Comprehensive Study
on
The Aquaculture Sector in Bangladesh with Particular Focus on Existing Policy Support Received by the Sector and Scope for Improvements

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Supported by

Agri - Business for Trade Competitiveness Project (ATC-P), Bangladesh

Implemented by

Ministry of Commerce, Bangladesh

Published on

January 2018

Prepared by

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TABLE OF CONTENT

List of Tables

List of Figures

List of Boxes:

List of Annexures:

List of Acronyms and Abbreviations

ADP	Annual Development Programme
AIGA	Alternative Income Generating Activities
AMPs	Aquaculture Medicinal Products
ATC-P	Agri-business Trade Competitiveness Project
BBS	Bangladesh Bureau of Statistics, Government of Bangladesh
BFFEA	Bangladesh Frozen Foods Exporters' Association
BMPs	Better Management Practices
BSFF	Bangladesh Shrimp and Fish Foundation
CBO	Community Based Organizations
CIP	Country Investment Plan
CoCs	Code of Conducts
DBSM	Developing Business Services Markets
DOF	Department of Fisheries
EU	European Union
EWG	Expert Working Group
FAO	Food and Agriculture Organization
FY	Financial Year
FYP	Five Year Plan
GAqP	Good Aquaculture Practices
GDP	Gross Domestic Product
GED	General Economics Division of Planning Commission
GMP	Good Management Practices
GoB	Government of Bangladesh
HBMP	Hatchery Better Management Practice
HFMAP	Hilsa Fisheries Management Action Plan
HIES	Household Income and Expenditure Survey
HVS	High Value Species
MoC	Ministry of Commerce
MoFL	Ministry of Fisheries and Livestock
MT	Metric Ton
NRCP	National Residue Control Plan
PKSF	Palli Karma Sahayak Foundation
SDGs	Sustainable Development Goals
UFO	Upazila Fisheries Officer
USAID	United States Agency for International Development

Message

Fisheries and aquaculture sector occupies an important place in the Bangladesh economy. The sector's contribution to the country's Gross Domestic Product (GDP), export earnings and providing livelihood to millions of Bangladesh are well known. From the Ministry of Commerce, we have been associated closely with all national efforts to accelerate development in the sector, especially, in order to significantly increase the export of our fisheries and aquaculture products.

I am glad to know that with the active support of SwissContact Katalyst under the Agribusiness for Trade Competitiveness Project (ATC-P)of Ministry of Commerce the present study entitled "Comprehensive Study on the Supports received by the Aquaculture Sector in Bangladesh - Existing Reality and Scope for Improvements" has been carried out by a Bangladesh Shrimp and Fish Foundation (BSFF) multi-disciplinary research team to identify the ground level production reality in the fisheries and aquaculture sector of Bangladesh. An important focus of the study has also been to find out the state of public support for the sector which is crucial for the sustained growth of the sector. As the study has revealed, the Government of Bangladesh is committed to extend all support to the aquaculture sector and many policy initiatives of the Government during the recent years attest to that. However, as it emerges from the study, there is significant scope for up scaling public sector support for the future accelerated growth of the aquaculture sector which is so vital for our overall national growth and attaining Sustainable Development Goals (SDGs) in the context of Bangladesh. The wealth of information and analysis based on actual field level research documented in the study will certainly be an important input to our future policy deliberations. All the recommendations in the study are important and I am confident that in the months and years ahead, the study findings and recommendations will be of invaluable importance in scripting a new orientation of our public support for the sector.

I would like to thank Swiss-Contact Katalyst for the support which made this compilation possible. I would also like to thank BSFF for completing such an important and seminal research work.

07/11/2017

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Message

Bangladesh is one of the world's leading fish producing countries with a total production of 4.134 million MT, where aquaculture production contributes more than 56 percent of the total production. Last 10 years average growth performance of this sector is around 5.42 percent. Government is trying to sustain its growth performance, which eventually ensures to achieve the projected production target of 4.552 million MT by 2020-2021.

A country with significant fisheries and aquaculture resources, Bangladesh has an enduring interest to further develop this sector for a whole range of important reasons. Realizing the full potential of the sector demands sustained efforts on wide front including increased public support and assistance both in terms of enabling policy environment, regulatory framework, capacity building of relevant stakeholders, introduction of GAP/ GMP/GHP in production system, increase public sector investment and sustained private sector pro-growth initiatives.

I am glad to know that the present study on *The Aquaculture Sector in Bangladesh with Particular Focus on Existing Policy Support Received by the Sector and Scope for Improvements* undertaken by BSFF address some key realities regarding the state of public support and assistance for the fisheries and aquaculture sector. Historically, countries which have done well in the fisheries and aquaculture sector all benefited from the sector's important contribution to the national economy. The fisheries and aquaculture sector in those countries received sustained and robust government assistance. As the present study shows Bangladesh can also do much better if we revisit the needs of increased public sector support for our fisheries and aquaculture sector. There is ample scope for improvements in this regard.

I commend BSFF and its study team for its meticulous work on the study. I am confident that all the forward looking recommendations in the study will be positively taken into account by our policy makers and that through their implementation; we shall be able to impart a much needed further momentum to our fisheries and aquaculture sector with more positive outcomes.

(Syed Arif Azad)

Message

The Agribusiness for Trade Competitiveness Project (ATC-P), branded as Katalyst, is a pioneer market systems development project contributing to sustainable poverty reduction in Bangladesh. It is implemented by Swisscontact under the umbrella of the Ministry of Commerce, Government of Bangladesh. The project has been operating in Bangladesh since 2003 in three phases. The current phase 3 (March 2014 to March 2018) is co-funded by the UK Aid, Swiss Agency for Development and Cooperation (SDC) and the Danish International Development Agency (Danida).

Bangladesh has become a global player in aquaculture production as the fourth largest farmed fish producer in the world. In spite of a phenomenal growth in production of fish in Bangladesh over the past decade, the demand of fish still outstrips the supply. Katalyst has been working in farmed fish sector since 2004 in order to contribute to the sectoral growth thereby increasing the income of the farmers. The project has benefitted over 461,864 farmers in the last 14 years.

In 2016, Katalyst partnered with BSFF to conduct a study titled "**Comprehensive Support Measures for Development of an Inclusive and Sustainable Aquaculture Sector in Bangladesh**". The objective of the study is to identify the growth opportunities and scopes of improvement and recommend the relevant support measures for this to the relevant public sector institutions. The draft study has been disseminated among the experts and feedbacks from them have been incorporated in this version of the report. The recommendations stated in this study are expected to provide with road-map for public private partnership to achieve competitive and comparative advantage in the fish production and export.

I am very happy to acknowledge this Comprehensive Study on Aquaculture Sector in Bangladesh prepared by BSFF. I strongly hope, the report will provide a pathway for building capacity on food safety improvement issues within the aquaculture value chain.

I want to thank Bangladesh Shrimp and Fish Foundation for the successful publication of this study and expect it to be disseminated and adapted within the aquaculture value chain actors.

Gupta Bahadur Banjara
General Manager
AT-CP/Katalyst

Message

Bangladesh Shrimp and Fish Foundation has, as one of its main objectives, to leverage its ongoing and planned activities to support the Government of Bangladesh, the private to support the Government of Bangladesh, the private sector in Bangladesh and all the sector in Bangladesh and all the major stakeholders in the country's important fisheries and aquaculture sector to implement concrete actions that are needed to overcome impediments stymieing the sector's growth. The Foundation's works have thus been focused to help address a whole range of supply side constraints standing in the used to help address a whole range of supply side constraints standing in the used to help address a whole range of supply side constraints standing in the way of modest growth of the fisheries and aquaculture sector. Equally importantly, the Bangladesh Shrimp and Fish Foundation has continued to work to mobilize both public and private sector support for the growth of the aquaculture sector – especially, significant public support for the sector. Similar support was instrumental in other countries which have in the recent past registered significant growth and development in the sector.

The present study entitled "**The Aquaculture Sector in Bangladesh with Particular Focus on Existing Policy Support Received by the Sector and Scope for Improvements**" is one of the most important comprehensive evidence based studies on the production realities in the fisheries and aquaculture sector in Bangladesh and the state of public support to it. The study has provided to obtain a deep insight into where we do stand in extending public support to our aquaculture sector. The Government is definitely committed to promote accelerated growth in this important sector. However, as our study establishes there is considerable scope to further widen and increase such support to our aquaculture sector. In fact, extending and increasing such support has the potential to have a multiplier effect on the growth of this sector which is certainly going to help us achieve most of our economic development goals and the SDGs.

Bangladesh Shrimp and Fish Foundation is grateful to the Ministry of Commerce and Swiss Contact Katalyst for generous help and assistance which facilitated the work on the study. It is also grateful to Ambassador Liaquat Ali Choudhury, the study Adviser and the study team led by Dr. BazlulHaqueKhondker and his team including Mr. Rafiqul Islam, former Director General, Department of Fisheries for a very comprehensive study which has gone at great length in identifying the problems and constraints in the fisheries and aquaculture sector in Bangladesh and the type and magnitude of public support which would be needed among many specific initiatives to unlock the process of further accelerated growth in the sector and realize its full potential.

We shall consider our work on the study a most rewarding one if findings and recommendations in it are utilized in their proper context and help forge a new coalition of forces with much needed increased support for our vital fisheries and aquaculture sector.

Syed Mahmudul Huq
Chairman,
Bangladesh Shrimp and Fish Foundation (BSFF)

The Aquaculture Sector in Bangladesh with Focus of Existing Policy Support Received by the Sector and Scope for Improvements

1. Introduction and Background

Bangladesh has achieved impressive economic progress over more than 4 decades of her independence since 1971. Progress in increasing per capita in the country, reduction of poverty and improvements in social indicators have all been remarkable during this period. The country was largely able to cope with the consequences of the recent global economic downturn and met with admirable resilience the adverse impact of many natural disasters maintaining a steady state of real annual economic growths over 6% during the current decade. In 2015, the per capita income level in the country increased sufficiently for it to enter into the low middle income country according to the World Bank classification. Head count poverty in Bangladesh which was 48.9% in 2000, dropped to 23.2% in 2016 according to the new quarterly poverty estimates, implying that poverty in Bangladesh could effectively be halved within a period of 15 years. The economy of Bangladesh also underwent important structural transformations.

The fisheries and aquaculture sector in Bangladesh played an important role in this unfolding narrative of national growth. The sector's importance can be seen from the fact that its contribution to the Gross Domestic Product (GDP) currently is around 3.65%(Bangladesh Economic Review, 2016). Fish products are important in the diet of the people of Bangladesh and the sector meets nearly 60% of the national animal protein consumption in the country. Fisheries and aquaculture provides rural employment and income and around 11% of the country's population directly or indirectly depends on the sector (DOF Annual Report, 2015). As most of the fish farmers in Bangladesh lives in the rural areas of the country, the healthy performance of the sector is critical for rural income generation and poverty alleviation. The fisheries sector also generates a whole stream of upstream and downstream economic activities in the fisheries value chain in the economy, employing a sizeable number of people.

The growth performance of the fisheries sub-sector within the broader agriculture sector has also been quite impressive with the sector posting around 6% growth per annum during the recent years. It has rightly been recognized that notwithstanding the recent progress only a part of the full growth potential of the sector has been realized. Bangladesh is yet to reach the performance level of many of the country's neighbours in the region in terms of productive efficiency, overall volume of production and export earnings from the sector. The potentials of growth are there and Bangladesh would significantly gain by imparting greater impetus to higher growth in the sector with systematic and sustained efforts to increase production performance at all levels. Bangladesh has been actively involved in outlining and adoption of the ambitious UN Sustainable Development Goals (SDGs) particularly those relating to, amongst others, such

broad goals as those on poverty reduction, elimination of hunger, good health and well-being, decent work and economic growth, climate action and life below water etc. The Government of Bangladesh is already seized with how the relevant SDGs in these broad areas can be achieved through comprehensive national efforts. The development of fisheries and aquaculture sector will continue to receive attention in the context of these efforts.

The future growth in fisheries and aquaculture sector, it is believed, will have to play an important role in the achievement of SDGs in the Bangladesh context. Affordable fisheries products may lead to significant improvement in the nutrition, protein intake and dietary diversity as in many other developing countries. However, it would be particularly challenging to realize the full potential of the sector in contributing to the achievements of the relevant SDGs in the Bangladesh context as the sector is presently operating at a sub-optimal level. The contention is based on the ground reality of low Bangladesh fisheries and aquaculture productivity compared to her neighbours and other developing countries which have recently done well in the sector such as Vietnam, Thailand and other countries. The idea of present study was first mooted in a meeting of the Project Steering Committee of the Agri-business Trade Competitiveness Project (ATC-P) under Ministry of Commerce supported by SwissContact. It was decided to commission the study to facilitate better understandingon production reality in the fisheries and aquaculture sector, the state of public support that has important bearing for overall growth and development of the sector, identify gaps and inadequacies and recommend steps for future action which would help realize the untapped potentials of growth in this important sector by unlocking the process of positive forward movement. It was hoped that such a study and its useful recommendations would be particularly helpful informing future public support policy formulation and implementation in Bangladesh which would enhance competitiveness of shrimp sector of Bangladesh. The Bangladesh Shrimp and Fish Foundation (BSFF)was assigned to carry out the study with active coordination and support from DOF and SwissContact.

The study contents have been organized in 10broad sections as follows:

Section-1:Introduction and Background
Section-2: Broad Tasks of the Study
Section-3: Framework for Analysis
Section-4: Review of Literature
Section-5: GrassrootsLevel Reality
Section-6: Lessons from recent collaborative development interventions in the fisheries and sector of Bangladesh
Section-7: State of Public Support to the Sector- a selective comparative reality check
Section-8: Conclusions and recommendations
Section-9: Bibliography
Section-10: Annexure

2. Broad Tasks of the Study

As planned, the team undertaking the present study had following broad tasks before it, i.e., to-

i. Utilize existingreports and researchon the significance of fisheries and aquaculture sector in Bangladesh,focused on the need for the country's growing population and the sector's potential to contribute to export earnings;
ii. Conduct a stocktaking and analysis of the current public supports (policy, finance, infrastructure) in aquaculture, including comparisons with other related sectors (e.g., crop agriculture)and other countries in the neighborhood of Bangladesh;
iii. Conduct economic and financial analysis of production of important species and aquaculture practices to determine the scope for public support including the credit requirements for stakeholders in the fisheries sector;
iv. Extract experiences of Katalyst and its previous project phaseDeveloping Business Service Markets(DBSM) in enabling fishery sector policy interventions and draw lessons for further improvement of policy initiatives such as Feed Law, Hatchery law, water body leasing policies and exporting regulations.
v. Provide road-map and recommendations for public support as well as modalities for extension of assistance, in particular to implement the National Aquaculture Development Strategy and Plan of Bangladesh (2013-2020).

3. Framework for Analysis

3.1 Methodology

The study was conducted by following a rigorous methodology utilizing both qualitative and quantitative tools. The methodology followed included the following:

- A detailed desktop review of relevant literature, secondary data, information and analysis on the fisheries and aquaculture sector in Bangladesh.
- Consultations and interviews with experts, policy-makers, representatives of specialized agencies and implementing authorities of the Government of Bangladesh.
- Focus group discussions with DoF officials, representatives of government banks and specialized financial institutions and private banks, representatives of PalliKarma SahayakFoundation (PKSF), Non-Governmental Organizations (NGOs) and, microfinance institutions.
- Consultations with representatives of development partners and donor agencies actively involved with development program and initiatives in the fisheries and aquaculture sector in Bangladesh.
- A comprehensive field-level questionnaire survey of growers involved in aquaculture practices.

The study was carried out with a multi-sectoral team of experts including economists, aquaculture specialists and, data processing experts and specialists. Its main focus has been aquaculture in particular which has emerged as the dominant component of the broad fisheries sector in most of the countries during the recent years including in Bangladesh. The study was originally expected to be spread over a period of three months. However, it had to be completed in a shorter period of two months between January-February 2017 for unforeseen circumstances. The limited duration, together with difficulties encountered in the field by surveyors of the study team, posed considerable problems. Most respondents interviewed during the survey do not maintain recordsof their income and expenditure, production costs and similar details. It was, therefore, difficult to obtain exact information on them and the data obtained was mostly approximations and based on memory recall.

The field survey was conducted over a period of 12 weeks. Survey instruments and questionnaires for the intended respondents by sectoral specialists were designed through desk review of relevant documents, available data on fish farmers in Bangladesh, production patents, their geographical dispersion and, relative importance of specific fish species produced in different parts of Bangladesh.

Pre-testing of questionnaire was an important part of the field investigation. Questionnaires which were prepared for fish farmers were field-tested to assess their appropriateness in ground-level circumstances.Pre-testing wascarried out in four districtsGazipur, Mymensingh, Bagerhat and Rajshahiinvolving 17 fish farms. Following pre-testing, the questionnaires were suitably modified, adding clarity and needed simplification to make the respondents more willing to respond to them. Additions and simplifications were effected on issues relating to income expenditure andrecourse to credit by respondents.Two separate sets of questionnaires were prepared for hatcheries and feedmills.

Three-daylong training workshops were conducted in Dhaka to train field enumerators and supervisors.

The actual field surveyswereconducted in between December 10, 2016 and February 10, 2017.

3.2 Sample Design

Fish production data by district are available in DoF publication (Fisheries Statistical Report of Bangladesh). It was the basis for developing the sample design and selection of samples. Proper sampling techniques were followed to determine sample size, distribution and, selection of samples.According to available annual production data in Bangladesh, districts which are known as “fish producing hubs/areas” were chosenfor conducting the study. These hubs/areas are not synonymous with classifications based on fish species. The following sample upazilaswere selected for the study based on the highest production of pond fish during 2014-15(DoF Report)

Table 1:Selected pond fish production area by upazila, district and division

No.	Division	No.	District	No.	Upazila	No. of sample	Farm/pond selection criteria
1.	Dhaka	1.	Gazipur	1.	Kaliakoir	20	▪ Minimizing regional disparity ▪ Priority on high production performance (i.e. per unit area production) ▪ Consider species diversity (i.e. potential aquaculture species) ▪ Representation of all farm sizes/categories ▪ Preference of location-specific aquaculture technologies ▪ Presence of aqua-farms, fish hatcheries and feed producing entities
		2.	Narshindi	2.	Palash	20	
2.	Mymensingh	3.	Mymensingh	3.	Bhaluka	40	
				4.	Trishal	40	
				5.	Fulpur	30	
		4.	Kishoreganj	6.	Sadar	20	
3.	Rajshahi	5.	Rajshahi	7.	Paba	25	
		6.	Natore	8.	Sadar	25	
		7.	Bogra	9.	Adamdighi	20	
4.	Rangpur	8.	Rangpur	10.	Sadar	15	
				11.	Mithapukur	15	
5.	Khulna	9.	Jessore	12.	Sadar	20	
		10.	Bagerhat	13.	Fakirhat	25	
		11.	Satkhira	14.	Shyamnagar	25	
6.	Barisal	12.	Barisal	15.	Sadar	20	
7.	Chittagong	13.	Comilla	16.	Sadar	30	
		14.		17.	Laksham	30	
		15.	Cox,s Bazar	18.	Chokoria	15	
8.	Sylhet	16.	Habiganj	19.	Sadar	15	
					TOTAL	**450**	

Figure 1: MAP locating Upazilas

Map of Bangladesh locating the Upzilas selected for the survey

3.3 Determination of sample size for fish farm

Taking into account the above information on aquaculture pattern, time and resource constrains, it was decided to determine the sample size using the following formula:

$$n = \left\{\frac{z_{\propto}/2}{r} \times (CV)\right\}^2$$

Where n = sample size

CV = co-efficient of variation i.e. standard deviation / mean = 1.0 (assumed)

r= relative risk (estimation error as a proportion of true value) = 1.0

z= standard normal value with 5% level of significance ensuring that the probability of achieving the assumed error limit as 0.95 = 1.96

Putting these values into the above formula, the sample size determined was 384. However, for better precision,some guiding principles (such as species, aquaculture pattern, farm's type, etc.) were followed for sample selection and the sample was raised from 384 to 450 fish farms.The sample size and distributions of samples for the Study on Aquaculture sector in Bangladesh as used in the study is presented in Table 2.

