resource starved farmers of the polder region. However, the introduction of GIFT and its subsequent strains contributed to the dramatic increase of Tilapia in Bangladesh. Farmers have just started GIFT cultivation in Southern Bangladesh with different species of carp. Tilapia has huge market demand and consumer acceptance. Moreover, due to its attractive price, there is scope of expanding Tilapia in the polders and its neighbouring areas.

Culture Practices

Commercial farmers start in mid-April/May, they stock fingerling in ponds from as early as April/May and harvest Tilapia after 3/4 months intervals. In contrast, due to scarcity of water most of the subsistence farmers usually start June-July that is just the beginning of monsoon and complete the Tilapia harvest in a single cycle at the beginning of the dry season in November/December. This period is very crucial in terms of financial management at house hold level, as farmers prepare for T. Aman cultivation in this period. So, investment in Tilapia (usually undertaken by female farmers) in pond preparation (lime, fertilizer), fingerling purchase and feeding can face competition with T. Aman. Clearly, a good planning and sourcing of funds is important. Usually women are managing homestead aquaculture though they lack the appropriate knowledge on quality fingerlings and feed.

Fish farming at Polder 43/2F and 43/2D is actually season based and concentrates in places where rain water is trapped during monsoon usually in small ponds for aquaculture. Tilapia culture is dependent on fry producers (hatcheries, nurseries and big farmers) from both inside and outside of the polder. Farmers of this region usually don't use commercial feed (only commercial farmer do). Farmers sometimes provide homemade feed, like- rice bran, oil cake, and/or kitchen residue when available. Small pond owners produce fish (Tilapia and others) for house hold consumption without much focus on income generation through selling the excess.

Production Trend

Over the last few years, total Tilapia production at Patuakhali and Barguna district has increased more than four times. Five years ago only 5-10% farmers used to cultivate Tilapia, but at present about 60-70% of the farmers culture Tilapia with other fish (mainly carp) in their ponds in a mix culture. GIFT Tilapia culture is also getting popular as it can be produced without much commercial feed and culture expense is comparatively low.

A total of 10.322 farmers are involved in Tilapia farming with other fish (carp) in polders 43/2F & 43/2D. These farmers buy fingerlings from the fry producers, patilwala/hawkers and produce marketable sized

²681 ha X 2.47 X 6 = 1 MT, 1 MT X 100 (Tk/kg) =Tk. 10 lac.

³681 ha X 2.47 X 20 = 3.3.64 MT, 3.3.64 MT X 100 (Tk/Kg) = Tk. 33.64 lac

Tilapia. Normally it would take 3-4 months for the farmer to produce an edible size of Tilapia but farmers start to consume from their own production much earlier.

Productivity

The production of Tilapia in polder area is very low, only 4-6kg per decimal. At smallholder farmer level, culture practice, input utilization and commercial motivation is very poor. There is a huge opportunity for productivity increase in the existing ponds. By introducing new culture and management practices, there is an opportunity to at least double the production from present levels. This still remains far below standard commercial farm production of up to 20-22kg Tilapia per decimal following a semi-intensive method of farming⁴.

The major constraint to productivity is that GIFT Tilapia in general is relatively new but has high yield potential—particularly if practices can be improved. The major constraints can be listed as:

- Lack of knowledge related with pond preparation and mixed culture operation-joint production of different fish cultures.
- Tilapia fingerlings are suffering from inbreeding deterioration.
- Farmers apply inappropriate stocking ratio and density.
- Traditional farmers are not used to feeding and lack knowledge about proper feeding methods.
- Lack of knowledge about appropriate fish culture due to non-existence of support services.

Extensive production technology

It appears inherent to farming tradition that fish including Tilapia can be cultured with a minimum of care. Small and marginal farmers apply, if anything, seldom more than lime at the time of pond preparation. Usually pond preparation takes place in May at the advent of monsoon and farmers then wait for rain water to fill the pond. When the pond is ready, farmers purchase fingerlings from patilwalas or directly from fingerling producers. Due to lack of knowledge and awareness, their stocking rate is usually about 500 fingerlings per decimal, which is way above the prescribed rate of 100-120 per decimal and a barrier for proper growth of fingerlings. On the other hand traditionally farmers do not purchase feed and seldom feed regularly due to a lack of financial means as they set aside any funds for T. Aman cultivation. They also lack knowledge about the benefit of using feed. Only seldom they provide household residual food in the pond. This practice is impeding the growth of this overcrowded pond. Thus fingerlings do not grow properly and the output is very low and farmers actually fail to make a profit. However, the formulation of local level feed with locally available ingredients like dry fish, rice bran, maize, oil cake can enhance the productivity of Tilapia if behavioural change can be brought in.

Harvesting

Usually farmers start harvesting fish after two months of fingerling release for house hold consumption. It is usually women who catch these small fishes by angling. At the beginning of winter in the months of November-December, when water level starts decreasing, they harvest the few remaining fishes that are still available using a fishing-net, sometimes with the help of other farmers. This time the catch may be a little bit bigger. Farmers can sell the Tilapia of the final harvest (if the catch is large enough) to neighbours, at farm gate or at the nearby market.

2.3 Marketing

Sorting of Tilapia according to size

There are not many options for Tilapia value addition open to small and marginal farmers at polder level. Relatively larger size Tilapia can get a better price per kilogram compared to small size Tilapia (e.g. one Tilapia that weighs 200 gram can attract Tk. 10-25 more per kilogram compared to Tilapia that weight 50-80 gram). In general grading to size at farmer level is absent.

⁴As per WorldFish-Bangladesh and DoF

Local Markets for Tilapia

Farmers usually sell small Tilapia at the rate of Tk. 90-115/kg to neighbours, fish collectors at farm gate or at nearby markets. Selling Tilapia is not a problem. They can also take it to a nearby aroth. There are a few fish traders who will go to the pond site if they are contacted early and if the potential quantity is big enough to cover associated costs. From aroths, local traders' purchases fishes and then they retail those mainly in local markets.

There are two aroths in polder 43/2F and four in polder 43/2D. Arotdars usually take commission of about 10% on sales price. Farmers can directly go to these aroths for selling their fishes.

Small traders in turn buy from these aroths Tilapia and other fish, and retail these to consumers in the same market area. This limits their potential margins and they try to make a profit of 10-20%. Due to very limited local production and high demand there is no surplus to be forwarded to the regional or national markets. As most of the local market supply originates from outside the area, local production has a market advantage.