Table 2: Sample size and allocation of fish farm by division

Division	No. of selected districts	No. of selected Upazilla	No. of sample fish farm
Dhaka	3	3	60
Mymensing	1	3	110
Rajshahi	3	3	70
Rangpur	1	2	30
Khulna	3	3	70
Barisal	1	1	20
Chittagong	2	3	75
Sylhet	1	1	15
Total	**15**	**19**	**450**

3.4 Sample Selection

A total of 450 fish farms/ farmers were selected from the19 upazilas. The number of fish farmers was determined with reference to districts and upazilas, proportional to the number of farmers in them as well as production of fish. In the second stage, sampling was done for fish farmers in the

upazila. The updated lists of fish farmers were obtained from the office of the Upazila Fishery Officer (UFO). These were usedas a frame for selection of sample fish farmers in the selected upazila. Fish farmers wereselected by systematic random sampling method.

3.5 Data collection and data processing

Adequate numbers of qualified, experienced enumerators from local areas were deployed for collection of data. Team leaders and other members of the study team closely supervised the field survey.

Preliminary checking of filled-in questionnaires wascompleted at the field level completely edited manually and codedin Dhaka. Data processing was done using CsPro, in a microcomputer environment using STATA.

3.6 Concepts and classifications used

The following**assumptions**, **definitions**, **concepts** and **classifications**were followed in the collection and analysis of data.

3.6.1 Production method in aquaculture:

a. *Traditional* – In the traditional system, production is undertaken without any use of fish feed and Good Aquaculture Practice (GAqP). In the improved traditional system, some locally produced feed using local ingredients may be used. The resultant average production in the Bangladesh context is low, being below 1.5 MT per hectare. In the shrimp sector the yield under this method is less than 1 MT per hectare.
b. *Semi-intensive* – Farmers occasionally use fish feed available locally using local ingredients, mostly not including commercially produced industrial feed. The farmers follow GAP and production per hectare varies in general between 1.5-4.0 MT per hectare and for shrimp between 1-3 MT per hectare.
c. *Intensive* – Industrially produced commercial feeds are regularly used along with fertilizers and GAqP practice. Average production in Bangladesh under this method is above 4 MT per hectare and for shrimp the relevant production figure is above 3 MT per hectare.

3.6.2 Type of fish farm:

a. *Small farm* – Production carried out on in ponds/water bodies with an average area of 0.5 acre[1] or less.
b. *Medium farm* – Production carried out on in ponds/water bodies with an average area between 0.51 – 3.0 acres.
c. *Large farm* –Production carried out on in ponds/water bodies with an average area above 3.00 acres.

Note: It may be pointed out here that the classifications of agriculture farm holdings used by BBS (Bangladesh Bureau of Statistics) in Agricultural census as well as for agricultural statistics are as follows:

Small farm: 0.05 – 2.49 acre
Medium farm: 2.5 – 7.49 acre
Large farm: 7.5 and above.

3.6.3 Persons employed/engaged:

a. *Regularly employed*: Is a person who was either working one or more hours for pay or profit or working as an unpaid family helper during the period of cultivation.
b. *Irregular worker:* If a person working as/when necessary for cultivation of fish is termed as irregular worker. These may be day labourers, unpaid family helpers or a contract worker.

Own/self-employed: Is a self-employed person who himself/herself is engaged in aquaculture activities for profit or family gain.

[1] 1 acre = 0.40 hectare, 1 acre = 100 decimal

4. Review of Literature

A comprehensive review of the literature on the fisheries sector of Bangladesh undertaken as a part of the present study highlights several important facts about the sector's various specificities and contribution to Bangladesh's overall gross domestic product, growth in the sector, relative share in the absorption of country's work force and sectoral investment, especially investment in the sector. The review also provided an important opportunity to undertake a stock taking on the various Government plans and programs as well as the long term objectives that has been set for the future growth of the sector as part of the overall growth targets for the country outlined in the 7th Five Year Plan (2016-2020) of the country.

A sector with rich diversity and significance

The review findings, undertaken as a part of the present study, highlight several important factors. Bangladesh is unique in many ways from a purely geographical point of view as one of the most important deltaic regions in the world. Its landmass has been formed by the water flows of three great rivers – The Ganges, The Brahmaputra (The Jamuna) and The Meghna covering an area of approximately 14.4 million hectares. In view of the importance of the river system of Bangladesh's national economy, the fisheries and aquaculture sectors are prime contributors to the country's food security and employment. According to Food and Agriculture Organization (FAO), Bangladesh is one of the world's most important inland fishing nations. *The FAO Bangladesh Fisheries and Aquaculture Country Profile (2014)* notes that production from the sector has more than doubled between 1998 and 2009 and the catch in the sector is dominated by carp species accounting for about half of the total fresh water production. Marine catches of the country have remained stable without much increase during the recent years.

Bangladesh has approximately 2.5 million ponds covering 0.338 m ha and a seasonal cultured water body covering 0.122 m ha, baor or dead rivers covering 0.006 m ha and approximately 0.23 million shrimp farms covering 0.275 m ha. Bangladesh has, in addition, in land open water-bodies of 4.025 m ha which include river and estuary covering 0.854 m ha, mangrove forest in Sundarbans covering 0.178 m ha, KaptaiLake covering 0.069 m ha, beel or natural depression of 0.114 m ha and flood plains of 2.810 m ha, Marine and territorial waters of Bangladesh cover 9,060 km^2. (DoF FRSS, 2015)

The fisheries and aquaculture sector of Bangladesh is extremely rich in bio-diversity with approximately 260 identified fresh water fish species, 12 exotic fish species, 486 marine fish species, 24 fresh water shrimp species and 36 marine fish species. The standard classification of fish species used for statistical purposes in Bangladesh, both for inland catch and for marine catch are as follows:

Table 3: Major fish species in Bangladesh

Code	Type of Fish	Local name
A. Inland Fish		
01.	Major carp	Rui, Catla and Mrigel
02.	Exotic carp	Chinese carp, Silver carp, Grass carp etc.
03.	Other carp	Kalbasu, Ghania, Kalia etc.
04.	Telapia	Telapia, Nilotica etc.
05.	Cat fish	Rita, Baol, Pangas, Silen, Air Becha etc.
06.	Shake head	Shol, Gagar, Taki etc.
07.	Live fish	Koi, Singi, Magur,Jagur
08.	Other inland fish	Poa, Punti, Chapila,Chela, Baila, Pabda, Beta, Keski and Annyana, Mach etc.
09.	Diaromus fish: Hilsa	Illish, Illisha, Chandana, Illisherc.
B. Marine Fish		
10.	Bombay duck	Loita
11.	Indian salmon	Lauka
12.	Pomfret	Rupchanda, Hall Chanda, MakhanChanda, BailaChanda
13.	Jew fish	Poa, RupaPoa, Loondu, Kala Datina, Laipoa etc.
14.	Sea cat fish	Kata mach
15.	Sharks and rays	Hangar, Katnot, Haturi, Moishya, Pitambari
16.	Other marine fish	Chela, Churi, Tapassi and Annyaynyamach
17.	Big prawn and shrimp	Icha Mach, Golda Chingri, BagdaChingri etc.
18.	Small shrimp	Icha Mach, ChottaChingri, Chaka etc.
19.	Turtle and tortoise	Kachap

Source: FAO (2014)[2]

Total fish production in Bangladesh in 2014-15 was 3.684 MT of which 2.060 MT was from inland closed water (culture) and 1.024 MT was from inland open water (capture). Marine fishes accounted for 0.600 MT. The review, undertaken as part of the present study, indicates that in the inland fisheries sector, the cultured species surpasses the captured species with the former accounting for 55.9% of the total fisheries production and the latter accounting for 27.79% of the total production. The marine production is still an insignificant part of the country's total fish capture accounting for only 16.28% of the total output.[3]

[2]United Nations Food and Agricultural Organization, "*The FAO Bangladesh Fisheries and Aquaculture Country Profile (2014)"*

[3] DOF 2015

The following table presents details on the major cultured species in Bangladesh:

Table 4: Major cultured species in Bangladesh[4]

Cultured Native Carps		
Scientific name	**Common name**	**Bengali name**
Labeo bata	Minor carp	Bata
Catla catla	Bangladeshi major carp	Catla
Labeo calbasu	Carp	Kalbasu
Chrr hina mrigala	Bangladeshi major carp	Mrigel
Labeo rohita	Bangladeshi major carp	Rui
Heteropneustes fossilis	Stinging Catfish	Shingi
Anabas testudineus	Climbing Perch	Koi
Mystus cavasius	Gangetic Mystus	Gulsha
Ompok pabda	Pabda Catfish	Madhu Pabda
Cultured Crustaceans		
Penaeus monodon	Black Tiger Shrimp	Bagda Chingri
Macrobrachium rosenbergii	Giant Fresh water Prawn	Galda Chingri
Scylla serrata	Mud Crab	Kakra
Cultured Exotic Fishes		
Aristichthys nobilis	Chinese carp	Bighead carp
Barbonemus gonionotus	Barb	Raj/ Thai Sarpunti
Chanos chanos	Milkfish	Milkfish
Ctenopharyngodon idellus	Chinese carp	Grass carp
Cyprinus carpio var. communis	Chinese carp	Common carp
Cyprinus carpio var. specularis	Chinese carp	Mirror carp
Hupophthalmicthys molitrix	Chinese carp	Silver carp
Mylopharyngodon pisceus	Chinese carp	Black carp
Orechromis nilticus	Perch	Nilotica
Orechromis mossambicus	Perch	Tilapia
Pangasius hypothalmaus	Catfish	Thai Pangas
Pygocentrus natteri	Red Piranha	Piranha
Clarius batarchus	Walking Catfish	Magur
Genetically Improved Farmed Tilapia (GIFT)		

According to the review of the literature on the catch profile in the sector obtained from relevant FAO documents, the official statistics distinguish between industrial and artisanal fisheries (with artisanal encompassing all small-scale fisheries from the drag and push net to 20 m l.o.a. gillnetters). An estimated 93% of marine catch was produced in the artisanal sub-sector. Hilsa is the most important species with 202,951 MT, all from artisanal fisheries. Other important species are Bombay Duck (58,263 MT), Pomfret (46,643 MT), and Jew Fish (35,743 MT). The total shrimp fisheries production is approximately 52,217 MT, of which 2,932 are catches from trawlers, the balance artisanal production.

Contribution of the sector in the national economy: One significant fact emerging out of the review exercise has been the fact, that contribution of the fisheries sector to the country's growth

[4]Rahman, A.K.A., 2005: Freshwater Fishes of Bangladesh, 2nd edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000and BSFF Website

of Gross Domestic Product (GDP) has been consistently encouraging. Growth rate of fisheries has historically played a significant role in ensuring healthy GDP growth in Bangladesh. Strong positive association between growth of rate of fisheries sub-sector and GDP has been observed (Figure 2).

Performances of the fisheries sub-sector were better than the projection of the 6thFYP. Projected share of the fishing sector in 6thFYP was around 3.7% in 2015, whereas actual share of the fishing sector as a % of total GDP was around 3.68-3.73%. Actual share of the fishing sector in total GDP was higher in each year between 2011 and 2013 than the projected share in 6thFYP for this period (Figure 3)[5]. It is worth noting that significant contribution of the fisheries sector was largely helped by important growths and production gains in the aquaculture sub-sector of the sector.

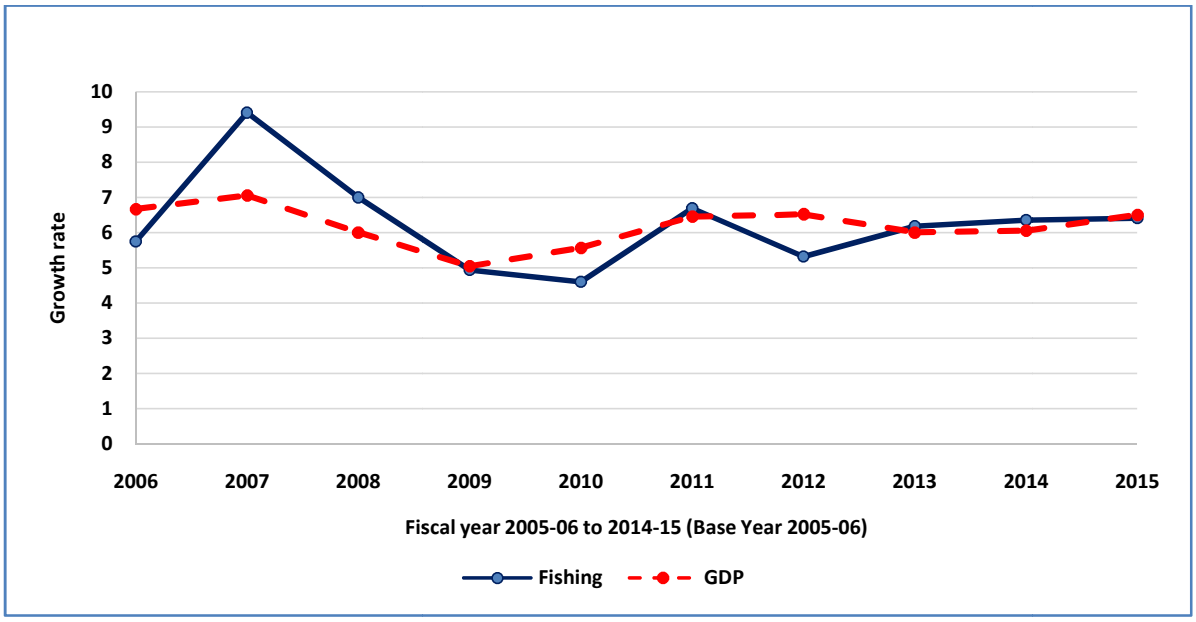
- In fact, among the subsectors of Agriculture, the performance of the fisheries sector has been much better than the other subsectors and the projected rate at 6thFYP. The fisheries sector contributed 25% of the contribution of the broader agricultural sector to the GDP in 2013/2014.[6]

- Without the significant contribution of the fisheries sector a desired growth rate of the broader agricultural sector and its contribution to the country's overall GDP growth would have been much modest.

[5] BSFF (2016), "A Preliminary Study on Support to Bangladesh Aquaculture Sector Existing Reality and Scope for Improvements", Bangladesh Shrimp and Fish Foundation, February 2016.

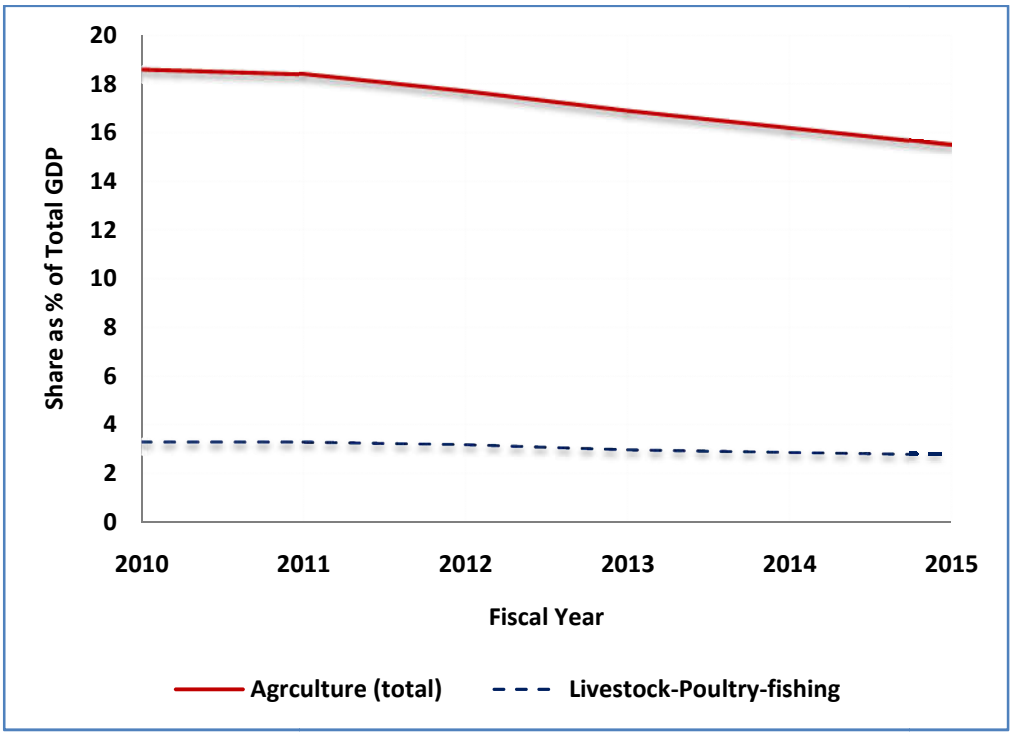
[6] National Food Policy of Action and Country Investment Plan Monitoring Report 2015 prepared by Food Planning and Monitoring Unit, Ministry of Food, Government of Bangladesh; PP-51

Figure 2: Growth Rate of Fisheries and GDP (%)



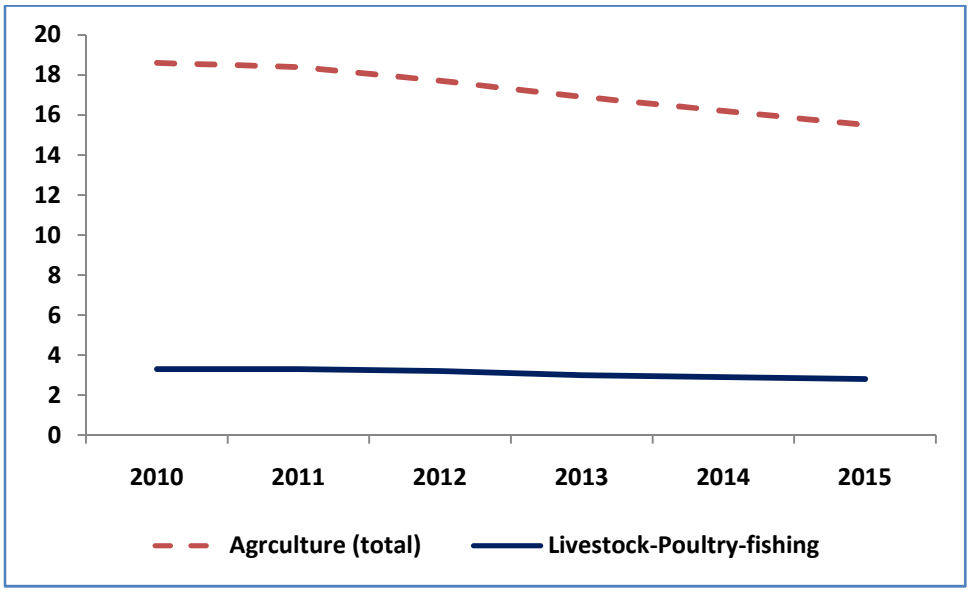
Source: Bangladesh Bureau of Statistics (various years)

Figure 3: Projection at SFYP, Bangladesh Share as % of Total GDP



Source: 6th Five Year Plan & Bangladesh Bureau of Statistics (various years)

Figure 4: Contribution of Agriculture to GDP (%)

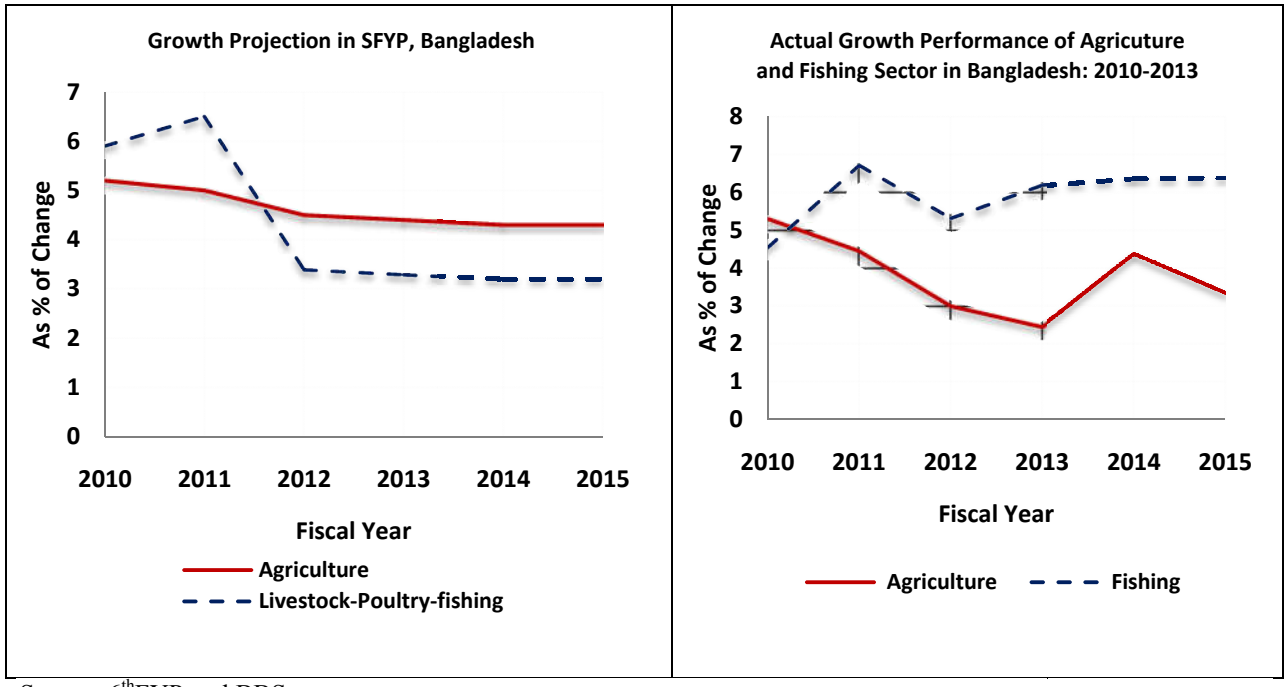


Source: 6th Five Year Plan & Bangladesh Bureau of Statistics

Figure 3 plots the projected growth of agriculture and fishing sectors in Sixth Five Year Plan of Bangladesh. It was projected that during the sixth five year plan period agricultural growth rate would remain stable while growth of livestock-poultry-fishing would go down over the period. However, actual performances of these sectors were more positive: Figure 4 shows that between 2011 and 2013 overall annual agricultural growth rates were lower than those of fisheries and aquaculture sector. In 2013, actual growth rate of the entire agriculture sector was around 2%, 100% down from the projected growth rate. On the other hand growth rate of the fisheries sector was more than 75% than the projected growth rate in SYFP.[7]

[7] BSFF (2016), "A Preliminary Study on Support to Bangladesh Aquaculture Sector Existing Reality and Scope for Improvements", Bangladesh Shrimp and Fish Foundation, February 2016.

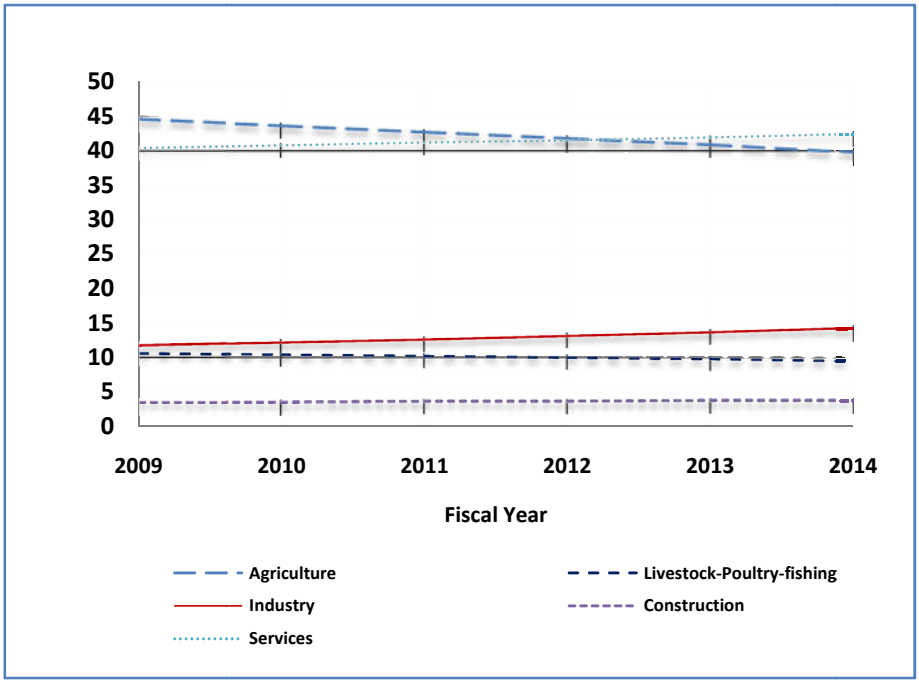
Figure 5: Growth Projection in SFYP, Bangladesh and Actual Growth Performance of Agriculture and Fishing Sector in Bangladesh: 2010-2013



Source: 6th FYP and BBS

The Sector and Employment Generation

Figure 6: Sectoral Employment Share (%)



After cereal crops and the industrial sector, livestock-poultry-fishing sector plays a major role in employment generation. A study undertaken by Ministry of Fisheries and Livestock, World Fish and Bangladesh Shrimp and Fish Foundation in 2006 that the sector plays a major role in the country's poverty alleviation efforts and absorption of rural workforce[8]. In 2014, sectoral employment share of livestock-poultry-fishing was slightly less than 10% and around 71,33,712 people were employed in this sector. However, the share of employment in the fishing sector was close to the share of employment of the entire industrial sector during 2009 to 2014. Though relative sectoral employment share of the livestock-poultry-fishing sector dropped slightly in 2014, it was mainly due to the drop in employment in the poultry sector. Expansion of the fisheries sector can offer more employment in coming years and can keep the unemployment rate of the country to a reasonable level. In addition to the positive contribution in overall employment, fishing sector can also offer more participation of the rural women in the employment sector. [9]

[8]Policy Working Paper: Dynamic Agribusiness-Focused Aquaculture for Poverty Reduction and Economic Growth in Bangladesh by *M. Karim, M. Ahmed, R.K. Talukder, M.A. Taslim, H. Z. Rahman, March 2006*

[9]BSFF (2016), "A Preliminary Study on Support to Bangladesh Aquaculture Sector Existing Reality and Scope for Improvements", Bangladesh Shrimp and Fish Foundation, February 2016.

It has been noted as an example that in case of shrimp and fisheriesproduction alone due to large value chain (i.e. backward and forward linkages to other sectors or activities), the expansion ofactivities in the sector is likely to lead to increase in production and income from other linked activities. Using the Input-output Table (IOT) of Bangladesh for 2012[10] (which was a component of the 7thFYP technical framework and constructed under the aegis of the Bangladesh Planning Commission), the backward and forward linkages of all 86 activities of IOT were estimated. Interestingly, shrimp and fish processing activities turned out to be two leading activities in terms of 'backward' and 'forward' linkages (i.e. they are among the top 5 backward linked activities). More specifically, shrimp activity has a 'backward' linkage of 2.33 implying that a one (1) unit increase in the production of shrimp activity would lead to 1.33 units increase in the production of other linked activities. It has also a high 'forward' linkage estimated at 3.13.

Sector's Contribution to Export Earnings

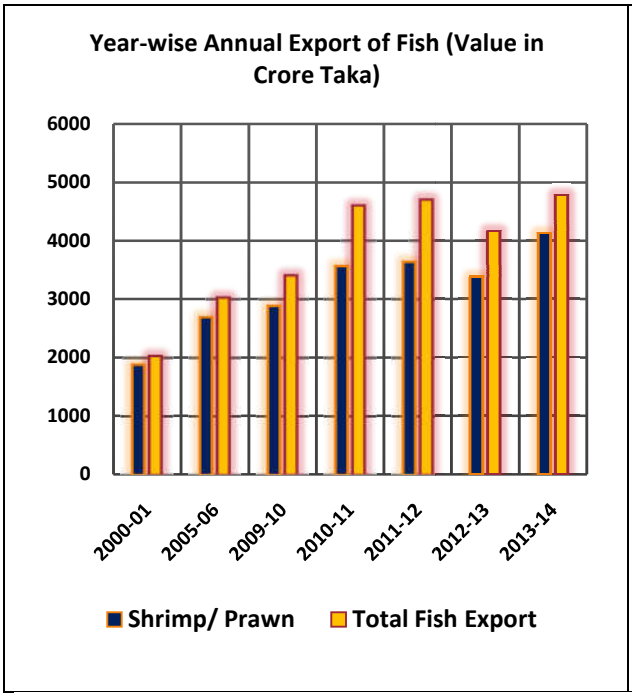
Between 2008-09 and 2013-14, about 70% of total exports of fish items were from prawn and shrimp. And the picture is almost the same in recent years. In 2013-14, annual export of fish was around 500 million Taka[11] among which more than 400 million taka came from shrimp and prawn export. Between 2001 and 2014, total export earnings from shrimp and prawn increased more than 100%, so as the export earnings from the fishing sector.

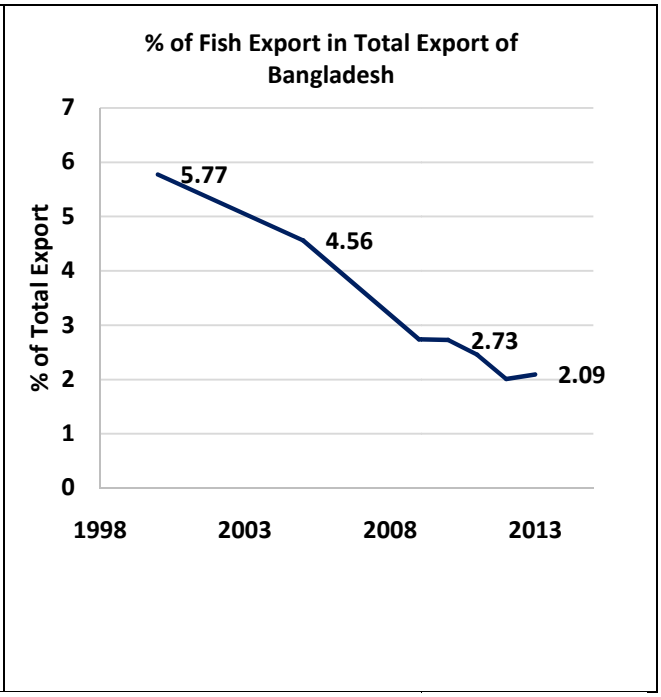
As Figure8 shows that in last four years total value of exports from the fishing sector as well as from aquaculture remained stagnant-suggesting no growth in export earnings from the fishing sector in this period. Figure 9 captures the declining trends in fish export in total export. Fishing sector has been lagging behind other export oriented sectors in terms of growth which is an area of serious concern and requires public attention.

[10]General Economics Division (GED) of Planning Commission: "Bangladesh Input-output table 2012: Methodology and Results", Background Paper: 7FYP Technical Framework, March 2014. Backward linkages are measured in the paper by the total column sum of the multiplier matrix of the Input Output Table (IOT). These provide valuable information about the degree of integration of an activity with the rest of the economy. Using this measure, it is possible to determine which activities contribute most to the economic growth as a result of an exogenous increase in final demand, for instance shrimp export. Forward linkages, on the other hand, help us to understand the importance of a commodity for the rest of the economy in terms of intermediate demand. Therefore, a commodity that exhibits high forward linkages it is said to be important to growth since growth in that activity will have knock on effects in other sectors.

[11]At the present market rate as on March 13, 2017 Taka conversion rate is US Dollar 1 = Taka 80.55 [http://epaper.thedailystar.net/index.php?opt=view&page=17&date=2017-03-13].

Figure 7: Year-wise Annual Export of Fish and Fish Export in Total Export of Bangladesh





Sector's Contribution to Nutrition

According to available most recent data, the fisheries sector provides 60% of the total protein consumed by the country's 160 million plus population. Current fish intake (g/person/day) in the country is 55.00 as against the desirable fish intake (g/person/day) of 60.00.[12]

Government's Policy Priorities for the Sector

A comprehensive review of the sector shows that, from the policy perspective, the importance of the fisheries sector was recognized from the early days of Bangladesh's emergence as an independent country. Bangladesh developed and implemented a number of policies for fisheries and aquaculture sector. In 1972, under Bangladesh Water and Power Development Board Ordinance, water management infrastructure for shrimp farming was introduced. In 1973, Bangladesh Fisheries Development Corporation was formed to develop the fishing industry. For the conservation of marine fisheries, Territorial Water and Maritime Zone act was formed. These suggest that Bangladesh has long historical background targeting fisheries sector starting from the period of Bangabandhu Sheikh MujiburRahman, the founder of Bangladesh. In 1997, Bangladesh introduced Fish and Fish Product Rules to control quality of fish and shrimp, targeting export. National Fisheries Policy in 1998 focused on conservation, management, exploitation, marketing and quality control.

[12]DoF 2016: National Fish Week Compendium

According to the review exercise, during the recent years, Bangladesh has enacted a whole range of rules, regulations and guidelines to improve the performance of the sector which include the following:

- Fish and Fish Products (Inspection and Quality Control) Ordinance, 1983 includes legal powers for the CA related to infringement procedures in relation to fishery products.
- Marine Fisheries Ordinance 1983 includes legal powers for the CA related to infringement procedures in relation to fishery products.
- Fish and Fish product (Inspection and Quality Control) Rules, 1997 (amended 2008 and 2014) gives powers and enforcement rights to the CA and also contains structural requirements for vessels, transports, landing sites, vending centers, ice plants, cold stores, packing centers, hatcheries, nurseries and processing establishments; standards for potable water; maximum limits for heavy metals; requirements for buying agents and proof of source of origin of fishery products; food additives; prohibited use of certain substances; veterinary medicinal products allowed to be used.
- Fish Feed Acts 2010 and Fish Feed Rules 2011- fishery products are also included in these acts, e.g. maximum limits for mercury, lead and cadmium.
- Fish Hatchery Acts 2010 and Fish Hatchery Rules 2011 including e.g. polychlorinated biphenyls (PCBs).
- Public Servants Conduct Rules, 1979 includes requirements for official staff concerning conflict-of-interest.
- Fish and Fishery Products Official Controls Protocol summarizes the legal framework for the CA; contains e.g. detailed requirements for risk based official controls and rating of establishments and gives guidance to staff on how to perform sampling, audits and approvals. A number of detailed checklists developed for different types of control objects are included.
- National Residue Control Plan (NRCP) Policy Guideline 2011 (revision 2012) gives advice on substances to monitor; sampling strategy and planning; collection and handling of samples; result reporting and investigation procedures.
- Guidelines for the Control of Aquaculture Medicinal Products – AMPs (2015) gives advice to the distribution chain of veterinary medicinal products and for the CA's field monitoring of use.

According to a recent EU audit[13] of the sector, the improvement with regard to the compliance with the above Government rules, regulations and guidelines will be of particular relevance fort the future sustainable growth of the sector and access of Bangladesh products originating there from in EU markets.

13 Final Report of an Audit Carried Out in Bangladesh from 20th April, 2015 to 30th April, 2015 in Order to Evaluate the Control Systems in Place Governing the Production of Fishery Products Intended for Export to the European Union by European Commission Directorate-General for Health and Food Safety, Directorate F - Food and Veterinary Office, DG (SANTE) 2015-7469 - MR

Water is one of the main resources on which the development of the broad fisheries sector and its most important sub-sector aquaculture depends. However, there is competing demand on this scarce resource from other sectors and water-bodies in Bangladesh continue to be affected by unsustainable, uncoordinated and unplanned use.Hence, specific aspects of policy environment having a bearing on the management of water resources is therefore of vital importance for Bangladesh. The recently enacted Bangladesh Water Act 2013 deserves a special mention as one of the Government policy and regulatory instruments, with important bearing for the sustainable development of the sector.

Bangladesh Government has also a very pro-active policy with regard to promotion of cooperation and collaboration with development partners and international organizations and entities which are also keen to help Bangladesh in accelerating growth and development in the fisheries sector. Thus, Bangladesh in the recent past, actively worked with USAID, EU, Swisscontact, FAO, WorldFish etc. for the purpose. Ministry of Fisheries and Livestock and Department of Fisheries of Bangladesh have also very close collaborative relationship with the Bangladesh Shrimp and Fish Foundation, BFFEA. The Ministry of Commerce is also actively involved in addressing trade related promotional aspects and trade negotiations as they affect the fisheries sector. The Business Promotion Council of the Ministry of Commerce is in the process of successfully completing a major project with a significant fish component under its ATC-P project with a total committed resource of US$ 0.38 million which was provided by Swisscontactand its development partners.

The Sector in the Country's Development Plan(s)

In the present Government policy prioritization for the sector, the **National Aquaculture Development Strategy and Action Plan of Bangladesh, 2013–2020**[14]plays a very important role. The plan has 4 objectives (Box3) and 16 projected outputs are linked to them. The 4 main objectives of the plan, the formulation of which has been informed by the National Fisheries Policy of 1998, Country Investment Plan 2011–2015, Sixth Five Year Plan 2011–2015, National Fisheries and Livestock Sector Development Plan, are the follows:

Box 1: Broad National Aquaculture Development Strategy and Action Plan of Bangladesh objectives

Social	Economic
• Augmenting the health and well-being of the people through the production of nutritious food • Promoting productive and secure livelihoods.	• Stimulating additional economic activities in rural areas and creating more rural employment opportunities. • To increase incomes of rural households, and save or earn foreign exchange through import substitution or more export earnings.

[14] This section draws heavily from the strategy.

Ecological	Institutional
• Promoting the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience.	• Establishing enabling environment and developing the capability to effectively manage the sector, providing support services needed for sustainable and responsible development • Ensuring equity and fairness in the allocation of production resources and distribution of benefits.

The strategy is to be implemented over a period of 8 years starting from 2013. The lead agency for the implementation of the Plan is The Ministry of Fisheries and Livestock (MoFL). A priority setting exercise will establish the priority rankings among the outputs. The stakeholders' workshop identified 7 project ideas for implementation in the first two years of the Plan period. Funding will be allocated by goal and subdivided among outputs. An indicative budget allocation is provided below based on a total investment of US$170 million over 8 years or an average of US$21 million per year. The funding is envisioned to be from national funds, private sector contribution and donor assistance. This indicative allocation is 1.68 percent of the estimated cost of the Country Investment Plan (CIP), which is US$10.1 billion (GoB, 2011).

Funding Sources and Budget Mechanism includes: (i) Funding sources will be from the national treasury (US$40 million) and external assistance; (ii) Programmes and projects will be developed for external assistance (US$100 million); (iii) Certain projects will be a public-private partnership (private sector share US$30 million); (iv) Budget management and control will be by the Ministry of Fisheries and Livestock; (v) Direct responsibility for budget disbursement for projects will be devolved to the collaborating institutions, and agreements will be made as to which of the partners shall be the lead agency, which shall be responsible for project coordination that includes financial management.

The **7th Five Year Plan of Bangladesh**[15] has also very ambitious goals and targets for the sector (Box 2)

Box 2: 7th Five Year Plan sector specific goals and targets

Goals	Targets
01. Attain self-sufficiency in aquaculture and fisheries production and generate surplus for export	a. Increased 45% aquaculture production by 2020 b. Increased 20% fisheries production by 2020 c. Raise per capita protein intake to 60 g from domestically produced fish and fisheries product by 2020 d. Raise export earnings to US$ 1.25 billion by 2020 from frozen shrimp, fish and value added fish products
02. Improve conservation of aquatic biodiversity in inland open water-bodies	a. Reappear at least 75% of endangered fish species insanctuary area by 2020 from baseline b. Increased 20% hilsa fish production by 2020
03. Enhance coastal and marine fisheries production in line with Blue Economy Initiatives	a. Increased 18% marine fisheries production by 2020 b. Introduction of mariculture by 2020 c. Diversified coastal aquaculture
04. More income and equitable distribution of benefits	a. Creation of more (25%) employment opportunity for unemployed youths b. Fish farmers/ fishers income raise by 20% by 2020 c. Participation of women in aquaculture production, fisheries CBOs and fish/ shrimp processing industries increase to 25%
05. Improve food safety	a. Good Aquaculture Practices (GAP) and Good Manufacturing Practices (GMP) at all stages of fish/shrimp supply chain to comply internationalmarket. b. Food safety measures for domestic markets

The review exercise undertaken as part of the present study indicates that for the development of the sector Government has adopted a comprehensive approach that underlines the importance of both macro and micro policy initiatives and actively encouraging initiatives by all stakeholders particularly the growers, processors and relevant Government institutions. The Government has also been pursuing a pro-active policy in promoting Good Aquaculture Practices, Better Management Practices, affordable and easy access to good seed and feed, post harvest management and where considered appropriate, appropriate capacity building and institutional strengthening. The review has also highlighted the importance of sustaining efforts to address supply side constraints impeding growth in the sector, uncertainties and vulnerabilities adversely affecting growers at the grassroots level, ecological adversities and challenges arising out of increasing national and international concerns over quality of products from the sector, need for compliance with production norms and standards, certification and traceability.