2.4 Profitability

Production Cost

Table 3: Cost of Production for Tilapia (10 decimal)

Production Cost	Common practice	With limited Input	Ideal condition
Cost Item	Cost (BDT)	Cost (BDT)	Cost (BDT)
Pond Preparation	125 (Use only lime)	650 (Use lime & fertilizer)	650(Use lime & fertilizer)
Fingerling	4500 (Over stocking)	1800	1800
Feeding	500 (Use HH by-products)	4500 (Local feed)	10500 (Use commercial feed)
Fertilization (after stocking)	-	-	500
Harvesting	-	500	500
Total Production cost	5125	7450	13950
Production	60Kg	120Kg	200Kg

Yield

A farmer usually achieves a yield of 4-6 kg per decimal with traditional practice that is associated with minimum pond preparation, high stocking density and very limited feeding. By implementing improved culture practices including appropriate pond preparation, using good quality fingerlings and providing appropriate feed, the maximum production that can be achieved is 20-22 kg per decimal⁵.

Table 4: Productivity of Tilapia-Current and Potential (1 decimal)

Current (kg/dec)	With intervention (kg/dec)	Highest Potential (kg/dec)
4-6	10-12	20-22

Table 5: Comparative Price at Different Levels (Tk/ kg)

Crop	Price at farm gate	Trader	Consumer
GIFT Tilapia	TK 90-100	TK 105-115	TK 115-125

Margins and Profit

It is interesting to note that farmers are actually making a minimum of profit by producing Tilapia in a traditional way. In traditional practice, in a ten decimal pond, production cost is estimated at Tk. 5125, but the production value is only Tk. 6.000 (a profit of Tk. 875), mainly due to low productivity (only 60 kg fish due to high stocking density and limited feeding). In contrast 200 kg of comparatively large fish can be

⁵As commented by Worldfish experts.

produced in the same pond if improved culture practice can be followed. The production value is then Tk. 24.000 with more than Tk. 10.000 profit and a Return on Investment (RoI) of 72% (Table-6)

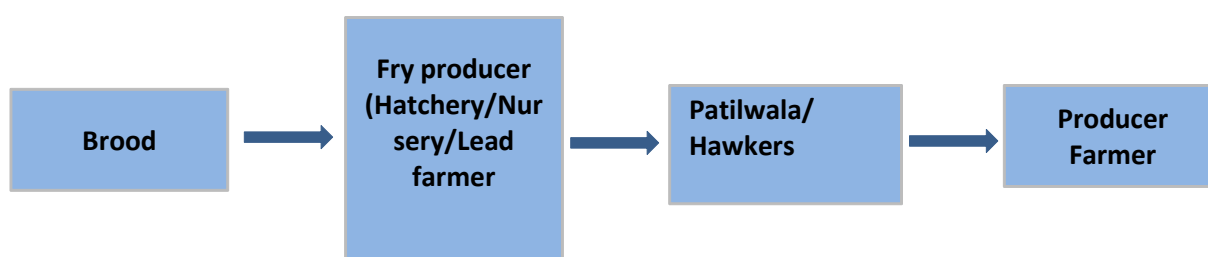
Table 6: Profit Calculation –Tilapia (Tk/10 decimal)

Production Cost	Common practice	With limited Input	Ideal condition
Cost Item	Cost (BDT)	Cost (BDT)	Cost (BDT)
Pond Preparation	125 (Use only lime)	650 (Use lime & fertilizer)	650(Use lime & fertilizer)
Fingerling	4500 (Over stocking)	1800	1800
Feeding	500 (Use HH by-products)	4500 (Local feed)	10500 (Use commercial feed)
Fertilization (after stock)	-	500	500
Harvesting	-	500	500
Total Production cost	5125	7950	13950
Production	60Kg	120Kg	200Kg
Sales Price (Tk./kg)	100	110	120
Income (TK.)	6000	13200	24000
Profit (Tk.)	875	5250	10050
RoI	17%	66%	72%

2.5 Backward linkages

Brood Supply:

In order to produce Tilapia fingerlings good quality brood stock is needed. Fry producers start to collect brood and produce fingerlings from the beginning of March. The supply of good quality brood is not sufficient. Fry producers are collecting broods from BFRI, Mymensingh and from other hatcheries/farmers through personal connections. It is a great impediment for the production of quality spawn and fingerlings. Only WorldFish is working with hatcheries to improve brood of Tilapia. WorldFish had collected good quality brood from foreign sources and FRIs and distributed those to some large hatcheries.



Fingerling Producer:

Fingerling is produced by hatcheries, nurseries and large farmers. One hatchery, 20-25 fry producers (nursery operator) along with some lead farmers are producing GIFT Tilapia fingerlings in the region.

Nursery:

At present, there are about 8-10 nurseries in polder 43/2F and 20-22 nurseries in polder 43/2D. There exist some other nurseries outside the polders, from where Tilapia fingerlings come into the polder. The main motivation or business of these nurseries is to sell fingerling. Some of them culture the remainder of unsold fingerlings. Most of the nurseries produce GIFT Tilapia due to its market demand in this region.

The nursery owners produce spawns and fingerlings. Generally a capital investment of Tk. 200,000 is required to operate a viable size nursery that produces fingerlings of different species of fishes including Tilapia and carps. The profit margin from fingerlings is about 100%. Generally fingerlings within the size of 1 to 1-1/2 inch are of high demand and can have a sales price of Tk. 1 to 1.5 per piece. Larger size

fingerlings will attract a higher price. Every nursery has good linkages with Patilwalas. They receive fingerlings at a reduced price (Tk. 0.20 to 0.50 per fingerlings) but are expected to capture the fingerlings themselves from the pond.

Patilwala (Fingerling Traders):

Roughly 10-15 fingerling hawkers/patilwalas are selling fingerling to the farmers of 43/2F and 45-50 in polder 43/2D. Fingerling hawkers/patilwalas also play a key role in providing information to the farmers on Tilapia farming, though their knowledge is questionable. Hawkers buy from the fry producers in bulk and sell those to the farmers. Sometimes, Hawkers buy fingerling from the lead farmers who stocked GIFT Tilapia and produced fingerlings in their ponds.

On average, each patilwala has an investment of Tk. 2000 (to buy patil mean 'pot') complemented only by physical labour. This investment can last 4/5 years of business. He carries the patil with fingerlings and walks through villages to sell fingerlings to fish farmers. He generally makes a profit of 10% over his investment and labour. In order to maximise his sales he tries to motivate farmers to purchase more fingerlings than necessary by any means even though he sometimes has knowledge (accurate or not) of appropriate stocking densities of each fish species.

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 for homemade feed, different aqua-chemicals and pesticides, to the farmers. These input suppliers are an important channel for the dissemination of information. Nine input traders are doing this business in polder 43/2F and 13 are involved in polder 43/2D.