[15] GOB (2016), "Seventh Five Year Plan Fiscal Year 2016-2020: Accelerating Growth, Empowering Citizens", General Economics Division, Bangladesh Planning Commission.

The Future Growth Potential of the Sector

The review exercise also highlights how in several ways the growth in the sector especially in the aquaculture sector may help Bangladesh. The following citation from Policy Working Paper: Dynamic Agribusiness-Focused Aquaculture for Poverty Reduction and Economic Growth in Bangladesh *by M. Karim, M. Ahmed, R.K. Talukder, M.A. Taslim, H. Z. Rahman, March 2006*" deserves particular mention in this regard:

> *"Creation of additional employment in Bangladesh requires investment in both physical and human capital. Some production activities (e.g. steel or textile production) require much great investment in human and physical capital than certain other activities (e.g. ready–made garments). This makes the task of increasing employment through such activities difficult and expensive. A country that lacks sufficient trained human resources and investment resources would find it difficult to increase employment substantially by investing greatly in capital-intensive industries. However, aquaculture requires only modest investment. Neither the physical nor human capital requirement is prohibitive. The principal factor of production required for aquaculture is Water bodies or land that could be mobilized by appropriate policies and incentives at modest cost……. It is necessary to both expand the area under aquaculture and increase the productivity or yield in order to harness the full potential of aquaculture for poverty reduction."*

Other recent studies have also highlighted the rich growth potential of the sector including in the shrimp sector in particular in Bangladesh. According to one important contribution of Dr. Mahmudul Karim for the Country Investment Plan (CIP) Study significant growth is possible in the sector. His projections for the possible production gains in the sector are presented in Box 6.

Box 3: Projection on potential production gains

A. Bringing 500,000 ha haors and other flood plain lands under aquaculture may lead to a production of 750,000 mt fish by 2017

Floodplains/ flood-land

- Irrespective of private or public ownership, all open floodplains and low lying flood lands that naturally retain at least 60 cm of monsoon water for at least 3 months at a stretch can be brought under aquaculture applying pen culture not interfering with water movements
- Public land may be leased out to groups of poor, but entrepreneur community farmers

Suggested Supportive Actions:

- Determine criteria for selecting sites, farmers, fish species, pen webbing materials

- Conduct survey, select suitable areas, demarcate them in upazila / mouza maps, computerize data and the maps

- Select 500,000 ha in phases within 2-3 years time from Greater Mymensingh, Sylhet, Faridpur, Khulna, Jessore, Pabna and Comilla

Attainable Target Production:

750,000 MT with farm gate price of Tk75,000 million or over US$ 1,000 million; creation of significant employments.

B. Significant increase in galda shrimp aquaculture is possible

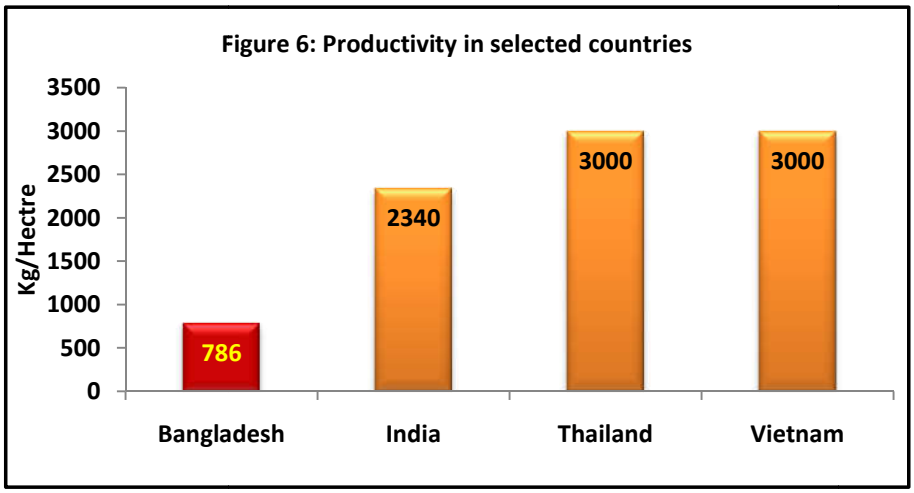
- Increase in galda farm area from existing 50,000 ha to 120,000 ha will be needed;
- Increase in galda production from 25,000 MT to 80,000mt with farm-gate price of Tk 48,000 million or US$ 685 million may be targeted;
- Introduction of double crops of galda with over-wintered juvenileson acommercial scale in 12,000 ha farms may lead to a production of 36,000 MT = US 308 mill; this will require water supply network and other facilities.
- Improvement in general farming systems may also be introduced in the remaining 108,000 ha to produce 44,000 MT @ of over 400 kg/ha/yr of shrimp;

C. Improved Bagda-fish farming technology may raise shrimp production to 150,000 mt& export to US$1.3 billion by 2017

- Existing total area of 170,000 ha;
- Intensify culture in 35,000 ha in perennially saline areas:
  - 10,000 ha @ 3 MT/ha x 2 crops = 60,000 MT;
  - 25,000 ha @ 1,000 kg/ha x 2 crops = 50,000 MT;
  - Totalling 110,000 MT with sale price of Tk 66,000 mill or US$ 943 million
- Essential infrastructure, logistic support and contract farming facilitating traceability
- Rest 135,000 ha:
  - Shrimp @ 300kg/ha or 40,000 MT: @ Tk 600,000/MT amounts to Tk 24,300 mill or US$ 347 million;
  - One crop of salt-resistant aman paddy.

Challenges to be addressed to realize the rich potential of the sector

Figure 8: Productivity in selected countries



One of the main characteristic features of the aquaculture sector of Bangladesh is its low performing production practices. It has thus been noted that, i*n Bangladesh* annual Productivity of Shrimp/ Prawn Farm (including other fishes) was 786 kg/ hectare in 2013-14 (Fisheries Statistical Report of Bangladesh 2013-14). *In India*Shrimp productivity was 2,340 kg/ hectare (Handbook of Fisheries Statistics of India 2014). Productivities were even higher in *Thailand and Vietnam*. The average product per hectare was more than 3000 Kg in both of these two countries (Department of Fisheries Website of Corresponding Countries and FAO Fisheries and Aquaculture Statistics 2014). The above productivity statistics indicate that there are huge scopes for expansion of the aquaculture production in Bangladesh if backed by appropriate public sector support. More specifically, achieving a double digit growth rate for fisheries sub-sector is a real possibility.

The challenges standing in the way of fisheries sector growth in Bangladesh have also been the subject of extensive treatment in relevant literature on the sector. It has thus been noted that purely from the supply side constraint perspective the sectoral growth continues to suffer due to degradation of natural resources, particularly reduced opportunities for fishing in flood plains, beels (depressions) s and rivers caused by reduction in water flows, encroachment, rapid urbanization etc., over fishing, use of destructive gears, silting up of water-bodies, closure of natural fish passes, no-fishers' control of the jolmohal, pollutions of water-bodies by agrochemicals, industrial wastes and urban sewers.

The abundant literature of fisheries and aquaculture sector, however, documents the successes achieved in reversing the declining trend in Hilsa catch in Bangladesh through the

implementation of a comprehensive Hilsa Fisheries Management Action Plan (HFMAP)[16]. The implementation of the plan comprised initiatives for establishment of Hilsa sanctuaries and time-specific fishing bans, conservation of gravid Hilsa for uninterrupted spawning, enforcement measures with multi-tier oversight and monitoring and incentives for affected fishermen in the form of food assistance during the fishing ban period and Alternative Income Generating Activities (AIGA) support.

The government's success in implementing HFMAP highlights how coordinated government efforts may contribute to addressing sector specific challenges. In the Bangladesh context with specific reference to challenges being faced in the aquaculture sector, considerable scopes for initiatives were identified and acted upon during the recent years. The Government has also taken initiatives for conservation of Halda river as a habitat for indigenous species and ensuring the use of their pure strains in aquaculture which is one of the major 7th Five Year Plan strategic objectives for the sector[17]. Recent Government initiatives also include conservation interventions for other breeding and nursery grounds that contribute to aquaculture development as well.
In so far as inland aquaculture development is concerned, the following challenges have been identified[18]:

- Poor brood stock management
- Inadequacy of supply of fish and shrimp spawn and fries of desired quantity and from reliable sources at reasonable price
- Low availability of reliable and quality fish feed at reasonable price
- Spread of infectious diseases of both fish and shrimp
- Lack of institutional capacity with the needed extension service, and the need to ensure supply of quality inputs and quality produce and supply chain development[19]

During recent consideration of challenges to faster growth of aquaculture sector, the problems in the area of making available quality aquaculture seed and feed to the growers have also been highlighted. The respondents of the filed survey carried out as part of the present study also identified this as a major problem faced by them (details can be seen in the next section of the report). The findings on both these main areas of concerns have also been the subject of a comprehensive FAO publication entitled "Aquaculture Seed and Feed Production and

[16] Hilsa and Hilsa Fishermen- exploring conservation-livelihood win-wins by *Dr. Hossain Zillur Rahman, Dr. Md. Abdul Wahab, Mr. Liaquat Ali Choudhury*
[17] 7th Five Year Plan (2016-2020), PP-289 (li)

[18] The farmers' perception on challenges and problems faced by them, documented in course of the filed survey for present study, is presented in Section 5 of the report.
[19] 7th Five Year Plan (2016-2020), PP-286

Management in Bangladesh – Status, Issues and Constraints"[20]. Key recommendations of the study are summarized below (Box 4):

[20] Aquaculture Seed and Feed Production and Management in Bangladesh – Status, Issues and Constraints (FAO 2015) edited by *Mr. R. Hasan, J. Richard Arthur*

Box 4: Improvements suggested for ensuring availability of quality feed and seed

- **Improving seed quality by developing and implementing selective breeding programmes for the important species-groups.** To support this programme, the capacities of government Fish Seed Multiplication Farms (FSMFs) and the focusing of their efforts on broodstock development needs to be strengthened. While the Fish Hatchery Act (2010) provides for hatchery registration and certification, this should be accompanied by a certification standard process and hatchery better management practice (HBMP) guidelines.

- **Improving aquafeed quality by developing the guidelines and technicalsupport to implement the Fish Feed and Animal Feed Act (2010).** The guidelines could be developed through a national consultation process led by the DOF.

- **Improving the capacity of farmers to utilize feed efficiently.** To accomplish this, the government should develop and promote the adoption of BMPs. Farmers should be encouraged to organize themselves into clusters or associations for better uptake of BMPs.

- **Improving the technical efficiencies of small aquafeed producers.** To accomplish this goal, farmers need to be assured of a reliable supply of quality key ingredients at a stabilized cost, assistance with the upgrading of equipment and processes, training in good manufacturing practice, and encouragement to organize themselves to achievebetter economies of scale in buying raw materials and for other transactions.

5. Grassroots Level Reality

5.1 Demographic and Economic profile of respondent farmers

Almost all of the sample households or respondents (i.e. 99.3%) are male. For half of the survey districts, all respondents were males. More than 90 percent of the respondents were married while7 percent of respondents were unmarried. Average family size of respondents was 5.7 which is slightly higher than the national average family size of 4.5 reported for 2010 (HIES 2010). Information on education of respondents revealsthat only 4.2 percent of them are illiterate. More than one-third of them passed class 5. Percentage of sample respondents having passed the secondary level was around 60 percent.

Table 5:Key demographic characteristics

Variables/Divisions	Dhaka	Mymensingh	Rajshahi	Rangpur	Khulna	Barisal	Chittagong	Sylhet	Percentage of Total
Sex									
Male	98.3	99.1	100.0	100.0	98.6	100.0	100.0	100.0	99.3
Female	1.7	0.9	0.0	0.0	1.4	0.0	0.0	0.0	0.7
Marital Status									
Married	90.0	94.6	94.3	83.3	91.4	90.0	97.3	100.0	93.1
Unmarried	10.0	5.5	5.7	16.7	7.1	10.0	2.7	0.0	6.7
Widow or Widower	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.2
Education Level									
Illiterate	3.3	6.4	10.0	3.3	0.0	0.0	1.3	6.7	4.2
Class 5 passed	31.7	14.6	30.0	23.3	62.9	45.0	40.0	66.7	34.7
Secondary Passed	35.0	21.8	30.0	26.7	14.3	15.0	32.0	13.3	25.1
Higher Secondary Pass	15.0	24.6	11.4	10.0	15.7	25.0	9.3	13.3	16.0
Degree and Higher	15.0	28.2	18.6	36.7	4.3	15.0	16.0	0.0	18.2
Technical	0.0	0.0	0.0	0.0	2.9	0.0	1.3	0.0	0.7
Religious Education	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	1.1
Average Family Size	5.7	5.9	4.6	5.1	5.6	6.6	6.2	6.6	5.7

Source: Field Survey

More than 70 percent of all respondents reported fishing as their main occupation (Table 4). However, wide variations are found in surveyed districts. The percentage share of respondents in the coastal area with fishing as their main occupation is above average: Barisal (95%); Khulna (89%); and Chittagong (87%). Percentages below the 70 percent average were observed in three districts: Rangpur (67%); Sylhet (53%); and Dhaka (52%). Most respondents reporting aquaculture as their main occupation have secondary source(s)of income.*The main secondary occupation reported were crop farming (by cultivable land-owning respondents) and, business*. *Together these two avenuesof additional income account for more than 70 percent of respondents with secondary occupations.*

Table 6: **Occupation profile of the sample respondents**

Occupation	Dhaka	Mymensingh	Rajshahi	Rangpur	Khulna	Barisal	Chittagong	Sylhet	Total
Main Occupation									
Fish Farming	51.7	72.7	52.9	66.7	88.6	95.0	86.7	53.3	71.6
Crop Farming	6.7	7.3	22.9	6.7	1.4	0.0	6.7	33.3	9.1
Poultry Rearing	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Cattle Rearing	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.2
Service	5.0	8.2	1.4	10.0	5.7	5.0	2.7	6.7	5.3
Business	35.0	11.8	18.6	16.7	2.9	0.0	2.7	6.7	12.7
Others	0.0	0.0	4.3	0.0	0.0	0.0	1.3	0.0	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Secondary Occupation									
Crop Farming	25.8	24.1	32.4	30.0	48.4	15.8	81.3	37.5	41.6
Poultry Rearing	6.5	5.1	0.0	0.0	1.6	0.0	3.1	0.0	2.8
Cattle Rearing	0.0	1.3	0.0	5.0	1.6	0.0	1.6	0.0	1.3
Service	16.1	7.6	5.4	0.0	4.8	5.3	0.0	0.0	5.3
Business	25.8	32.9	27.0	45.0	29.0	68.4	7.8	50.0	29.1
Daily Labor	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.3
Others	16.1	15.2	35.1	20.0	4.8	10.5	6.3	0.0	13.4
No occupation	9.7	13.9	0.0	0.0	8.1	0.0	0.0	12.5	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Field Survey

Income profiles of respondent aquaculture farmers suggest that they are not income poor in the accepted sense of the term (Table 5). Their reported average per day per capita income is BDT 1,500 or USD 18.8. This income level is significantly higher than the per day per capita poverty threshold of USD 1.90 used by the World Bank. The above, however, depicts an average picture and wide variations in per day per capita average income were observed for three types of aquaculture farmers classified by their farm size.The per day per capita income of large aquaculture farmerswere found to be about ten times greater than that of the smaller aquaculture producers.However, these variations notwithstanding, it is significant that per day per capita incomefor evensmall aquaculture farmers($4.9) was more than double the international poverty line. Aquaculture, it seems, therefore, can be economically empowering income-wise, even for smaller producers.

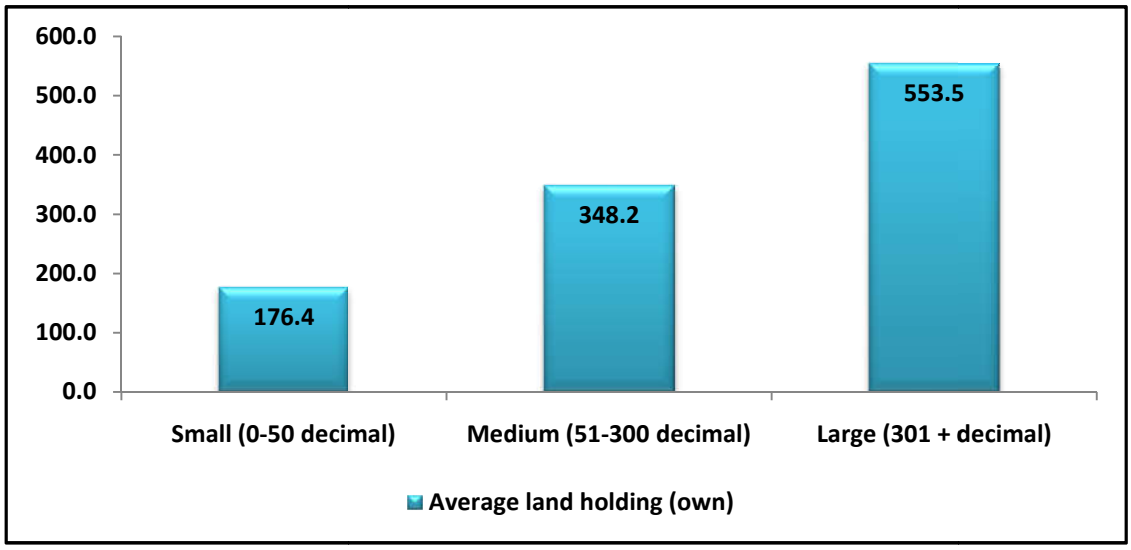
Table 7: **Income profile of the aquaculture farmers**

	Overall		Small (0-50 acre)		Medium (51-300 acre)		Large (301 + acre)	
	BDT	USD	BDT	USD	BDT	USD	BDT	USD
Annual AverageHousehold Income	2,986,821.0	37,335.3	653,383.2	8,167.3	1,542,642.0	19,283.0	5,940,008.0	74,250.1
Per Capita Annual Income	547,539.9	6,844.3	144,236.3	1,803.0	287,278.6	3,591.0	1,077,922.0	13,474.0
Per Capita Daily Income	1,500.1	***18.8***	395.2	*4.9*	787.1	*9.8*	2,953.2	*36.9*

Source: Field Survey

Land holding (ownership) pattern of aquaculture farmers is presented in Figure 7. Average land holding or ownership of small farmer, medium and larger aquaculture farmers are respectively 176 decimal; 348 decimal and 554 decimal. They are not land poor like the landless or near-landless peasantry in Bangladesh.

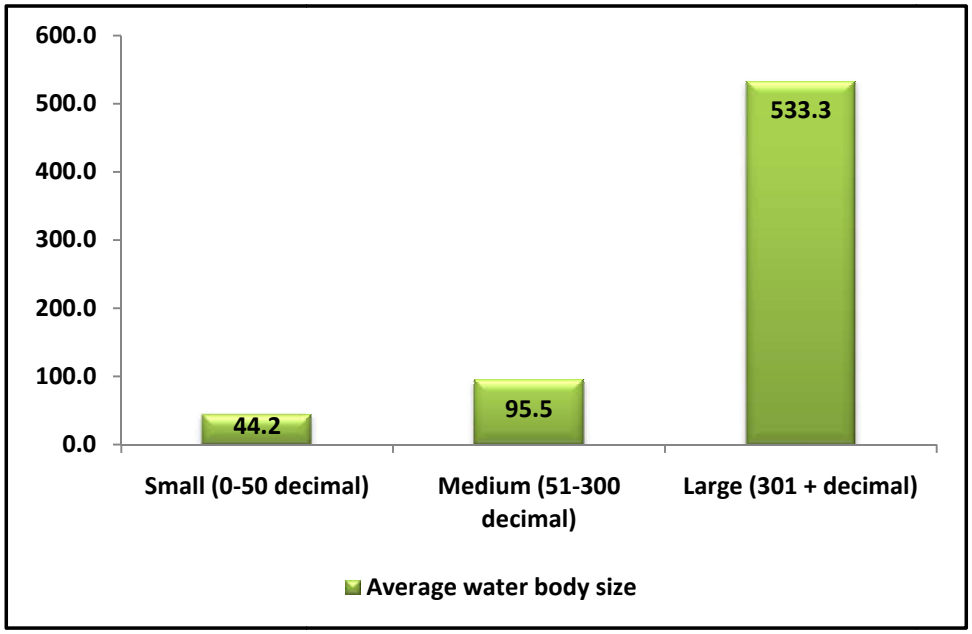
Figure 9: Land ownership pattern by farm size (decimals)



Source: Field Survey

For aquaculture, ownership of waterbodies is of critical importance. Average size of waterbodies owned by aquaculture farmers classified by farm-size is provided in Figure 10. Wide variations in the size of waterbody owned werealso found during the survey using the yardstick of farm sizes owned. The average size of waterbodies belonging to large farmers was found to besignificantly larger than that of small and medium farmers.

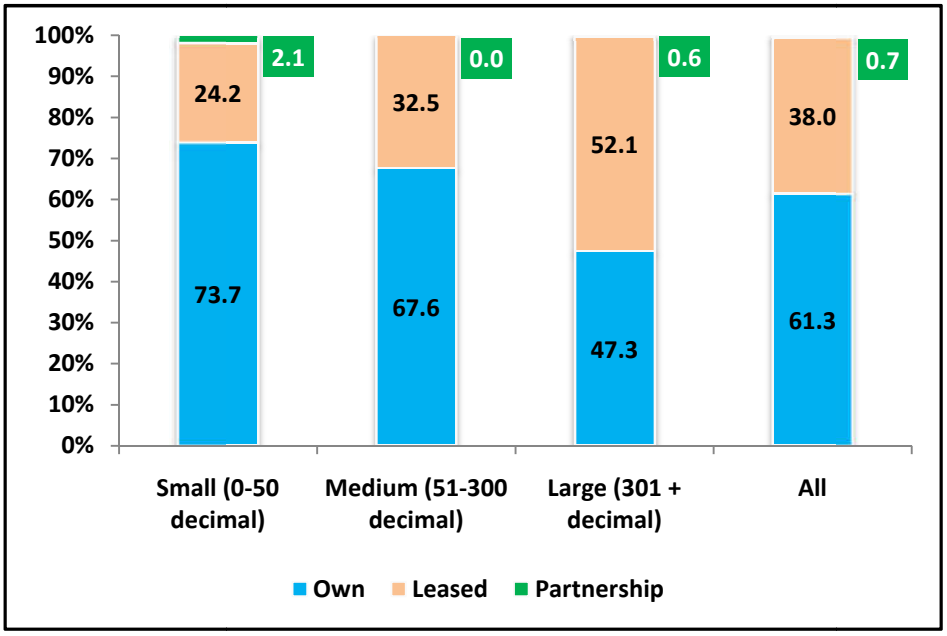
Figure 10: Average size of waterbodies owned (decimals)



Source: Field Survey

Types of waterbodies being used by aquaculture farmers according to a three-type classificationowned, leased and used on a partnership basisis shown in Figure 11. More than 60 percent of the sample respondents reported using their own waterbodies for aquaculture activity. The proportion of growers using leased waterbodies is around 38 percent. However, use of water bodies through partnership arrangement was not found to be preponderant. The pattern of ownership of waterbodies across the farm sizes suggests that 52 percent of waterbodies used by large aquaculture farmers are leased. For medium aquaculture farmers this proportion is relatively less at 33 percent and for small aquaculture farmers, it is 24 percent. It appears that small and medium farmers are likely to use self-owned waterbodies. It is however not clear what percentage of these self-owned waterbodies are singly owned or owned jointly with others.

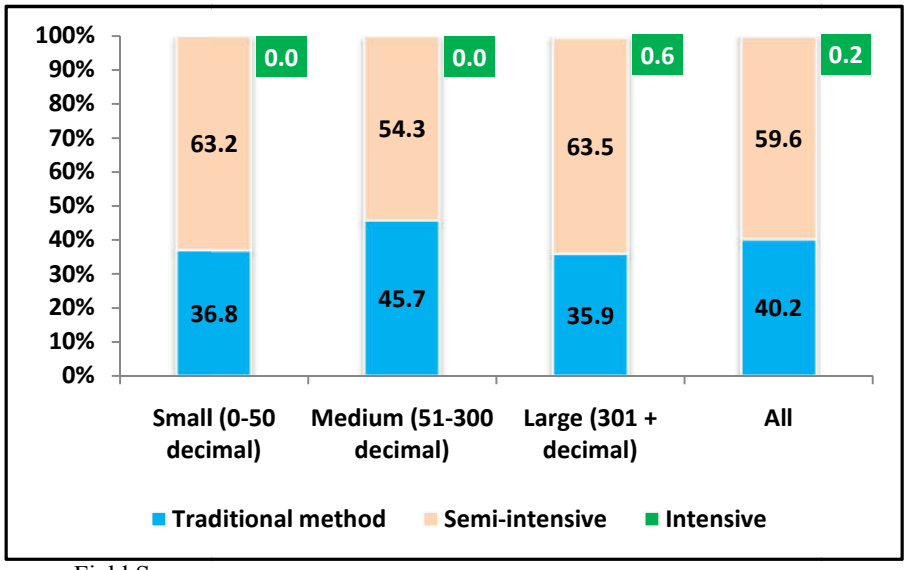
Figure 11: Ownership of water bodies (decimals)



Source: Field Survey

The figure below sums up types of production methods used by aquaculture practitioners in Bangladesh:36 percent of small farmers practice traditional production methods and surprisingly even among them, 63.2 percent practice semi-intensive production methods. The corresponding percentage for medium farmers reported, surprisingly, is 54.3 percent. Only 35.9 percent of large aquaculture farmers practice traditional production methods.On the whole, 40.2 percent of total respondent aquaculture producers are engaged in traditional production methods.

Figure 12: Distribution of production by farm size (%)



Source: Field Survey

5.2 Production realities

5.2.1 Soil types in the sample areas

Three major types of soils were identified where aquaculture farms surveyed are located. More than 90% of these farms use loamy (doash) (44%), Sandy Loamy (beledoash) (27.1%) and clay (25.7%) soils. Intensive aquaculture farming is practiced mainly in locations with loamy (doash), sandy loamy (bele doash) and clay soils. It is also the dominant type of soil found in locations where semi intensive production methods are practiced.

Table 8:Soil types in sample locations where aquaculture is practiced (%)

Soil Type	Production method			
	Traditional	Semi-Intensive	Intensive	Total
Clay	29.0	36.8	23.7	25.7
Loamy_Doash	41.9	28.0	46.6	44.0
Sandy-Loamy_ Bele Doash	29.0	24.5	27.3	27.1
Sandy	0.0	0.0	1.6	1.3
Peaty	0.0	10.5	0.5	1.7
Total	100	100	100	100

Source: Field Survey

5.2.2Water sources

Water is the indispensable resource needed for fish production and more so for aquaculture farming where ensuring availability of adequate quality, pollutant free safe water is of vital importance. In survey locations it was found that rain water was not the only source of water used by aquaculture farmers. *Most of them use more than one sources of water implying that arranging for supplementary water and cost incurred in the process has abearing for the cost of production for the farmers practicing aquaculture*.The details obtained in this regard are presented in the table below:

Table 9:Source of water used by aquaculture farmers in study locations (%):

Water Sources	Farm size			Production method			
	Small	Medium	Large	Traditional	Semi- Intensive	Intensive	Total
Rain Water	37.6	13.8	13.5	6.4	24.5	18.8	18.6
Underground Water	7.5	15.4	12.2	3.2	5.2	14.6	12.6
River/ Canal Water	1.0	5.3	9.8	38.7	17.5	1.4	6.0
Rain and Underground Water	43.0	44.1	42.3	9.6	19.3	50.0	43.2
Rain, Underground and River/ Canal Water	0.0	1.0	3.0	3.2	0.0	1.6	1.5
Rain, Underground, River/ Canal Water and others	0.0	0.0	0.6	0.0	0.0	0.2	0.2
Rain and River/ Canal Water	7.5	16.4	17.7	35.4	31.5	10.6	15.0
Rain and others	2.1	0.5	0.0	0.0	0.0	0.8	0.6
Underground and River/ Canal Water	1.0	3.1	0.6	3.2	1.7	1.6	1.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Field Survey

5.2.3 Equipment used

Owners of all the sample aquaculture farms in the survey areas use equipment of different nature, most dominant type of equipment being the water supply/pumping machines. More than 50% of farms use them. In case of farms practicing intensive production methods 56.2% of them use such equipment. 53.4% of the farmers practicing semi-intensive production methods use equipment to pump water. 23.5% of the farmers practicing traditional production method use such equipment. Significantly, this indicates that most aquaculture farms have to depend on other than rainwater as source of water. This also implies that aquaculture farmers require resources to avail the services of such machines. *In case, the aquaculture farmers require deep tube well, their procurement cost at the present market price may exceed taka 0.5 million. Shallow tube wells may cost between taka 0.1-0.2 million. Fuel cost for the operation of such pumping machineries may also be considerable.*

Table 10: Equipment used by aquaculture farmers survey locations (%)

Equipment used	Farm size			Production method			
	Small	Medium	Large	Traditional	Semi-Intensive	Intensive	Total
Water Test kit	12.0	8.2	17.4	11.7	4.6	14.2	12.8
Water supply implements (pumps of various types)	65.5	56.3	47.5	23.5	53.4	56.2	54.1
Aeration device	0.0	0.0	2.1	0.0	0.0	1.0	0.9
Others	12.0	19.5	22.3	64.7	30.2	14.9	19.4
Use of Multiple implements Water Test kits and Water supply implements	10.3	13.5	7.6	0.0	11.6	10.9	10.4
Use of Multiple implements Water Test kit, Water supply implements and Aeration device	0.0	0.0	0.7	0.0	0.0	0.3	0.3
Use of Multiple implements Water Test kit, Water supply implements and others	0.0	0.0	0.70	0.0	0.0	0.3	0.3
Use of Multiple implements Water Test kits and Aeration device	0.0	1.5	0.70	0.0	0.0	1.0	0.9
Use of Multiple implements Water supply implements and Aeration device	0.0	0.0	0.70	0.0	0.0	0.3	0.3
Use of Multiple implements Water supply implements and others	0.0	0.7	0.00	0.0	0.0	0.3	0.3
Total	100	100	100	100	100	100	100

Source: Field Survey

5.3 Cost of production

The data collected in course of the present study indicate that feed cost constitutes the major part of the total cost of production of the aquaculture farmers ranging between 46-66% if small, medium and large farmers are considered. The share of feed cost significantly varies with the variation of methods of production. Feed cost of farmers using traditional methods (including improved traditional method), semi-intensive method and intensive method vary between 28.7%-61.9%. This has important implications as the aquaculture farmers cannot possibly sustain the

relatively high level of production without using fish feed in appropriate proportions. The aquaculture farmers who cannot meet the feed cost from their own resources certainly need easy and hassle free credit or investible resources to incur this type of important variable or running cost. If quality feeds are not available and their prices are unreasonably high this impacts on the eventual profitability from production from aquacultures farmers. It is also revealing from the survey data the sample aqua farmers did not reportedly make any significant investment in infrastructure development which may be an important requirement for sustained increase in production in many locations. This may be indicative of the fact that disposable resources of individual aqua farmers, even in cases where available, are not enough to finance high cost infrastructure development projects. The establishment cost component of the total cost including lease value and water body rentals, fuels etc. was also found to be quite high varying between 8.6% - 21.8% for small, medium and large farms and between 12.5% - 19.6% for farmers using traditional, semi-intensive and intensive farming methods. The seed cost share in the total cost of production of the sample aquaculture farmers was found to vary between 11% - 17% for small, medium and large farms and between 14%-32% by production methods, i.e., intensive, semi-intensive and traditional. The seed cost is an important element of production as without good seed being used production cannot be increased. From the survey locations it was also found that if the aquaculture farmers do not have adequate resources at a time when they need such fund most for procurement of seeds they stagger the procurement of seeds in less than optimal amounts over time which may not help ideal and adequate stocking with adverse impact on production. The details in table below also show that a graduation leads to significant increase in the percentage share of feed cost in the total cost of production.

Table 11: Nature of cost incurred by aquaculture framers in the study area* (%)

		Farm size			Production method		
	Overall	Small	Medium	Large	Traditional	Semi-intensive	intensive
Establishment Cost **	12.6	21.8	8.6	12.8	19.6	14.1	12.5
Pond Preparation Cost	4.5	5.1	4.4	4.1	6.4	12.1	4.3
Seed Cost	14.9	17.9	15.3	11.9	32.3	32.1	14.4
Feed Cost	61.0	46.9	66.1	62.9	28.7	33.5	61.9
Fertilizer Cost	1.2	0.8	0.5	2.6	0.1	1.0	1.2
Labor Cost	4.3	6.0	3.6	4.2	12.3	6.1	4.2
Other Cost	1.2	1.1	1.1	1.3	0.3	0.8	1.2
Total Cost	100.0	100.0	100.0	100.0	100.0	100.0	100.0

expressed in percentage of total cost of production

****Establishment cost in the survey questionnaire included expenses incurred for lease value, payment for land tax, payment for electricity bill, fuel cost (Diesel), interest payment of debt/ loan etc.***

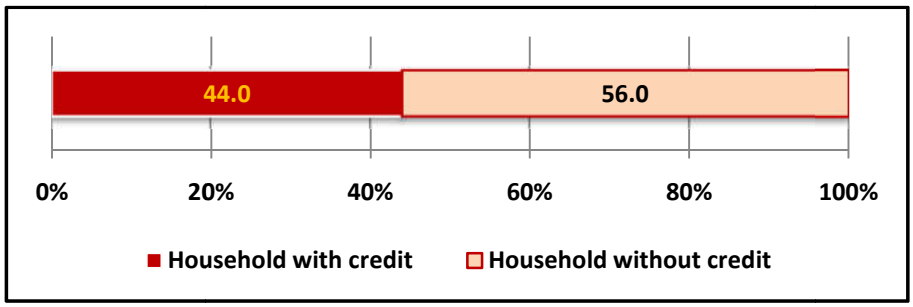
Source: Field Survey

The cost data obtained for different species (Carp, Pangas, Tilapia, Koi, Galda, Bagda and others) produced under different production methods are presented in the statistical tables in Annexure – 1. Data and information in the statistical tables on different species also confirm the ground reality that aquaculture farming in Bangladesh is characterized by a relatively high requirement for production cost needed for feed.

5.4 Financing reality

In course of the field survey it was found that 44% of the respondent aquaculture farmers took credit of some form or the other and 56% of the respondents did not utilize any credit.

Figure 13: Distribution of sample aquaculture farmers by credit (%)*



**Percentage of the total respondents*
Source: Field Survey

Average amount of credit used by respondents vary significantly by farm sizes. A*verage size of credit used by small, medium and large farms varies between Tk235,000 and TK3,633,430*respondents*engaged in semi-intensive production is almost 9 times higher than the average credit of* respondents*engaged in traditional method.Average credit used by large and small farmers also varies significantly-15 times high in case of large farmers.*

Table 12: Average credit amount used byrespondents

Farm size	Amount of credit Average credit size (BDT)
Small	235000
Medium	270840
Large	3633430

Source: Field Survey

Data on sources of credit collected by the survey team show that government scheduled banks and government specialized banks were sources of credit for only 19% of small and 37% of medium farmers and 39% of large aquaculture farmers. Five (5%) of small farmers, 11% of medium farmers and 26% of large aquaculture farmers received loans from private banks indicating that private banks loan disbursement for small farmers were insignificant. FGD

consultations undertaken with private bank representatives revealed that such banks are reluctant to extend credit to small aquaculture farmers as they cannot offer collaterals, administration and supervision cost for loan processing and monitoring was high and aquaculture was a risk sector with production uncertainties specially in the shrimp sector due to apprehension of outbreak of undetectable diseases which may have disastrous consequences. 23%of whom met their credit needs from NGOs. The corresponding percentage of large farmers receiving credit from NGOs was only 16%. Relative microfinance contribution to credit disburse to aquaculture farmers in the sampler locations was quite insignificant. A significant 45% of small farmers obtained loans from relatives and friends.

Table 13: Source of Credit Finance* (%)

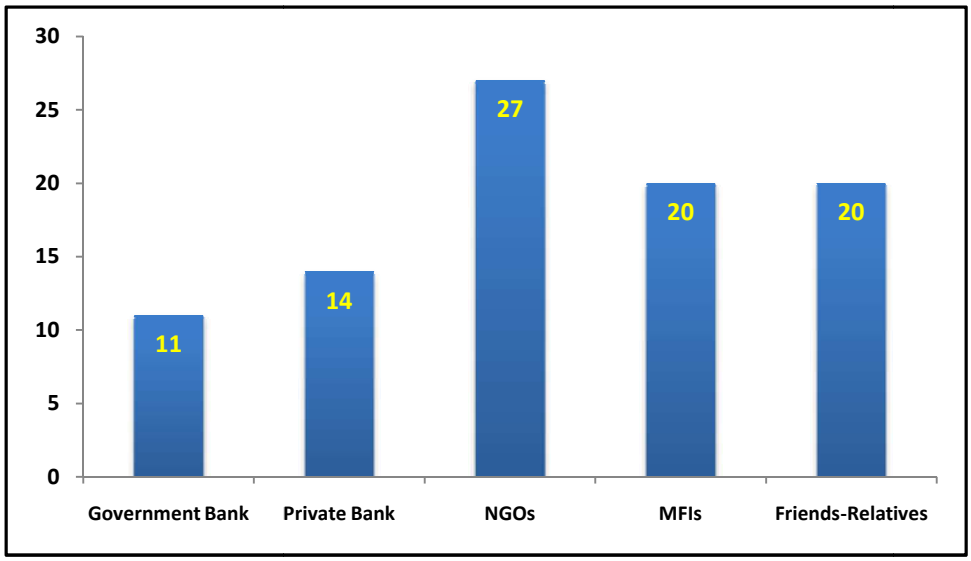
	Farm Size		
Source of fund	**Small**	**Medium**	**Large**
Government scheduled bank	14	18	17
Government Specialized bank	05	19	22
Private Bank	05	11	26
NGO	23	25	16
Microfinance/ (Micro-credit) Institution	05	07	03
Co-operative	05	03	00
Government Support	00	00	01
Loan	00	04	02
Relatives / friends	45*	13	13

*Among the 45% famer taking loan from relative only 20% give interest

** Percentage of the total number of farmers

Cost of finance by major sources is shown below (Figure 15). The cheapest source of finance was found to be the government banks(including specialized banks) followed by the private sector banks. On the other hand, the cost of finance was found to be significantly higher for credits from NGOs and microfinance institutions.The respondents complained about hardship caused by obligation to make weekly repayment even when the production cycle was not complete and that no grace period was allowed. Most respondents also reported that they had to pay over and above the stipulated interest rate as underhand payment to access credit.