Farmers can purchase inputs like feed and feed ingredients from input traders from nearby markets. Input traders on average make a profit of 20% over sales.

Problems with the supply of brood, quality spawn and nursery management

Tilapia nurseries/fingerling producers are located both in and outside of the polder area. They lack technical knowhow and management capacity for the production of good quality fingerlings. Farmers can purchase fingerlings directly from these nurseries or from patilwalas (fingerling hawkers). Some fingerlings die if the patilwala carries them in patils for a long time. Patilwalas are motivated by sales volume and profits. They cannot be relied upon to disseminate proper information regarding stocking density for each type of fingerling and mix of culture. Farmers lack proper information about Tilapia culture as a whole. Proper information through training, demonstration, experience sharing and exchange visits can enhance the knowledge level of farmers.

Weak information on the use of feed and other inputs

Farmers traditionally do not use commercial feed for Tilapia culture. Generally there is also no network of feed input providers. They lack the knowledge regarding the benefits of proper feeding and overall knowledge of pond management. There is no extension service available in the polder providing assistance on the use of feed, health care, pond water examination and remedial actions when a particular problem can be identified.

2.6 Forward linkages

Arots

Arots fulfil the function of a wholesale market place where farmers sell their produce to the paikers and retailers through the arotdars who work on commission. There are 2 arots in polder 43/2F and 4 in polder 43/2D.

Retailers

Retailers buy Tilapia from aroths/ Paikers and sell it to the end consumers.

Limited presence of local trader and aroth

The Tilapia value chain is very short in the polders. Locally produced Tilapia is consumed by the producer himself and by other consumers within the polder. There are small fish traders inside the polder who are local market based. They can easily purchase fish from the farm yard. Besides, there are a few aroths in polder 43/2D & 43/2F. Farmers can take their produce to these aroths for selling. Since the demand of Tilapia is very high and fish is imported in the polder to meet the demand, the absence of forward actors seems justified. Only more production can effectively create the need for forward actors who can connect the excess production to regional and national markets. The price variation of Tilapia at different levels was presented in table 4.

2.7 Extent of Collaboration

Horizontal Coordination in the value chain:

Horizontal coordination in the Tilapia value chain can be defined as the accumulation of similar activities at a specific level in the value chain. Horizontal coordination can be inward (for example, input procurement in bulk by several farmers to achieve economies of scale) or outward focused. While they are mostly small pond owners they stand to benefit from some coordination and collaboration. Horizontal coordination allows farmers to share resources at that level e.g. transportation for fingerling collection, feed ingredients collection etc. In Tilapia culture farmers have an opportunity to produce low cost feed using local ingredients.

Fish farmer cooperatives in the project area are rare or non-existent. The types of collaboration that Blue Gold envisages, e.g. collective actions by MFS members with an objective to reduce cost and enhancing benefit for all group members is mostly absent.

Vertical integration in the value chain:

Vertical integration in value chains can be expressed as combining the functions of more than one actor in a value chain or eliminating an actor or directly reaching a higher level actor bypassing a lower level actor. The objective is to get a better price (as it adds the margin of the eliminated actor and integrates its function) while maintaining or improving efficiency of operations. Considering the characteristics of the polder and its geographical location and production volume, vertical integration can be an option to realise benefits for the producers in the value chain.

There are few fry producers/nurseries present both inside and outside the polder region. Organising their own supply of inputs from nearby markets will help farmers and there is chance of reducing individual transportation cost by coordination. Forward linkage actors (trading actors) are present in polder 43/2D & 43/2F but as the aim is only to supply the local market there is no need for any integration.

Support functions

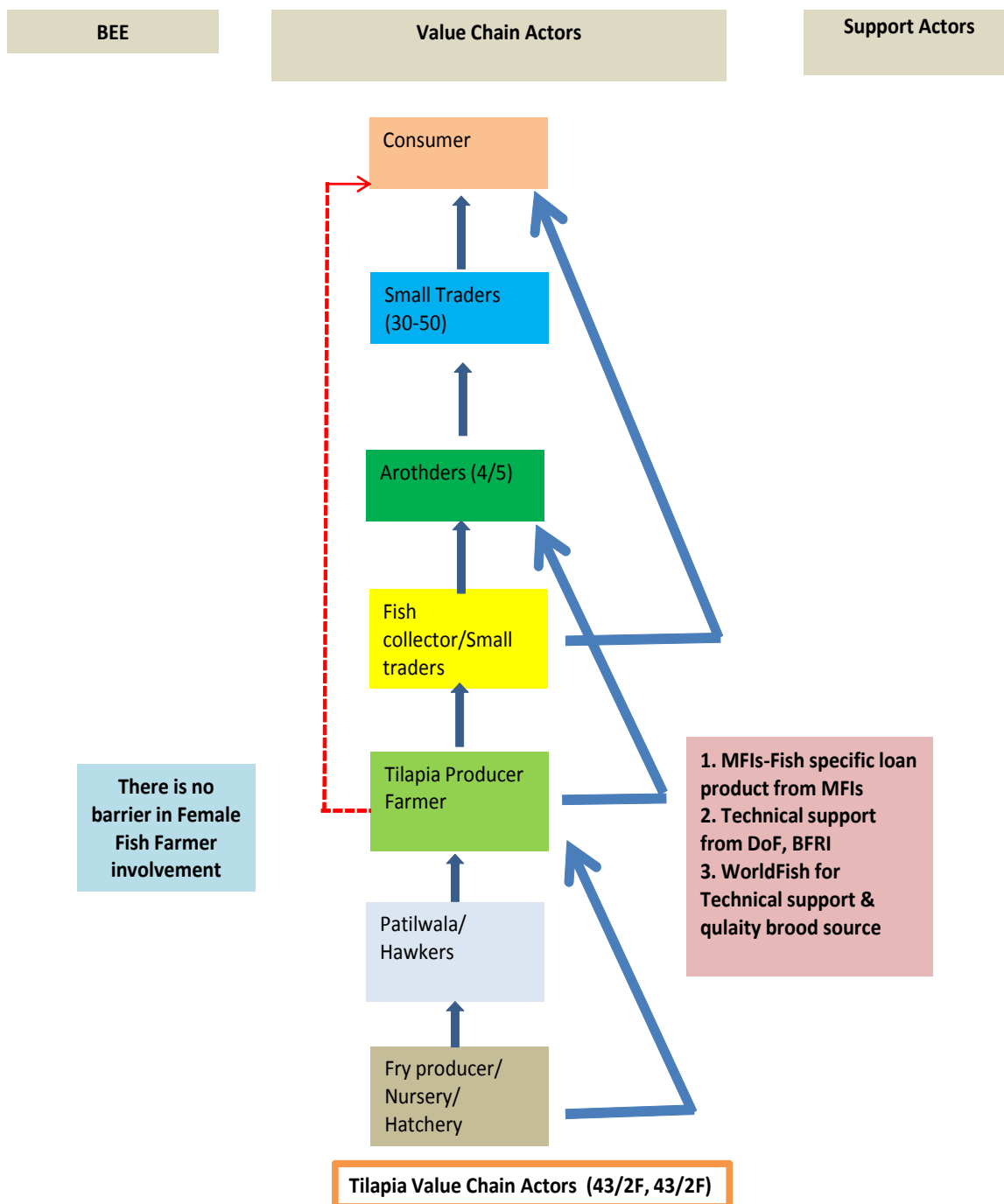


Figure 1: Tilapia Value Chain Actors (43/2F, 43/2F)