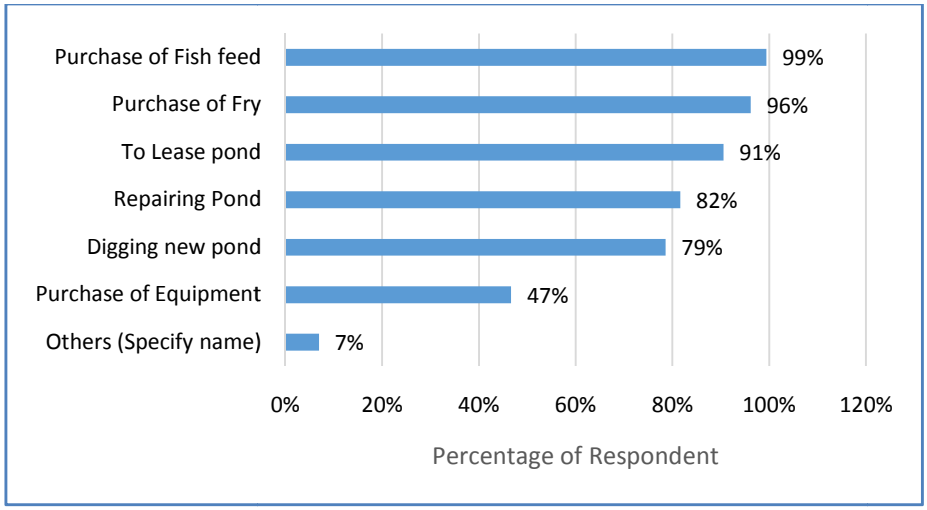
Figure 14: Lending rates by major sources (%)



Source: Field Survey

The figure below sheds some light on the specific purposes for which the respondents interviewed during the field survey would like to use credit if it is available on affordable terms.

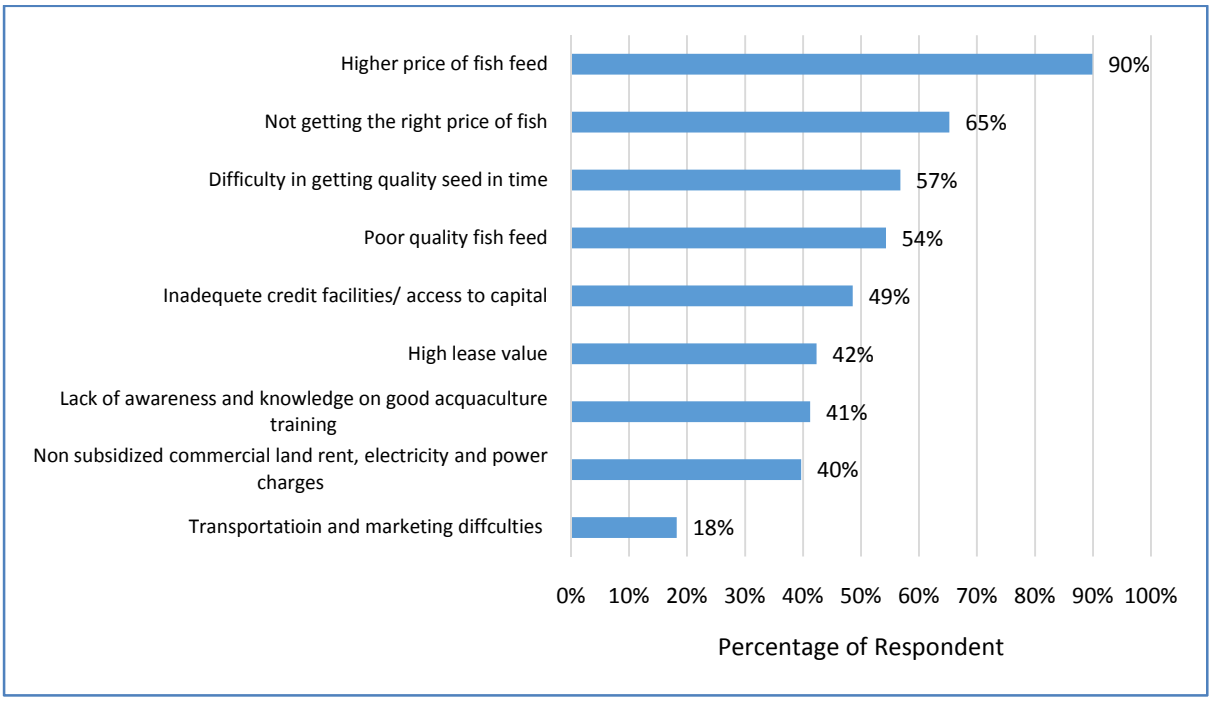
Figure 15: Specific Items where Credit Support is required (%)



Source: Field Survey

5.5 Farmers Perception from the field on Problems and Challenges faced

Figure 16: Problems and Challenges Faced by the Aquaculture Farmers



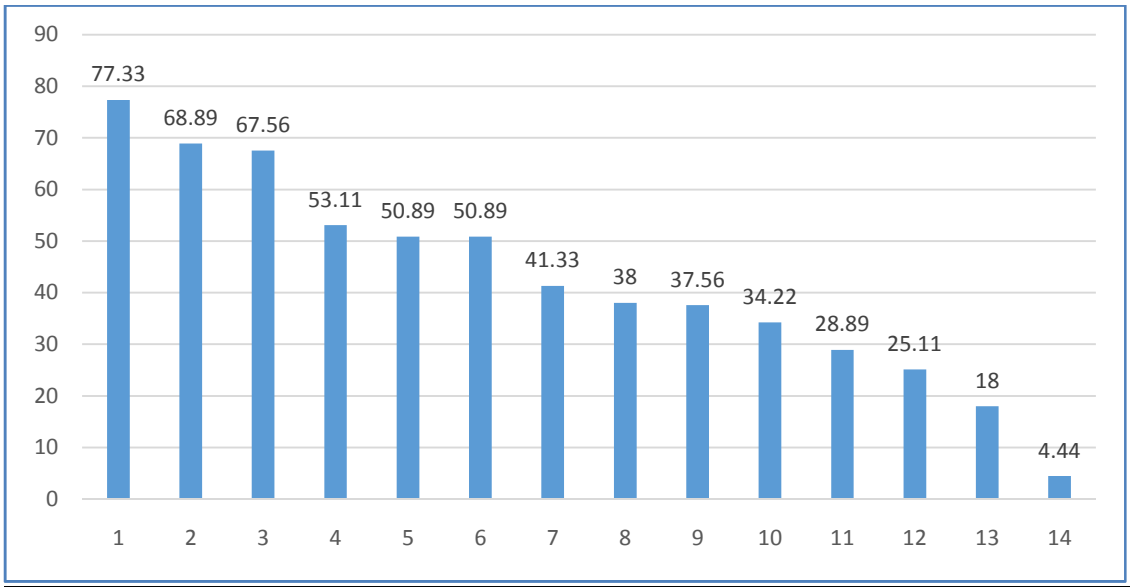
Source: Field Survey

The information and data obtained by the members of survey teams working in the field in connection with the present study offer an interesting insight into how the sample aquaculture farmers perceived the problems and challenges faced by them on the ground. 90% of the respondents interviewed during the survey identified higher price of fish feed as one of the most important problems. 65% of them were of the view that they were not getting the right price of their produce. Slightly over 50% of the respondents identified difficulties in getting quality seed in time and poor quality of fish feed as major problems. 49% of the respondents stated that inadequate credit facilities and access to capital were problems about which they had concerns. Other problems identified were high lease value for water-bodies (42% of the respondents referred to this particular problem), lack of awareness and knowledge of Good Aquaculture Practices (41% of the respondents mentioned this as a problem), non-subsidized land rent, electricity and power charges (40% of the respondents mentioned about this problem).

5.6 Aquaculture Farmers Perception on Problems Encountered in Accessing Financial Resources/ Credit

The information in the figure below shows that the respondent farmers identified as many as 14 constraints faced by them in utilizing credit. Problem regarding inability to offer collateral to access credit was identified as a major problem by 77.3% of the respondents. Other problems include reluctance of Banks to sanction loan, long approval time for processing Bank loan, inadequacy of loan available, absence of insurance to help farmers overcome difficulties due to product loss, high interest rates and repayment modalities. All of these points towards the need for development of special credit products for aquaculture farmers especially the smaller and medium sized aquaculture farmers.

Figure 17: Problems and Challenges Faced by the Farmers in Accessing Financial Resources/ Credit (%)



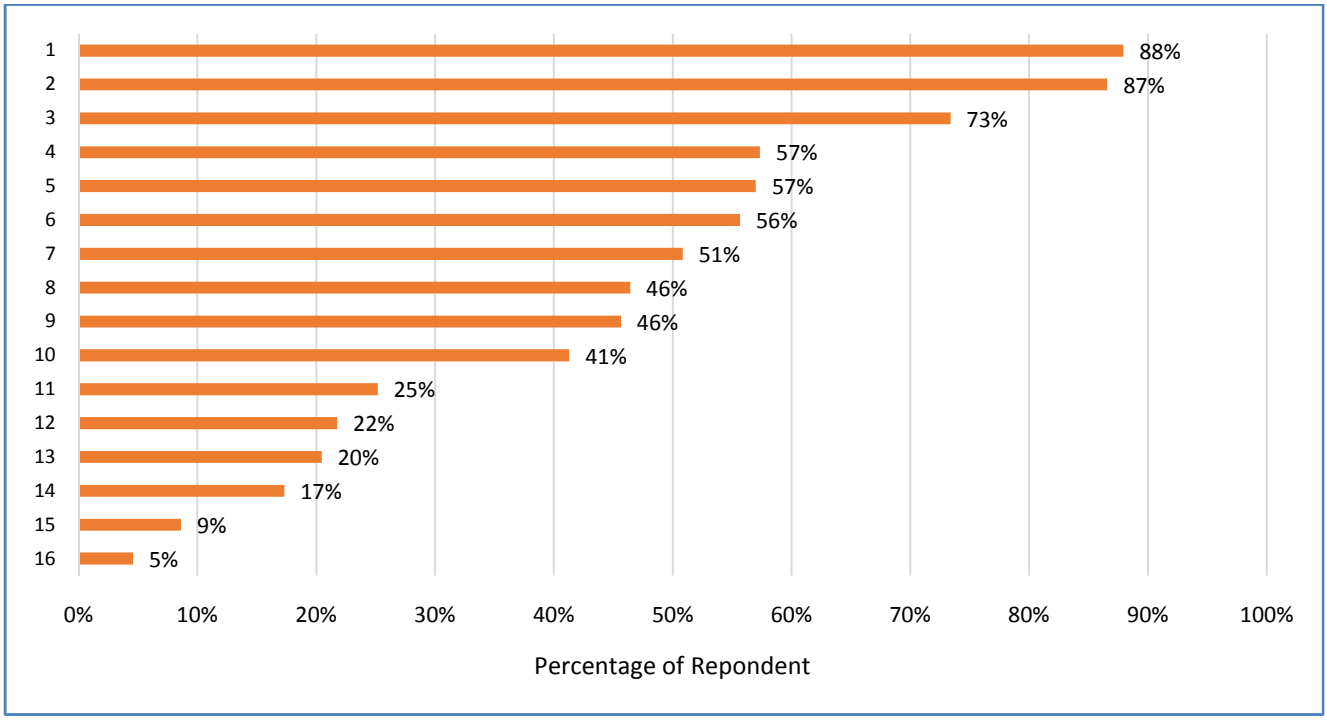
Legend/ Code of Bar diagram

1	Problem regarding collateral for bank loan	8	High interest of microfinance institution
2	High interest rate of bank loan	9	Reluctance of provide bank loan
3	Long approval time for bank loan	10	Absence of grace period
4	Reluctance/ (Unwillingness) to sanction bank loan	11	Weekly installment of NGO and other financial institution not suitable for fish farming
5	Inadequacy of loan availability	12	Total duration of paying loan/ NGO is low
6	Absence of insurance for production loss	13	Reluctance of micro-finance institution to extend loan
7	Credit access problem of small farmers	14	Others (Including name)

Source: Field Survey

5.7 Growers Perceptions from the Field of Support Measures needed for Growth and Development

Figure 18: Aquaculture Farmers' Perception on Support Measures needed for Development and Growth (%)



Legend/ Code			
1	Ensuring availability of credit and capital on easy terms	9	Preferential tariff on import of feed ingredients
2	Ensuring production and availability of quality fish feed at low price	10	Train and make available skilled professional needed for development in the sector
3	Preservation of product and other steps to ensure good return for farmers outputs	11	Introduction of new high variety species and training on their production
4	Insurance schemes for the growers	12	Ensure Security
5	Ensuring availability of quality and good sized fries of different species	13	Geographical zoning aquaculture farming with emphasis on suitable species
6	Concessional and subsidized land rents, power and energy prices as in the crop sector	14	Increase awareness and legal measures on the need to stop use of banned chemicals
7	Improvement in transportation and communication for Ingredients needed for their sector/growers and marketing of products	15	Development of physical infrastructure and water supply
8	Organize training for the skill development of all stakeholders	16	Other Suggestion

Source: Field Survey

The field level findings on what our aquaculture farmers would like to have most as support measures to promote growth and development in the sector are quite revealing but not unexpected. 88% of the respondents in the survey area identified availability of credit and capital on easy terms as one of their foremost requirements. 87% of those, who were interviewed, said that they would benefit if quality fish feed are produced and made available at low price. 73% of the aquaculture farmers noted that steps to help them to preserve their products and ensure good return to them for their produce are of vital importance. Among other support measures insurance scheme for growers, ensuring availability of quality and good sized fries of different species, concessional and subsidized land rents, power and fuel prices as in the crop sector were also mentioned by the respondents.

6. *Lessons from recent collaborative development interventions in the fisheries and aquaculture sector of Bangladesh*

Most of the recent developments in the fisheries and aquaculture sector in Bangladesh have benefited from the commitment, clear policy direction and integrated planning and implementation of sector specific initiatives. The development has also benefited from a collaborative approach to realize the national policy goals for this important sector. Development partners, private sector entities and non-profit business support organizations like, Bangladesh Shrimp and Fish Foundation (BSFF) have made important contributions in this regard which undeniably complemented Government's efforts with tangible impacts. In order to have a broad idea on how the contribution by the development partners evolved in Bangladesh to improve and sustain growth performance of the fisheries and aquaculture sector, in course of the present study, the contribution of Swisscontact in the sector, was specifically looked into.

SwisscontactKatalyst commenced its first scoping of support activities for the fisheries and aquaculture sector in 2003 and began implementing concrete interventions in 2004. In phase one, spanning over 2003-2008,SwisscontactKatalyst interventions focused on addressing some very important supply side constraints by adopting an *Adopt, Adapt, Expand, Respond (AAER)* framework. Its interventions were undertaken to ease and improve the supply side constraints as they related to important inputs such as availability of quality fingerlings, fish feed and cultivation practices associated with commercial fish farming. Activities were specifically initiated to help fresh-water prawn sector from 2006. The area of focus for the purpose was thesouthern-belt of Bangladesh.SwisscontactKatalyst primarily intervened in developing stronger channels for inputs like hatchery post larvae (HPL) and prawn feed, improving availability of modern technology and expanding prawn cultivation in untapped areas.

Initiatives to address supply side constraints

Katalyst's work in the area recognized that significant problems stood in the way of the development of the sector in the form of scarcity of good seed in Bangladesh. The performance of traditional fingerlings of different species has been low due to high mortality rates of the spawn produced and relatively low productionin case of **High Value Species (HVS)**. Katalyst's initial exploratory works identified that HVS fingerling markets had a number of characterizing features that were not operating to their full potential in Bangladesh and were perpetuating their below desired level of utilization, especially by small farmers. These exploratory works also identified the need for improved hatchery management, the critical role of ensuring healthy brood stock supply and management and aquaculture information marketing. Katalyst work from the very initial stage also recognized that interested farmers and processors would benefit from agriculture information marketing and sustainable and profitable business practices linking the

producers at the grass-root level, processors, exporters and domestic market outlets depending on the stakeholders being targeted.

Introduction of High Value Species (HVS)

In the phase 2 (2008-2013) of its interventions, Katalyst decided that instead of replicating the promotion of the cultivation of local species its intervention would focus on the nationwide cultivation of High Value Species (HVS) like Tilapia, Pangus and Koi.A main intervention addressed the brood quality related issues. In collaboration with the Bangladesh Agriculture University (BAU), the Bangladesh Fisheries Research Institute (BFRI) and 16 of the leading hatcheries, Katalyst initiated and co-financed the import of fresh brood stock from Vietnam and the Philippines where universities develop and market it on a commercial basis for industrial fish production. In phase 3 of its activities, Katalyst continued facilitating the linkage between local hatcheries and international brood sources in a more structured way. As part of the project, Katalyst initiated a discussions among personnel from DoF, hatchery owners, BFRI and the Bangladesh Fisheries Research Forum (BFRF) on how to import brood in a more legalized manner. DOF suggested the need of an association, which would apply for the brood permission, on behalf of hatcheries. DOF also suggested guidelines and checklist that specified documents which would be required to get permission to import brood. With Katalyst support, a regional hatchery association was formed which submitted documentation to DOF in order to get import permission. It is worth noting that, as part of its broad initiatives, in order to promote HVS among marginal farmers, Katalyst also started adjusting its project strategy by introducing i) poly-culture of high value and less input-intensive local species, which allows small farmers to earn more than before but not at the maximum level of optimal feeding and ii) green pond technology which basically allows low input cultivation of HVS through use of natural feed and low density of fingerlings.

Advocacy at all levels and support to introduction of GAqP and BMP

In the just concluded Phase 3 (2014-2017) of the Katalyst project, a major part of Katalyst – Government of Bangladesh initiatives in the fisheries sector was implemented under the Agri-business Trade Competitiveness Project (ATC-P) of Business Promotion Council of the Ministry of Commerce. In this phase, Katalyst supported a series of initiatives to raise awareness nationally on main challenges in the policy domain which Bangladesh requires to address with a due sense of urgency to make the fisheries and aquaculture sector a more dynamic one with significant production gains and its overall contribution to the country's GDP, employment generation in the sector and export earnings. The Katalyst activities with active collaboration of Ministry of Fisheries and Livestock, Department of Fisheries and other stakeholders thus increasingly emphasized on the need for formulating water-body leasing policies, allocating enough resources for the sector, meeting the resource needs of small farmers, stringently

implementing the Feed Law, Hatchery Law and other rules and regulations of the Government which need to be enforced seriously and with effective monitoring arrangements in place. The 3rd Phase of Katalyst activities also actively supported formation of cluster farms involving fresh water small prawn producers in the southern part of Bangladesh, introduction of Good Aquaculture Practices (GAqP), Better Management Practices (BMP), production of affordable quality feed and ensuring access of interested farmers especially small farmers to them. Given the prospects of production, marketing and export of value added products, Katalyst also supported specific initiatives in the area. As part of its initiatives, Katalyst supported training programs organized in collaboration with BSFF for production of value added products in the sector and a first ever study was undertaken on the available volume and nature of offal generated in the fisheries and aquaculture sector of Bangladesh. Activities undertaken for the purpose also examined the possibilities for commercial utilization of offal for profitable new areas of business promotion. The just concluded 3rd Phase of Katalyst work also involved branding and market promotion exercises for Bangladesh shrimp products.

Market Promotion and Branding

With a view to market promotion and branding and to help specific initiatives in these two key areas, Katalyst and BSFF have been working as a business support organization to apprise overseas consumers about the recent progress made in the fisheries sector in Bangladesh to improve product quality. Katalyst and BSFF thus facilitated the participation of Bangladesh at the Seafood Expo North America (March 06-08, 2016; Boston, USA).The participation of Bangladesh in the SENA and the multi-stakeholders dialogue provided a valuable opportunity to project the image of Bangladesh and her recent economic achievements. The occasion also provided the forum and a ready opportunity to highlight and apprise the US audience of the pro-business active policies being pursued by the present Government of Bangladesh. Recent achievements of Bangladesh in increasing production, especially, in the shrimp sector, ensuring quality and product safety were also highlighted in the meeting.Bangladesh participants in the meeting were able to well inform themselves through subject specific discussions on contemporary price and market trends in the USA, consumer preferences and regulatory requirements which will have to be appropriately taken into account in the future marketing strategy for shrimp/ seafood exporters of Bangladesh to the US market.

Initiatives for improving operation of Hatcheries

A review of Katalyst supported initiatives and interventions highlight several important issues with important policy implications. It has been found that increased production of HVS can be a very important contributing factor to future growth in the fisheries and aquaculture sector in Bangladesh. A whole range of complex factors, however, will require sustained interventions to ensure that HVS are made available and the farmers can access them including the small farmers. At the hatchery level, this would call for a well planned strategy to promote and encourage good

hatcheries with healthy production practices which would take care of water quality, brood, feed and disease management. Most hatchery owners and employees in Bangladesh still lack adequate understanding of Good Breeding Practices and there are perceptible capacity gaps in hatchery management. A recent Katalyst – BSFF lesson learning exercise, involving Galda hatcheries in Bangladesh and Myanmar, also highlights that introducing appropriate bio-security measures alone may not help avoid hatchery level problems arising out of high mortality. Future initiatives for lesson learning and capacity building for identifying underlying diseases causing mortality need therefore be one of the high priorities for the future. Bangladesh has now the testing facilities for outputs and products, thanks to some recent initiatives. However, developing lab capacities and trained manpower for disease diagnostics are still areas in which actions would be called for.