Research

Bangladesh Fisheries Research Institute (BFRI) has been working on Tilapia for a long time. There are also regional BFRIs working hard to promote improved cultural practices. All of these regional stations are working on developing Tilapia varieties to increase production under varying climatic conditions. There is a BFRI station at Patuakhali which is within 10 km from the polders. It can be a good source of information and technical support for producer groups.

The Patuakhali University of Science and Technology (PUST) is another very important organization within 20 km from Patuakhali. Its Fisheries faculty undertakes good research options on Tilapia culture. Resource persons can be drawn from these institutes to transfer improved culture practices.

State Owned Enterprise Involvement – DoF

The Department of Fisheries (DoF) has a nationwide network of technical experts and extension officials. Beyond the papilla level, at the small and marginal farmer's level, their service capacity is very limited. Upazilla Fisheries officer can be a source of information and technical service provider. But their service is mostly focused in captured fish and for large commercial farmer. Extension service for small house hold level farming is very difficult.

Presence of other projects in the region

The CSISA-BD of project is addressing nutritional aspects and promoting fish culture through its projects implemented by WorldFish. There is another USAID supported project in the polder area AIN (Aquaculture for Income and Nutrition), also implemented by WorldFish. This project is working to improve variety by supplying good quality brood. World Bank funded Integrated Agricultural Productivity Project (IAPP) is also working in the area for capacity building of producer farmer and providing inputs to improve productivity. DAE-DANIDA is also implementing a project in the region called Integrated Farm Management Component. It promotes different fish cultures through a few of their specific FFS sessions.

Association of Tilapia farmers

There is no association of fish farmers in polder 43/2D or in polder 43/2F. There are no effective group representations from small scale farmers that can press their demand. There are no support functions that can help farmers with necessary skills to make them entrepreneurs or teach them business skills.

Transportation

Polder 43/2D & 43/2F are connected with Patuakhali city by road transportation and waterways while its communication with Barguna district head quarter is rather difficult. Different types of vehicles are available for transporting fish to nearby markets. However, patilwalas often walk on foot to market fingerlings. Only sometime they need to use transport like rickshaw van to carry fingerlings from nurseries to fingerling purchasers. On the other hand, Tilapia can be sold from farm gate. Farmers can take excess fish to nearby markets using rickshaw van, or by foot which are within few km. So, transportation is not a big issue.

Access to Finance

There are two bank branches and four post offices inside polders 43/2D & 43/2F, along with many B-Kash centres. Through all of these, cash transactions are possible. In addition, many national, regional and local Micro Finance Institute (MFIs) are operating inside these polders. Usually, a small Tilapia farmer required Tk. 3000-4000 at the time of pond preparation and fingerling stocking. The need of finance for a female farmer can be an obstacle at that particular time as farmers need to invest in T. Aman cultivation. People with limited income can become member of MFIs to obtain credits. However, loan repayment schedule (weekly, monthly) often is not conducive for small scale fish culture. Thus a fish culture specific loan can be very helpful.

One such option is loan from BCUP. BRAC- BCUP is present in Patuakhalisadarupazilla and Amtaliupazilla of the Barguna district. As BCUP's service area extends to 9 km from the BCUP-BRAC office, most farmers of polder 43/2D & 43/2F will have the opportunity to access its service. Negotiations are ongoing with BRAC to enable BCUP loan facilities up to a range of 20 km which would cover virtually all Blue Gold beneficiaries. BCUP offers a very attractive source of finance due to its low interest rate, i.e. 18% reducing (9% effective).

Fish farmers can receive a loan for Tilapia culture from different MFIs and from BCUP by becoming their member.

Involvement of Women

In Tilapia cultivation, women play an important role along with all other family members. A significant contribution from female members can be observed at the time of fingerling purchase, releasing fingerlings to pond, providing feed (mostly house hold residuals) and catching fish by angling for HH consumption. Women are often found to be the investors in small scale Tilapia culture. They often purchase fingerlings from patilwalas at farm gate. Due to a lack of experience and proper knowledge, these women are often misled by patilwalas about the stocking density and ratio. Patilwalas often apply different techniques to

push sell their fingerling stock. Women are in great need for training and information on overall fish culture.

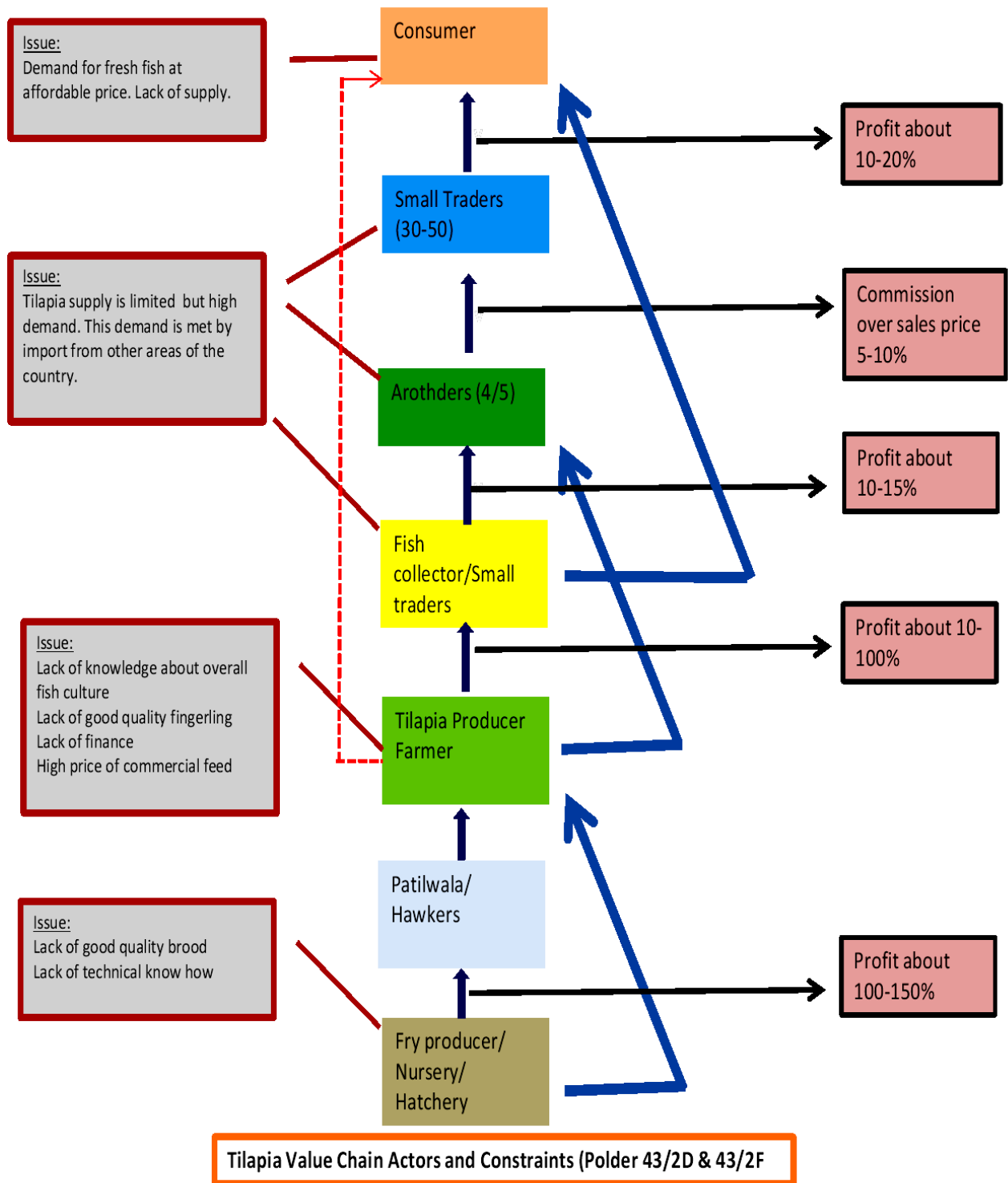


Figure 2: Tilapia Value chain Actors and constraints (Polder 43/2D & 43/2F)

2.8 Tilapia value Chain Actors, Functions and Roles

S.N.	Actors	Functions	Roles	Cost / Price/Profit information
1	Consumer	Purchase and consume	Purchase from fish retailers, farm gate	

2	Small trader (Retailer)	Purchase from , aroth, preserve, Bulk breaking	Sell to consumers	10-20% profit
3	Arotdar	Linkage, purchase on behalf of forward fish trader, arrange transport, ice, financing	Work as commission agent for fish trader. Usually purchase on behalf of producer farmer.	5-10% commission over sales price
4	Fish Collector (Small Trader)	Purchasing Tilapia from farm gate, local aroth and retail	Purchase Tilapia from farm gate, transport, invest, preserve, retail.	10-20% profit
5	Producer Farmers	Culture Tilapia	Prepare pond, stock fingerling, provide feed, catch fish for household consumption and sells	Production costs –BDT 6000-8000 per 10dec Selling price depends on size (Tk. 80-120/ kg) Normal Rol = 15-20%
6	Patilwala/ Hawker	Fingerling trading	Collects fingerlings from fingerling suppliers and sells to farmers by hawking	10% over investment
7	Fry producer Nursery Hatchery	Fingerling supply	Fingerling production, sales	100% over production cost
8	Input Trader	Input retailing (lime, fertilizer, feed, medicine)	Purchase inputs from companies and retailing. Also trade other types of agri inputs.	10-20% profit (sometime trade commission)

2.9 Preliminary opportunities to increase production of Tilapia

Opportunities for production increase:

Productivity Increase: Productivity of Tilapia at present is about 40-60 kg per 10 decimal. There is scope of increasing production (Table - 3).

Increasing GIFT culture: By introducing inbreeding-free GIFT Tilapia household level nutrition and income for female farmer can be increased.

Improving culture practices:

- Proper pond preparation
- Appropriate stocking density and culture mix
- Post stocking management including fertilisation and proper feeding with low cost feed formulation

Baseline Indicators:

Volume of production: According to available information at present practice Tilapia production is only 4-6 kg per decimal. Production can be increased to 20-22 kg per decimal⁶.

Density and feeding practices: Tilapia is cultivated by over 60% pond owners, with stocking rate 95% over the recommended stocking density and without proper feeding.

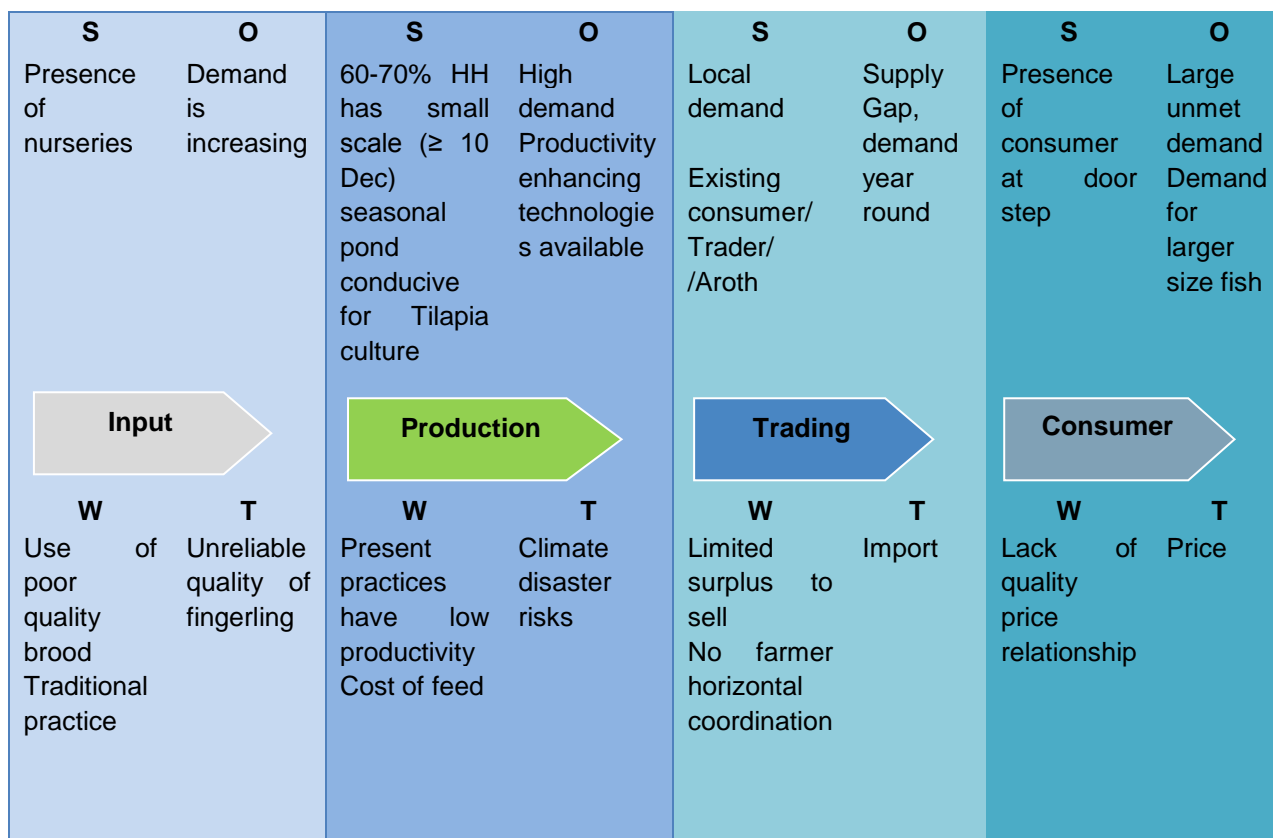
⁶WorldFish and DoF.