Bangladesh also faces problem of ensuring supply of adequate new brood stock to replenish old material and overcome the problem of perpetuating in breeding problems. The Bangladesh Fisheries Research Institute (BFRF), which is responsible for fisheries research and its coordination, is the only source of pure brood stock in the country and only at a very small scale. In the private sector, very small number of vertically integrated farms utilized imported brood stock; but their dealers only cater to the needs of large commercial farmers and vast majority of small farmers thus largely do not benefit from their operations. The small farmers are also at a disadvantage as they are resource poor. According to some recent Katalyst's surveys, hatcheries in Bangladesh in many instances do not also understand the protocols needed to be maintained and for sound brood stock management avoiding genetic problems. The country as a whole is also lagging behind in seizing the opportunities which are there in tapping the recent advances in fish breeding, such as innovation to improve size, taste, speed of growth, disease resistance etc. Investment in the sector by the public sector, or through public-private sector collaboration and assistance from development partners are priorities which, if pursued, can have positive impact. Improving industry coordination and appropriately reorienting the import policy of Bangladesh are also positive steps on which timely attention may be necessary.

Encouraging production and utilization of good feed is also a major area where future initiatives would be particularly helpful for Bangladesh. The Feed Law enacted by Bangladesh is a comprehensive one. However, its enforcement is an area of considerable concern. Ability of the Government through enforcement of the Law needs to be strengthened. There is also a need to build awareness around implementing measures needed for good and affordable seed.

In instances where the less than economically optimal or deserving production of HVS by small farmers are caused by limited understanding of the opportunities offered and their resource constraints interventions to inform them on opportunities available, better production practices to be pursued including use of HVS and undertaking necessary infrastructure related developments will be particularly helpful and for that purpose both public and private sector interventions may

be encouraged individually or through collaborative arrangements including, where needed, with significant supports from development partners.

Support for Development of sustainable business models

To promote the culturing of high value species, the Katalyst initiatives has been working on sustainable business model in which hatcheries and input companies can expand their customer base through promotions and trainings targeted at small farmers. It has also undertaken innovative interventions with several private sector procurement companies in establishing safe procurement channel in compliance with the safety standards, certification and traceability. As part of these initiatives some of the procurement companies have been encouraged to establish modern hygienic safe fish selling outlets that offer an assortment of contamination free fish to the consumers and institutional buyers. These are examples of forward looking interventions which need to be encouraged and integrated in the value chains of the sector.

Continued Support for Promotion of an Enabling Policy environment

The growth and development of the fisheries and aquaculture sector in Bangladesh will also critically depend in the years ahead in creating a policy environment where there would be an explicit recognition of the main impediments to be overcome to unlock the growth potential of the sector. Many improvements are possible in better utilizing the water-bodies of Bangladesh through a pro-growth inclusive water-bodies leasing system, development of infrastructure, introduction of new fish species suitable for Bangladesh and dysfunction in the production and marketing system. The creation of enabling environment will also call for, as the Katalyst interventions have shown, developing appropriate incentive packages for all concerned stakeholders and a review of import policies to see how inputs for the sector can be spared of distortions and biases standing in the way of use of critically needed inputs for the growth and development of the sector.

A significant increase in the export earnings from the sector which is closely interlinked, besides the supply side consideration, with international demands and quality concerns calls for ensuring the quality of Bangladesh aquaculture products, consumer confidence and growers and processors in the country complying with all the relevant sector specific norms and standards, Katalyst has supported Ministry of Commerce and BSFF in promoting Code of Conducts (CoCs) for 10 segments of the shrimp sector of Bangladesh and their introduction. Among many other initiatives taken by the Government of Bangladesh, this has been particularly helpful in avoiding restrictive trade measures in some of the major markets for Bangladesh shrimp, particularly, in the European Union. The initiatives and collaborative actions in this particular area have proved to be useful and deserve continued support and sustenance.

Help for Private Sector Entities to strengthen supply chain

Recently, initiatives have again been taken by Katalyst to help private companies in the sector to strengthen their supply chain and avail certified branded fish through improved distribution channels and modern outlets. The value of third party certification in addition to relevant government certification of Bangladesh fisheries and aquaculture products from the trade perspective has also been highlighted in many sector specific discussions supported by Katalyst and BSFF. Some initial piloting on introducing e-Traceability has been independently undertaken the need for which was highlighted in some of the Katalyst-BSFF expert level consultations during the 3rd phase of ATC-P project. It is an important area where future work would be helpful.

Initiative for Institutional Capacity Enhancement

The Expert Working Group (EWG) formed for the fisheries component of the ATC-P project under BPC of Ministry of Commerce implemented by BSFF provided a unique forum to identify and take actions on issues which needed attention for sectoral development. The participation of Government of Bangladesh(GoB) officials in the work of the Government, the private sector representatives and development partners in the forum should how the strength of such multistakeholderfora can be leveraged to address sector specific challenges, inclusive and participatory planning process, prioritization of needs and actions and effective monitoring. In all the areas with important bearing for fisheries and aquaculture sector in Bangladesh, the culture of committed collaborative actions encouraged by the EWG could be emulated in future with certain positive results. The Government, Katalystand BSFF collaboration also highlighted how a synergy could be reaped from utilizing the professionals and experts in the Government, experts from Katalyst and specialists from private sectors for sectoral improvement, in fact, one of the important positive outcome of collaborative Katalyst intervention was the optimal utilization of national and international experts in a cost effective integrated fashion to achieve specific growth objectives without duplication. It will be, as the present review underscores, a development intervention paradigm which will be helpful in future.

7. *State of Public Support to the Sector- a selective comparative reality check*

The research carried out as part of the present study found that in the Asian countries, which have prioritized fisheries and aquaculture development in their overall economic development program state support has played a major role. One most significant example in this case has been that of China.

Experience from China

Major increase in aquaculture production has taken place in China after 1978 making aquaculture a major contributor to the country's aquatic output. In the year 2000, the share of aquaculture output to China's aquatic production was estimated at 60%, compared to about 17% in 1950 and 20% in 1978……China also became the world leader in aquaculture production[21]. Chinese success in achieving remarkable progress in the sector greatly benefited from comprehensive state supports in various forms. Between 1949 and 1957, the Chinese Government made significant investment to improve aquaculture infrastructure and facilities and its investments for these purposes during this period amounted to 1.25 billion RMB (equivalent to US Dollar181 million). From 1978 onwards, as a general policy and approach to revive its stagnating economy the Chinese government gave high priority to the fishery sector, especially to aquaculture. The open market policies under the government economic reform initiatives were put into effect gradually by the Government since 1979. As a result, not only areas in aquaculture increased significantly, but also the species cultured increased from 20 to more than 80 species. Both freshwater and marine aquaculture developed rapidly during this period[22]. What may be of particular relevance for future policy prioritization in Bangladesh, in China apart from investment in infrastructure Chinese development policies for the sector, placed particular importance to pro-growth land issue policies, supporting structural reforms of farm ownership and property rights. It has thus been noted that since the early 1980s, the Government encouraged and supported the transfer of farm ownership from the public to the private sector. This policy relies on the creation of more fish farm owners instead of just wage earners on fish farms. This is a new form of economic organization. In contrast to the former collective system where ownership and benefits accruing from farming belonged to the States and/or collectives, under the new form of economic organization, the reformed socialistic principle of collective economy, property rights, particularly the ownership and individual rights to the produce from the farm are guaranteed and given to collective members. That is, each member has equal right to

[21]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamundaand Rohana P. Subasinghe*
[22]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamundaand Rohana P. Subasinghe*

the farm and gets a share of the value of the produce (farm income).[23]" In Bangladesh, there are no comparable state owned cultivation practices as was existent in 1979 pre-reform China. However, Bangladesh needs also to develop a comprehensive Jolmohol policy which would ensure optimal utilization of available water-bodies where absence of property rights or long term lease policies favouring genuine producers are considered as an important factor standing in the way of investment and growth in the sector.

The Government of China also, as a general policy, extends grants and subsidies to investors and has introduced a tax system whereby the tax burden of investment is shared by the central and the local government and has provisions to encourage joint ventures between the central and local governments, on the one hand, and domestic and foreign private investments, on the other[24]. The growth in the sector in China, particularly also benefited from support to promote diversification of animal species in aquaculture and introduction of new technologies including the ones sourced from abroad. Regular program has been set up since 1994 to especially support the introduction of exotic species contributed to the production significantly in the recent years. Tilapia, Malaysian giant fresh water prawn and European eel are the best examples[25].

China has also been extending significant economic incentives to investors in the feed industries. In the country, to promote development of the aquaculture feed relatively low tariffs are levied on the major imported raw materials. It has thus been noted that in 1999, import tariffs for fishmeal intended for aquatic animal feed were only 3% compared to 30% for fishmeal intended for human consumption. Similarly, import duties for soybean meal used for feed production were 40% compared to 114% for soybean imported for other uses[26]. Information in the following table captures the reality of the extent of support; the Chinese government has been extending by way of preferential tariff to the feed sector in China.

[23]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamundaand Rohana P. Subasinghe*
[24]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamundaand Rohana P. Subasinghe*
[25]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamundaand Rohana P. Subasinghe*
[26]FAO FISHERIES TECHNICAL PAPER 427 'AQUACULTURE DEVELOPMENT IN CHINA THE ROLE OF PUBLIC SECTOR POLICIES (2003)'by *Nathanael Hishamunda andRohana P. Subasinghe*

Table 14: Import duties on some feed ingredients in China in 1999

Item	Import duty *(%)*	Value added tax *(%)*	Total import duty *(%)*
Fish-meal for feed	3.0	13	16.3
Fish-meal for human consumption	30.0	17	52.1
Soya bean meal (mainly for feed)	40.0	17	63.8
Soya bean	114.0	13	141.8
Corn meal	91.2	13	116.0
Barley	91.2	13	116.0
Fine rice meal	91.2	13	116.0
Grouts and meal of rice	40.0	13	58.2

Source of data: www.chinavista.com/database/ (cited from Nathanael Hishamunda and Rohana P. Subasingpaper)

South Asian Experience

A comprehensive FAO Fisheries and Aquaculture Technical Paper (509) prepared by Hishamunda, Bueno, Ridler and Yap entitled *Analysis of Aquaculture Development in Southeast Asia-Policy Perspective* documents extensive state support measures extended by countries in Southeast Asia for the development of their aquaculture sector. These supports were extended in the form of, amongst others, providing an enabling and supportive policy environment, strengthening of institutions and support mechanisms and a whole range of assistance packages targeted at beneficiaries. These also included supports extended to increase in supply of good seed and feed. The table below compiled by Hishamunda, Bueno, Ridler and Yap sheds light on the range of policy and support measures adopted by countries in Southeast Asia to help accelerate growth in the sector.

Table 15: Policy measures adopted to increase the availability and quality of seed in the region and their results[27]

Policy goal	Measure	Country	Results	Remarks
Increase the supply of fry through the public sector	Provide government hatcheries	All countries	Positive	Useful for broodstock quality and social goals (seed for the poor)
		Cambodia	Negative	Lack of funding
		Indonesia	Negative	Took too long (shrimp) and the private sector took over
		Malaysia	Positive	For new species or for species with seed shortages or for species difficult to reproduce
		Philippines	Mixed	Seed as source of corruption-mark-up pricing
Increase the supply of fry through the private sector	Laisser-faire	Most	Positive	
		Cambodia	Negative	Private hatcheries lack expertise
	Privatize/ lease government stations	Myanmar	Positive	Leases transferred to those with expertise
	Tax exemptions, credits for hatchery upgrades	Philippines	Positive	Tilapia hatcheries are very profitable
	Tax exemptions	Viet Nam	Positive	For shrimp and for marine seed (grouper, cobia and milkfish)
	Increase for foreign investors	Viet Nam	Positive	For shrimp and for marine seed (grouper, cobia and milkfish)
	Price support and transport subsidy for fresh water seed	Viet Nam	Positive	To assist farmers in remote and mountainous areas
Improve seed quality	Selective breeding (tilapia)	Thailand	Positive	
	Allow foreign technicians	Philippines	Positive	
	Set standards ISO 9000	Indonesia	Positive	
	Seed inspection	Indonesia	Positive	Costly
	Seed certification and monitoring	Indonesia	Positive	Costly
	Specialized seed production	Philippines	Positive	Tilapia hatcheries concentrate on strains
			Positive	Develop strains with universities

[27]Reproduced from FAO Fisheries and Aquaculture Technical Paper (509) prepared by Hishamunda, Bueno, Ridler and Yap entitled *Analysis of Aquaculture Development in Southeast Asia-a Policy Perspective, (Rome-2009). This table is reproduced from a FAO Fisheries and Aquaculture study conducted by the authors and the support measures reflected in the report were all introduced/ practiced in the period leading up to 2009*

The feed related support measures extending by countries in Southeast Asia are summed up in the Table below[28].

Table 16: Some policy measures adopted to increase the availability and quality of feed

Policy goal	Policy measure/ tool	Country	Results	Remarks
Increase availability	Encourage (domestic and foreign) feed companies	Viet Nam	Positive	Production now meets most domestic demand
Reduce feed costs	Reduce imported ingredients through increased use of local trash fish	Indonesia	Poor	Quality of trash fish did not meet nutritional standards
	Reduce protectionism (tariffs)	Malaysia	Positive	Encouraged foreign feed companies
	Use local ingredients	Malaysia	Positive	Saved on imports
	Exempt imported ingredients from import taxes	Malaysia	Positive	Lowered feed cost
	Encourage integrated aquaculture	Cambodia	Positive	More profitable
Improve feed quality	Set feed standards for each species	Indonesia	Positive	
	Frequent monitoring	Indonesia	Unknown	Weak enforcement
	Regular inspection	Indonesia	Unknown	Costly
	Encourage use of formulated feed	Malaysia	Positive	
	Establish feed standards	Malaysia	Positive	
	Set up a Feed Quality Assurance Board	Thailand	Positive	
	Define feed formulas	Thailand	Positive	

The support regimes of the Southeast Asian countries also include a wide range of investment related supportive policy measures and concrete actions. Hishamunda, Bueno, Ridler and Yap study, as reflected in the table below, sums up details on these support measures. The feed related support.

[28]Reproduced from FAO Fisheries and Aquaculture Technical Paper (509) prepared by Hishamunda, Bueno, Ridler and Yap entitled *Analysis of Aquaculture Development in Southeast Asia-a Policy Perspective, Rome-2009. This table is reproduced from a FAO Fisheries and Aquaculture study conducted by the authors and the support measures reflected in the report were all introduced/ practiced in the period leading up to 2009*

Table 17: Some policy measures used in Southeast Asia to increase availability and access capital in aquaculture[29]

Policy goal	Policy measure/ tool	Country	Results	Remarks
Increase access to credit	Regulation of credit allocation to small farms	Indonesia	Positive	Some costs
	Micro-financing by government through banks or by NGOs	Indonesia	Positive	
	Special funds for cooperatives	Indonesia	Positive	
	No collateral needed for (small-scale) food operations	Malaysia	Positive	Increases default risks
	Livestock and Fisheries Bank concentrates on carp farming (excludes hatcheries and shrimp)	Myanmar	Did nor work	Requires collateral; only lends small amounts
	Low interest loans without collateral for diversification of fisheries to cage culture	Philippines	Positive	
Lower credit costs	Interest rate subsidy to all farmers (Food Security Credit)	Indonesia	Positive	
	Require banks and companies to allocate a share of their profit to small-scale business at low interest rates	Indonesia	Positive	
	Low to zero interest rate for food industries	Malaysia	Positive	
Tax breaks	Tax holidays for least developed (eastern) regions	Indonesia	Unknown	Regional development goal
	Exempt import duty and sales tax on machinery and equipment	Malaysia	Positive	
	Various other tax deductions and exemptions-not specific to aquaculture	Malaysia	Positive	
	Waive income tax for 3 years	Myanmar	Mixed	
	Tax exemptions and tax credits	Philippines	Positive	
	Simplify customs procedures	Philippines	Positive	
	Waive land tax for 3-5 years	Myanmar	Unknown	Only fallow lands
	Targeted tax exemptions for species and locations	Viet Nam	Positive	Regional goal and species development
Encourage foreign investors	Tax holidays	Indonesia	Positive	
	Exemptions from import duties	Indonesia	Positive	
	Guarantee capital and profit repatriation	Myanmar	Positive	
	Joint ventures only	Myanmar	Unknown	
	Three year tax exemption for FDI	Myanmar	Positive	
	Deduction of 50 percent of tax on profits of exports	Myanmar	Mixed	Too many
	Low interest rates	Viet Nam	Positive	

[29]Reproduced from FAO Fisheries and Aquaculture Technical Paper (509) prepared by Hishamunda, Bueno, Ridler and Yap entitled *Analysis of Aquaculture Development in Southeast Asia-a Policy Perspective, Rome-2009. This table is reproduced from a FAO Fisheries and Aquaculture study conducted by the authors and the support measures reflected in the report were all introduced/ practiced in the period leading up to 2009*

Relevant Indian Initiatives

Nearer to Bangladesh, the central Government of India also extends extensive support for the development of inland fisheries and aquaculture. Illustrative of one of many of these supports is the stipulation of a most relevant central Government notification in this regard [Notification No.: 31013/1/2007-Fy(3) dated July 02, 2015].The notification notes that under approved component of the central government sponsored schemes for the sector would focus on Development of Freshwater Aquaculture, Development of Brackish Water Aquaculture, Coldwater Fisheries and Aquaculture, Development of Waterlogged Areas, Productive Utilization of Inland Saline/ Alkaline Soils for Aquaculture, Integrated Development of Inland Capture Resources (Reservoirs/ Rivers Etc.), Innovative Projects (new component)". …… All components under the Scheme will be provided assistance in the form of subsidy for identified activities to individual beneficiary, self-help groups, women groups, fisheries cooperative societies and the National Federation of Fishermen's Cooperative Limited (FISHCOPFED). ……. Priority will be accorded to Self-help groups and Cooperatives to implement the Schemes and access funding there under."

The Annex of the Indian central Government notification also gives details on the development of the Freshwater Aquaculture ongoing component which is reproduced below:

Table 18: Development of Freshwater Aquaculture (FFDA's) ongoing component

SL No.	Description of Item	Rate (Rs.[30])
1.	Construction of new ponds/tanks	Rs. 0.3 million per ha in the plain areas. Subsidy @20% with a ceiling of Rs. 60,000/-ha for all farmers except SCs/STs for whom it will be Rs. 75,000/ha (25%) Rs. 0.4 million/ha in the hill States/Districts and North-Eastern Region. Subsidy @20% with a ceiling of Rs. 80000/ha for all farmers except SCs/STs for whom it will be Rs. 1,00,000/ha (25%)
2.	Reclamation/Renovation of ponds tanks	Rs. 75,000/ha. Subsidy @20% with a ceiling of Rs. 15,000/ha for whom it will be Rs. 18,750/ha (25%)
3.	Cost of inputs	a) Finfish Culture Rs. 50,000/ha. Subsidy @20% with a ceiling of Rs. 10,000/ha for all farmers except SCs/STs for whom it will be Rs. 12,5000/ha (25%) b) Freshwater prawn/trout culture-Unit cost Rs. 1.8 lakh/ha; Subsidy @20% with a ceiling of Rs. 36,000/- per ha except for SC/ST for whom it will be Rs. 45,000/ha @25%
4.	Freshwater fish seed hatchery	Rs. 1.2 million for a fish seed hatchery with 10 million (fry) capacity for the plain areas and Rs. 16 lakh for same capacity in the hill States/Districts and North-Eastern Region. Subsidy @10% with a ceiling of Rs. 1.2 lakh and Rs. 1.6 lakh in the plain and hilly areas respectively to entrepreneurs only.
5.	Fish feed units	Small Units-Unit cost is Rs. 0.75 million with a capacity of 1.2 quintals/day. The subsidy would be @20% a ceiling of Rs. 0.15million per unit to entrepreneurs.