Collective actions: Potential in input collection, feed formulation etc.

Average price: The price (last year-2014) for the Tilapia (small size) is Tk. 90-110/ kg at farm gate and Tk. 110-125 at local market. Large size Tilapia will attract additional Tk. 10-25 more per kg.

Profitability: Profitability levels of the farmers will improve 3-4 times from the present level (Table-4).

2.10 SWOT Analysis



Strengths:

- Southern region has favourable ecological conditions for Tilapia farming.
- Tilapia culture is possible in any size of ponds which is important as small farmers can cultivate Tilapia in their homestead ponds.
- About 90% of HH have ponds in which Tilapia cultivation is possible and feasible.
- 60-70% ponds of this region are seasonal pond. Tilapia has a short production period (3-4 months) compared to other fish.
- Tilapia can be cultivated with other carp fish which is an added advantage for the farmers.
- Tilapia is famous for its disease resistance, resulting in a guaranteed return on the farmer's investment.
- Tilapia can be cultivated in high density.
- It can be cultivated in multiple cycles in a year which gives farmers more production.
- Productivity of Tilapia is also high compared to the carps.
- High local market demand making it a short value chain.

Weakness:

- Weak linkages amongst the Tilapia value chain actors are prevailing in this area.
- Fry producers and nursery operators have lack of skilled manpower and technical knowhow.
- Quality of the fingerling is questionable due to inbreeding.
- Inadequate supply of quality fingerling of Tilapia in the region which restricted the growth of the sector
- Tilapia production needs relatively high investment and intensive care for commercial production.
- Traditionally the farmers of this region are reluctant to work hard. They rather prefer an easier option like capturing fish from natural sources.
- Farmers lack the appropriate farming knowledge for Tilapia production as the species is relatively new in the region.
- Farmers are reluctant to use supplementary feed.
- Women mostly buy the fingerlings and do so at farm gate from patilwala who might mislead them on practices.

Opportunities:

- Tilapia has strong local market demand. Large size Tilapia attracts high price.
- People of almost all income groups buy and consume Tilapia.
- Local production can only meet 10% of the present market demand.
- Feed companies are producing high quality Tilapia floating feed which gives farmers high production.
- Fry producers and other value chain actors are present in the surrounding area and active.
- The demand of Tilapia fry is still unmet in the region which reflects that more farmers are interested to cultivate Tilapia. Fry producers/nurseries have the opportunity to increase business.
- World fish and other development projects are working for the development of Tilapia and aquaculture in this region
- There is a huge gap between present productivity and optimum level of production with available new technologies or practices.
- Linking producer farmers with alternative sources of finance (BCUP) with friendly repayment procedures.

Threats:

- This is a disaster prone area and there is a threat for tidal wave during cyclone or abnormal high tide.
- The increasing cost of feed is a serious threat to the production and cultivation of Tilapia which will eventually increase the cost of production of the farmers.

3. Constraints, Findings, Problems and Interventions

3.1 Summary of Constraints and Findings

About 60-70 percent HH in the polder region has small seasonal ponds. Tilapia culture will not only contribute to improved nutritional uptake but also to generate more income or to serve expense substitution. There are several opportunities to improve Tilapia productivity. Farmers can benefit more by producing Tilapias for domestic consumption and by marketing any large size surplus. So, the Tilapia intervention is aimed at small and marginal households, particularly targeted at female farmers to build their capacity as well as to enhance an income generating opportunity while improving the nutritional uptake at household level.

Table 7: Area of Constraints its Analysis at a Glance

Area of Constraint	Findings	Resulting in
Sub-optimal use of finance	<ul style="list-style-type: none"> extensive production of Tilapia with limited inputs apparently minimises risks cash flow situation from households generally limits risk taking 	⇒ Low investment into the production resulting in sub-optimal productivity and profit.
Sub-optimal culture practices (Technical efficiency)	<ul style="list-style-type: none"> limited use of commercial feed and fertiliser due to traditional practice may be related with risk aversion using own and purchased feed of poor quality and of local sources knowledge gap about quality of fingerling inappropriate stocking density of fingerling and lack of knowledge about appropriate mix culture (e.g. across different species, at different level of water, feeding, health care) 	⇒ low productivity leading to reduced profitability
Sub-optimal post-harvesting practices (marketing efficiency)	<ul style="list-style-type: none"> farmers are not involved in producing relatively large size Tilapia with fast growing carp farmers sell small quantities at farm gate leaving transport to market to others farmers fail to cooperate and experience a weak position in the market when they sell at farm gate individually 	⇒ lower price and profitability

Small and marginal fish farmers, consider Tilapia as a low investment enterprise. For the production of good quality Tilapia, proper pond preparation and use of appropriate inputs is essential. Requiring investments at a time when there is little cash in the HH, makes access to finance very important for

expanding the culture of Tilapia. Since Tilapia is cultured in the monsoon period when T.Aman cultivation is at the peak, the households can be cash starved as they need money for T. Aman cultivation and family maintenance for the next four/five months. Investment funds are required for purchasing fingerlings, feed and other inputs. Thus linking farmers to MFIs and sources of funds is very important. It can also help them to take decisions on the appropriate use of inputs. As a result farmers will be able to overcome their financial barrier and produce more quality Tilapia for HH consumption with possibility to generate income. Farmers mostly use HH residuals as the only feed for their Tilapia production. They sometimes purchase feed of poor quality or feed that is available locally. The production of feed using local ingredients can overcome this if proper training can be provided to them.

Fish farmers, most of the times catch small size fish for household consumption. Farmers sometimes market small size Tilapia as those did not get larger due to a lack of feed and over stocking. This small size and lean Tilapia reduce their potential income considerably. On the other hand, farmers in the polder usually are not involved in sorting Tilapia according to size as sorting can reduce the sellable quantity without offsetting the benefit from a higher selling price. Nevertheless it is possible for farmers to consume the small size Tilapia and market large size Tilapia that can attract a comparatively better price. A conscious decision among producer farmers on the appropriate culture practices is important.

Farmers can reduce transportation costs if they decide to purchase inputs (lime, fertilizer) together. Different types of transportation are available in polder region. Farmers can avail those to transport to forward market if required.

3.2 Identification of interventions

The table below provides a summary of findings along with problem identification by analysing the findings and planned interventions to overcome the problems.

Table 8: Identifying Problems and planned Interventions

	Findings	Problem	Intervention
1.	extensive production of Tilapia with limited inputs apparently minimises risks	None or inappropriate financial products for fish (Tilapia) production in the market	improving the understanding for the need for, planning and using of financing within a household perspective
	cash flow situation from households generally limits risk taking	inadequate understanding of financing (in the household), risks and returns	Improving access to finance in general and to a more appropriate crop financing product in particular.
2	limited use of commercial feed and fertiliser due to traditional practice may be related with risk aversion	lack of appropriate extension or knowledge providers about proper use of feed and fertilizer	Training, pond trials and linking farmers to a network of sources of information (WorldFish, PUST)
	using own and purchased feed of poor quality and of local sources	limited availability of good quality feed at local input providers, so preparing feeds at home	Promote knowledge about improved feed preparation technology and linking farmers to ingredients feed providers and/or organising feed production
	inappropriate stocking density of fingerling and lack of knowledge about appropriate mix culture (e.g. across different species, at different level of water,	lack of appropriate knowledge about inputs (fingerlings, feeding), culture mix and overall culture practice as mostly female farmer are involved in	Setup pond trials and transfer appropriate information (public, private) and arrange training programme for input providers and farmers on culture

	feeding, health care, medicine dosage, timing, technology)	purchase of fingerling at farm gate.	
3	farmers are not involved in value adding activities e.g. shorting small vs large fishes when marketing	Lack of knowledge about fish size-price relationship (market demand)	Raise awareness about profit making opportunity by sorting fish (by information sharing, visits etc)

There are no really appropriate financial products for fish production in the market, particularly for the cultivation of Tilapia. There is widespread inadequate understanding of financing at household level. Due to lack of available funds and collective action by the farmers, often fingerlings and other inputs are collected individually in small quantities. Tilapia farmers, particularly female farmers, need financial support to be engaged with proper Tilapia farming. These farmers need to be able to estimate their financial requirement in advance and need to be linked to a funding source, potentially a MFI or BCUP with favourable terms.

To address the issue of finance, an improved understanding about the need for, planning and using of financing within a household perspective is very essential. Farmers need to make understand about enterprise budgeting, record keeping and cost benefit analysis along with the risks involved of the enterprise. There are no service providers which focus on entrepreneur skills and/or business planning. Improving access to finance in general and to a more appropriate fish financing product for Tilapia culture can help farmers overcome financial barriers.

Stimulated coordination and/or cooperation with respect to input procurement and marketing activities by farmers both individually and as groups has to be pursued through MFS sessions among PG farmers. Resource farmers can take a lead in this.

In the polder the availability of good quality feed is limited at local input provider’s level, so formulation and preparation of feed at home could be an alternative option and a source of low price feed supply. Farmers do not have much knowledge about quality of inputs such as fingerlings and feed and of culture practice overall. The extension providers are of limited assistance in this respect.

An MFS can teach farmers about the quality of inputs and help them to link with a local feed producer or teach them to produce feed at home. This should provide the input provider with a better understanding of what inputs he should supply, and what advice he should give to farmers. For this, PFs or even RFs can facilitate ‘trust’ between retailers and farmers, thereby improving both the retailer’s business and the producer’s farming. We will seek a ‘win-win’ situation in this relationship with other stakeholders and establish linkage through market oriented sessions in MFS. In this regard, a survey on farmer’s perception of input trader as source of information will be conducted. It is hoped that through MFS activities positive change in perception will take place.

Promoting knowledge about improved feed formulation technology and linking farmers to quality feed providers and/or organising local feed production is absolutely vital to improve Tilapia production in the polder areas. Implementing training, establishing pond trials and linking farmers to a network of sources of information (public, private) can help farmers to close the information gap about improved fish cultures. Setting up of pond trials and transferring appropriate information (public, private) and arrange a training programme for input providers and farmers on cultivation practices can improve expand Tilapia culture. On the other hand farmers can take initiative to sort their produced fish by size both individually or in groups to target a higher market price.

3.3 Action planning of interventions

In the following table, different activities are listed with activities that can be covered under MFS. Throughout the MFS programme gender awareness will be maintained.

Table 9: Planned Interventions with activities

S.N.	Intervention	MFS Activities	Other Activities
1.	improving the understanding for the need for, planning and using of financing within a household perspective	<ul style="list-style-type: none"> -Discussion about financial requirement and planning in advance. -Session on financial product and sources -Production planning to estimate financial requirement -Discuss alternative sources of funding (BCUP) - End of production cycle review of costs and benefits based upon record keeping 	
	Improving access to finance in general and to a more appropriate crop financing product in particular.	<ul style="list-style-type: none"> -Invite representative from MFI -Explain procedures of microcredit -Linkage with MFIs based on production budget (increase outreach) - Support WMG members to use funds from the WMG S&C 	<ul style="list-style-type: none"> -Initiate discussion with different MFI and commercial banks for creating collaboration and easy access to financial product. - Attempt to define appropriate fish financing product with MFI
2	Training, pond trials and linking farmers to a network of sources of information (public, private)	<ul style="list-style-type: none"> -Pond trials -Enterprise budget comparisons - Session on culture practice information networking -Linkage with culture practice source of information -Hands on training in pond trials 	-Involve DoF, WorldFish
	Promote knowledge about improved feed preparation technology and linking farmers to ingredients feed providers and/or organising feed production	<ul style="list-style-type: none"> -Knowledge transfer about good feed formulation at HH level -Linkage with input provider - Assess feasibility of feed formulation 	-Search for technical support from public-private organizations (WorldFish, BFRl).
	Setup pond trials and transfer appropriate information (public, private stakeholders) and arrange training programme for input providers and farmers on culture	<ul style="list-style-type: none"> -Trial setting & demonstration on different practice - Train input providers to improve their knowledge of appropriate culture practices - Input provider training programme - Resource farmer training programme 	
3	Raise awareness about profit making opportunity by sorting fish (by information sharing, visits etc)	-Promote information about market demand (size-price relationship)	

Appendix 1.

Table 10: A Brief Summary of Problems, Interventions, and Implementation work

	Findings	Problem	Intervention	MFS Activities	Other Activities
1.	extensive production of Tilapia with limited inputs apparently minimises risks	None or inappropriate financial products for fish (Tilapia) production in the market	improving the understanding for the need for, planning and using of financing within a household perspective	<ul style="list-style-type: none"> -Discussion about financial requirement and planning in advance. -Session on financial product and sources -Production planning to estimate financial requirement -Discuss alternative sources of funding (BCUP) - End of production cycle review of costs and benefits based upon record keeping 	
	cash flow situation from households generally limits risk taking	inadequate understanding of financing (in the household), risks and returns	Improving access to finance in general and to a more appropriate crop financing product in particular.	<ul style="list-style-type: none"> -Invite representative from MFI -Explain procedures of microcredit -Linkage with MFIs based on production budget (increase outreach) -Support WMG members to use funds from the WMG S&C 	<ul style="list-style-type: none"> -Initiate discussion with different MFI and commercial banks for creating collaboration and easy access to financial product. - Attempt to define appropriate fish financing product with MFI
2	limited use of commercial feed and fertiliser due to traditional practice may	lack of appropriate extension or knowledge providers about proper	Training, pond trials and linking farmers to a network of sources	<ul style="list-style-type: none"> -Pond trials -Enterprise budget 	-Involve DoF, WorldFish

	be related with risk aversion	use of feed and fertilizer	of information (public, private)	comparisons - Session on culture practice information networking -Linkage with culture practice source of information -Hands on training in pond trials	
	using own and purchased feed of poor quality and of local sources	limited availability of good quality feed at local input providers, so preparing feeds at home	Promote knowledge about improved feed preparation technology and linking farmers to ingredients suppliers/feed providers and/or organising feed production	-Knowledge transfer about good feed formulation at HH level -Linkage with input provider - Assess feasibility of feed formulation	-Search for technical support from public-private organizations (WorldFish, BFRI).
	inappropriate stocking density of fingerling and lack of knowledge about appropriate mix culture (e.g. across different species, at different level of water, feeding, health care, medicine dosage, timing, technology)	lack of appropriate knowledge about inputs (fingerlings, feeding) and overall culture practice as mostly female farmer are involved in purchase of fingerling at farm gate.	Setup pond trials and transfer appropriate information (public, private) and arrange training programme for input providers and farmers on culture	-Trial setting & demonstration on different practice - Train input providers to improve their knowledge of appropriate culture practices - Input provider training programme - Resource farmer training programme	
3	farmers are not involved in value adding activities e.g. shorting small vs large fishes when marketing	Lack of knowledge about fish size-price relationship (market demand)	Raise awareness about profit making opportunity by shorting fish (by information sharing, visits etc)	-Promote information about market demand (size-price relationship)	

Appendix 2. Matrix for Value Chain Selection

Blue Gold Program Matrix for Value Chain Selection Component-04																					
Criteria→	Indicate market level (Local, District, Regional, National, International)	Growth Potential (32)					Impact (32)					Structure of the Industry (15)				Gender & Employment		Collective Action(4)	Risk	Total Weighted Value	Rank
Or op↓		Market Size	Unmet market demand	Potential productivity improvement	Expansion of area/capacity adding to raw materials	Value added to materials	Current production	Number of households involved	Contribution to HH income and wealth	Short or longer production/harvesting season	Food Security	Nutrition	Forward/backward linkages conducive to market based approach	Existence of service providers	Favourable business environment	Other programme interests	Involvement of women	Employment generation	Action Opportunities		
Weight →		7%	6%	6%	7%	6%	5%	5%	6%	5%	6%	5%	4%	4%	2%	9%	8%	4%		100%	
Food																					
Boro Rice	National																				0
T Aman	National	5	1	1	0	1	5	5	1	3	1	1	1	3	5	0	1	1	0	Green	189 7th
T Aus	National	5	1	1	0	1	3	3	1	3	1	1	3	5	0	1	1	0	0	Green	169 11th
Betel leaf		3	1	1	1	1	3	3	3	5	0	0	0	1	1	0	0	0	1	Yellow	131 13th
Til (Sesame)	National/International	3	3	3	3	1	1	1	3	3	1	5	5	1	3	1	1	1	3	Green	23 5th
Mung bean		3	3	3	3	3	3	3	5	3	0	3	5	3	3	3	3	3	3	Yellow	366 2nd
Soybean																					0
Chilli	National	3	1	3	3	1	1	3	3	1	1	3	3	3	3	3	3	3	3	Yellow	26 4th
Bittergourd	District	3	1	3	1	1	1	1	3	0	3	5	3	1	1	3	1	1	5	Yellow	195 6th
Peanut	National	1	1	3	3	1	1	1	3	3	1	3	1	1	1	3	1	3	3	Yellow	186 8th
Bottlegourd	District	3	1	1	1	1	1	1	3	0	3	5	3	1	1	3	1	1	5	Yellow	183 10th
Sweetgourd	District	3	1	3	1	1	1	1	3	0	3	5	3	1	1	3	1	1	5	Yellow	195 6th
Countrybean	District	3	1	1	1	1	1	1	3	0	3	5	3	1	1	3	1	1	5	Yellow	183 10th
Sweet Potato	District	1	1	3	3	0	1	1	3	3	3	1	0	1	1	1	0	1	3	Green	148 12th
Khesari/Cowpea	Regional	1	1	3	3	1	1	3	3	3	0	1	1	1	3	1	1	3	3	Green	184 9th
Aquaculture																					0
Tilapia	National	3	3	5	3	5	1	1	5	3	5	5	5	3	5	5	0	1	5	Green	325 3rd
Livestock																					0
Native poultry	Regional	3	5	5	5	1	5	5	5	5	3	5	3	3	5	5	1	5	5	Green	432 1st
																					0