[30] 1 USD = 65.5 IRS

SL No.	Description of Item	Rate (Rs.[30])
6.	Establishment of Trout and freshwater Prawn seed hatchery	(i) Unit cost of Rs. 3.0 million for a large freshwater prawn hatchery with a minimum capacity of 25million PL/year. This would be one time grant to the States for establishment of hatchery at State level. (ii) Unit cost is Rs. 1.2 million for a small hatchery of 5-10 million PL/year capacities. Subsidy @20% with a ceiling of Rs. 2.40 lakh to entrepreneurs as one time grant.
7.	Provision of soil and water testing kits to each FFDA	Unit cost of each Soil and Water Testing Kit at Rs. 40,000/-. The kits are sanctioned once to each FFDA as one time grant.
8.	Setting up of integrated units, including hatcheries for ornamental fishes	Unit cost is Rs. 1.5 million, which include hatchery of 5-10 m (fry) capacity. Subsidy @10% with a maximum ceiling of Rs. 0.15 million to all categories of fish farmers.
9.	Brood banks for ornamental fishes	Rs. 2.5 million per unit including a farm; transport arrangements for dissemination. Available for the State Governments.
10.	Ornamental/fish seed certification	Rs. 2.5 million per unit including fish holding facilities and disease diagnostic laboratories. Available for the State Governments.
11.	Transportation of fish/prawn seed	This will be applicable only for the hill States/districts and North-Easter Region. Subsidy @Rs. 30/- for 1,000 fry transported to all FFDAs. Not applicable to individual fish farmers.
12.	Purchase of vehicle	50% cost of vehicle for each new FFDA and 50% cost for the replaced vehicle (second vehicle)

The Bangladesh Reality

In the specific Bangladesh context, a focused prioritized attention on the development of the broader agriculture sector and the fisheries and aquaculture sector as one of its important sub-sectors has formed one of the defining features of the country's overall development activities. The Government supports and investment for the crop sector development has been massive and the country has immensely benefited from that. The country has achieved self-sufficiency in crop production and this has helped to reduce hunger and malnutrition to a significant extent. The magnitude of the Government's support to the agricultural sector, particularly to the crop sector, is reflected in the subsidies extended by the Government to the fertilizers which constitute an important input for the country's farmers. The subsidy extended by the Government of Bangladesh increased from 4.1% to 5.3% of the national budget over a period of 2007/08-2012/13[31]. Urea fertilizer benefited from the largest share of fertilizer subsidy which ranged between 2248 billion Taka over the period 2007/08-2013/14. The table below shows how the fertilizer subsidy scenario evolved in Bangladesh during the recent years.

[31] National Food Policy of Action and Country Investment Plan Monitoring Report 2015 prepared by Food Planning and Monitoring Unit, Ministry of Food, Government of Bangladesh; PP-48

Table 19: Cost of subsidies on urea and non-urea fertilisers from 2007/08 to 2014/15

Year	Subsidies (billion taka)			Change from previous fiscal year (%)			% of fertilizer subsidies in national budget	% of urea subsidies in fertilizer budget
	Urea	Non-urea	Total	Urea	Non-urea	Total		
2007/08	31.5	3.7	35.3	NA	NA	NA	4.1	89
2008/09	42.7	8.0	50.7	35.4	111.3	43.6	5.1	84
2009/10	19.7	20.9	40.7	-53.7	162.0	-19.6	3.6	49
2010/11	25.7	29.7	55.4	29.9	41.5	35.9	4.2	46
2011/12	23.2	46.2	69.5	-9.5	55.6	25.4	4.3	33
2012/13	48.2	71.0	119.0	107.2	53.5	71.2	5.3	40
2013/14	34.0	52.4	86.4	-29.4	-26.2	-27.4	3.9	39
2014/15	27.0	42.2	69.3	-20.4	-19.4	-19.8	3.2	30

Source: Ministry of Agriculture

Government of Bangladesh's support packages of the crop sector also include important investments and expenditures for infrastructure development, research and extension and subsidy for the country's massive irrigation system which has continued to benefit from Government subsidy on diesel used by farmers for deep tubewell based irrigation at the growers level. The farmers of crops in Bangladesh can also access credit for various productivity related policies.

In course of the present study, it was pointed out during discussions with stakeholders in the fisheries and aquaculture sector that, no major investment to develop aquaculture sector in Bangladesh has been undertaken during the recent years. The sector does not also benefit like the crop sector for any favoured policies in terms of specific subsidies or equivalent assistance or help for the production and making available of good seed and feed to the growers. The fish farmers also do not benefit from favoured land or water-body rents and energy tariffs. Thanks to the Government and Bangladesh Bank prioritization the policies outlined for agricultural and rural credit policy and program recognizes the need for credit for stakeholders in the fisheries and aquaculture sector. The exporters of products originating from the sector also continue to benefit from Government's export support scheme (10% export incentive for shrimp and 5% on other fish). The guidelines outlined in successive annual agricultural and rural credit policy and program of the Bangladesh Bank clearly state that the sector should also benefit from credit disbursement for the agricultural sector as a whole and for rural development. Section 6.04.4 of the Bangladesh Bank policy on the subject for 2014-15 thus states:

> ***Credit for Fish Cultivation:*** *At present, fisheries are considered as a profitable sector. It is essential to expand cultivation of shrimp and fish for economic development of the country vis-à-vis satisfying the deficiency of animal protein. Fisheries loan may also be extended for production of fish lings, cultivation of endangered local varieties (koi, magur, Shing), Ruhi, Katla, Mrigel and Monosex Tilapia. To provide institutional finance in the fisheries sector with a view to increasing export earnings, banks/financial*

institutions shall themselves evaluate the potentials of fish cultivation and develop credit norms specifying the amount of loan, tenure disbursement period and repayment schedule etc. in the light of the Fisheries Policy of the government. In this regard banks/MFIs may consult with local officials of Fisheries Directorate, if needed. In case of fish cultivation in leased pond credit may be disbursed for fish cultivation taking lease deed/value into consideration instead of mortgaging the pond.

Credit for Purchasing Fishing Equipment by the Fishermen in Coastal Belts: *Banks/financial institutions shall take effective measures to provide short/long term finance to the fishermen residing at the coastal belts permanently at easier terms and conditions for purchasing/collecting fishing trawler, boat, net and other equipments. Besides, people engaged in small businesses, particularly those who are engaged in fishing, fish cultivation and production of dry fish may be provided with capital as per their requirement. If necessary, the coastal fishermen may be allowed credit facilities on group basis.*

Credit for Fish Cultivation in Water Reservoir/Jalmohal/Haor: *Banks/financial institutions may allow credit facilities to the fishermen of water reservoir/Jalmohal/haor areas on group basis for fish cultivation. In view of the importance given by the government on fisheries, banks shall take necessary steps to increase the supply of credit for fisheries and inform people through publicity about the available credit facility. Banks shall disburse fisheries loan developing suitable products for the fishermen so that they can become self-sufficient through availing the loan.*

Credit for Fish Cultivation in Cage: *The fish cultivation in cage got popularity in recent time in our country due to technical excellence. Fish cultivation in-cage is the technology of cultivation of fish commercially in high dense in suitable ages of different sizes under a controlled environment in various types of water body. Recently, fish cultivation in cage in the river of Dakatia in Chandpur district following Thai technology has attracted people's attention. There is huge potentiality of fish cultivation in cage in Kishoregonj, Netrokona, Shunamgonj and Cholonbil in Natore. Banks may extend credit facility in fish cultivation is cage" program as a sub-sector of fish. Banks will take decision themselves about the amount, time, period, disbursement, repayment and collateral of the loan with the help of officers of fisheries department and the local farmers.*

Credit for Aquaculture in Coastal Areas: *The costal fish cultivation is still now limited to only shrimp cultivation. But it is possible to earn more foreign currency by exporting potential fisheries under aquaculture in coastal areas in Bangladesh. The potentiality of crab cultivation, crab fattening, cultivation of other white fish like "vetki" and "bata"*

can be employed in this situation. To do this the costal people need to get proper training and timely credit facility. The poor people of coastal region need proper training and working capital for this regard.

Local banks will take decision themselves about the amount, time, period, disbursement, repayment and collateral of the load with the help of officers of fisheries department and the local fish cultivators.

The Agricultural & Rural Credit Policy and Program for the Financial Year 2016-17 announced by the Bangladesh Bank added a new component in the policy document outlining details of Fish Production Calendar & Credit Disbursement Schedule, as reproduced below, which should help in the processing and disbursement of credit by concerned financial institutions:

Field survey carried by the present study has some very revealing finding on how fishermen in Bangladesh meet their resource requirements, particularly their credit requirements. It is significant that of all the sample fishermen interviewed in course of the field level survey, overall 36% of the fishermen meet their credit requirements from Government scheduled Banks and Government Specialized Banks. Only 19% of them meet their credit requirements from private Banks, 19% from NGOs and 5% from microfinance institutions. If only small farmers are considered, only 19% of them meet their credit requirements from Government scheduled Banks and Government Specialized Banks and 5% of the small farmers meet their credit needs from the private Banks. They meet most of their credit requirements from NGOs (23%) and relatives (45%). It appears that positive policy highlighted in the Bangladesh Bank's guidelines on *Agricultural&RuralCredit Policy and Program*notwithstanding; the small fishermen do not or cannot yet use credit from public sources and private Banks as widely as their situation would demand. The guidelines are of a non-binding nature and do not oblige the public and private Banks to extend credit to small farmers even though they need them.

During consultations, carried out by members of the team working on the present study with the representatives of Government Specialized Banks, Government Scheduled Banks and private Banks, they mentioned a number of reasons for which in many cases they are not able to entertain loan requests from small farmers as they cannot offer any credible collateral, the high administration cost for such loans on widely dispersed production areas, susceptibility of the production in the sector to disease and natural disaster and volatility in prices of products and demand trends in the markets especially in international markets for species exported abroad. In one case, the representative of the Bangladesh Krishi Bank noted that his Bank did not benefit from the concessional refinancing facility from the Bangladesh Bank for loans extended to fishing and aquaculture sector. He also noted that his Bank charged an interest of 10-13% for loan extended for fisheries and aquaculture sector.

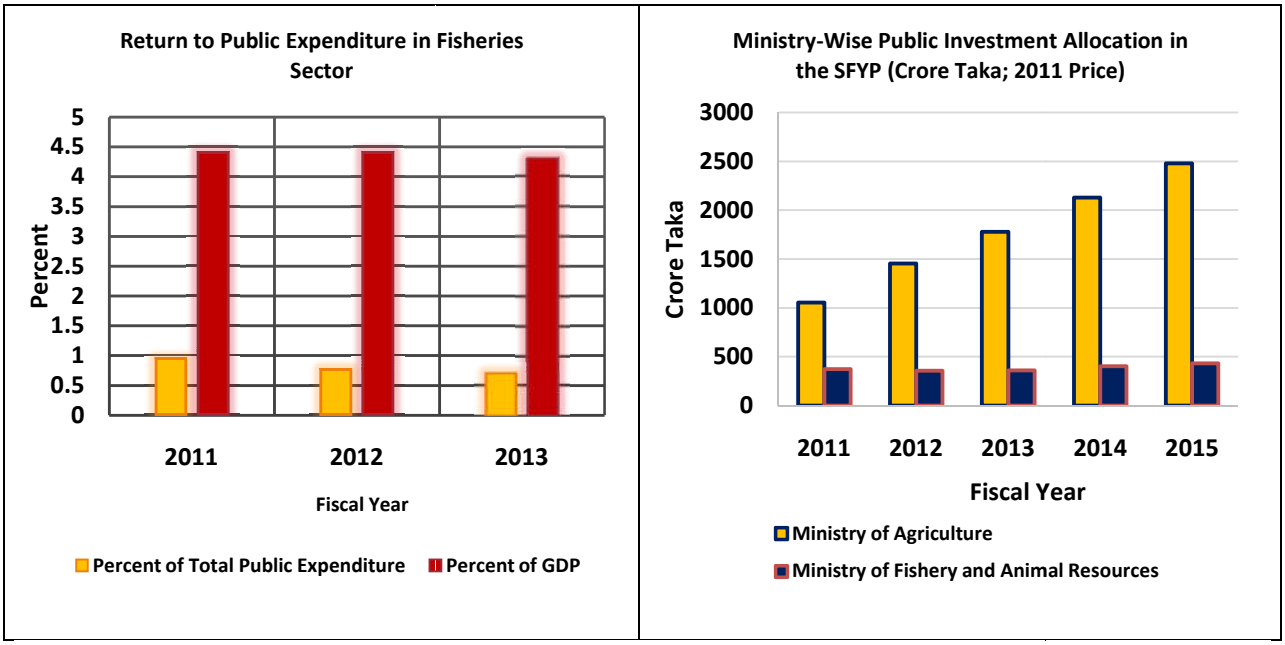
The credit information collected by the members of the present study team note that the small farmers involved in aquaculture utilize credit from NGOs and microfinance institutions. But many of them do not because interest from these sources is high within the band of 13-27% with no provision for grace period. In specific instances, the repayment schedule of the loans taken from such sources are not also synchronized with the production cycles and loan processing, disbursement and repayment cycles.

It was mentioned during discussions on credit requirements for small fishermen that credit disbursement alone would not benefit the farmer if they are not also provided with affordable quality seed and feed and a system where they can receive a good and assured return for their investments and product.

Between 2011 and 2015 public investment allocation in the agriculture sector increased over time. Between the periods public investment allocation for agricultural sector increased more than double during the period whereas the allocation for the Ministry of Fisheries and Livestock increased marginally. The fisheries sector maintained a good growth rate during this period contributing around 3.68-3.73% of the GDP in this period. However, this notwithstanding percentage of public expenditure on fisheries sector remain less than 1% of the total budget between 2011 and 2013 and slightly decreased over time. It has been argued that there is a convincing reason for more public investment in the fisheries and aquaculture sector due to assured relatively better return for investment from the sector and better record of ADP utilization in the sector which has faced chronic implementation problem in many other sectors.[32]

[32] A preliminary study on "The Supports received by the Aquaculture Sector in Bangladesh – Existing Reality and Scope for Improvements (2015)" by Md. AbulQuasem, Prof. Dr. BazlulHaqueKhondker, Dr. IftekherHossain, Mr. AbulKalam Azad

Figure 19: Return to Public Expenditure in Fisheries Sector and Ministry-Wise Public Investment Allocation in the SFYP (Crore Taka; 2011 Price)



The ADP allocations for broader agriculture sector suggested for the 7th Five Year Plan[33] projects and increase of more than 30% of the total allocation for the Ministry of Fisheries and Livestock. The projections in this regard may be seen in the tables below.

Table 20: ADP allocations for agriculture sector in the 7th Five Year Plan

a. Taka Billion: FY2016 Constant Prices

Ministry/ Sector	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Ministry of Agriculture	18.4	26.0	29.3	32.5	36.4
Ministry of Fisheries & Livestock	8.0	8.2	9.3	10.3	11.5
Ministry of land	2.0	2.3	2.6	2.9	3.4
Ministry of Water Resources	30.6	38.7	43.7	48.5	54.3
Total	**59.0**	**75.2**	**84.8**	**94.2**	**105.6**

b. Taka Billion: Current Prices

Ministry/ Sector	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Ministry of Agriculture	18.4	27.5	32.8	38.4	45.1
Ministry of Fisheries & Livestock	8.0	8.7	10.4	12.2	14.3
Ministry of land	2.0	2.4	2.9	3.4	4.2
Ministry of Water Resources	30.6	41.0	48.9	57.3	67.3
Total	**59.0**	**79.7**	**94.9**	**111.3**	**130.8**

Source: Seventh Plan Projections

[33] The "7th Five year Plan (FY2016-2020) – Accelerating Growth, Empowering Citizens" - General Economic Division, Planning Commission, Government of the People's Republic of Bangladesh; PP-304

It is, however, not specified what percentage of the allocations above would be earmarked for the fisheries sector in general and aquaculture sector in particular. The development of fisheries and aquaculture sector will be, among other things, contingent upon the protection and conservation of the water-bodies in the country, significant investment in development of aquaculture friendly infrastructure and utilization of sufficient resources for ensuring water resources and water management that would help and facilitate future growth and development of fisheries and aquaculture sector in Bangladesh whether part of the allocations for the Ministry of Water Resources which is also expected to increase significantly during the 7th Five Year Plan for this twin purposes also assumes great significance from this perspective.

8. Conclusions and Recommendations

The work on the present study, with extensive field level surveys and wide ranging consultations undertaken with all the major stakeholders, has been enriching in many ways in appreciating the growth potential of the fisheries sector in Bangladesh, particularly the aquaculture segment of it. The study work enabled the team members to collect a wealth of information on those involved in growing fish at the grassroots level - their income, family size, asset status and credit access pattern. Data and information from the field also helped obtain a deeper insight with great details on the production practices of the growers, the cost of production and how all of these vary significantly as farmers - small, medium or large opt for traditional, semi-intensive or intensive productive methods as the case may be. The information collected from the farms also enabled to have a comprehensive idea about the varying degree of importance with which the need for investment on infrastructure development and utilization of better seeds and quality feed with choice of different production arrangements are met. More significantly, the study provided the opportunity to examine the state of public support for the sector, which is so important for realization of National Fisheries Policy and Shrimp Policy objectives, specific SDG goals and 7th Five Year Plan objectives, aligned with the Government's **Vision 2021**, in such important areas as that of enhancing economic growth, improving nutritional status of country's growing population, reducing poverty level and ensuring food security.

In the light of the survey findings, and the suggestions from the stakeholders, the study identified and compiled a set of recommendations on where Bangladesh can do better in future in reorienting and strengthening public support regimes that would help the sector

Strengthening Institutional Framework for Promoting Sustainable Aquaculture Developmentis a vital pre-requisite for development

Bangladesh has made significant progress in terms of formulating sector-related policies, strategies, laws and regulations and code of conduct that aim to promote development of the sector in an environmentally neutral, technically and financially feasible and socially acceptable manner. Lessons learnt have shown that the challenge, however, is in the successful implementation of such sector development initiatives which would require bridging critical gaps of financial and manpower resources and inherent problem of making the implementation process in a time-bound fashion with due sense of urgency and cross sectoral collaboration and coordination which MoFL and DOF alone cannot accomplish. There is an imperative need to raise the profile of the sector in the national development planning, budget processes and capacity building of the Ministry of Fisheries and Livestock and DoF.

Raising the profile of the sector will help

The sector will stand to benefit if the planned activities of various implementing, monitoring and coordinating bodies of the sector can proactively associate and motivate national policy makers and political leaders on the relative importance of the sector in terms of its contributions to the economic development of the country. Highlighting success stories supported by evidence-based dataand making robust cases for resolving development issues could be steps in the right direction for being rightly recognized as a sector that merits special considerations.

Grassroots level involvement through comprehensive planning needed

The sustained growth of aquaculture sector can contribute in empowering those who are involved with it at the grassroots level by increasing income. How this can help them is evident from the income data collected in the field level survey during the present study. The study findings clearly indicate that modernization of the sector with gains in production is possible but this would entail a whole series of changes including the way the growers produce their fish, utilize Good Aquaculture Practices and use good seed and feed. A significant leap in the production and productivity from the aquaculture sector is possible by integrating advances in production practices, technological innovations and improved pond health managements. While adoption of modern aquaculture techniques and practices would likely result in enhanced income levels, stakeholders will have to work so that such adoptions help Bangladesh to address adverse climate change related consequences and would not cause damage to the ecology or society.

Adequate Comprehensive Planning and Resource Allocation are necessary for Aquaculture Water Infrastructure Development

Given the importance of the fisheries and aquaculture sector for the economy of Bangladesh, it is important that the resource needs for the sector should be fully met. The 7th Five Year Plan of Bangladesh has rightly identified the fisheries and livestock sector for incremental development resources allocation over the plan period. For fisheries and aquaculture sector to grow the actual allocation for the sector need to be continuously monitored and aligned with the growth targets and requirements of the sector. These development allocations should be balanced and no important segment of the sector should be allowed to stagnate for lack of resources. In course of stakeholders consultations undertaken during the work on the study it was pointed out that no major investment has been made in the sector for many years for water infrastructure development, specific to the requirements of coastal aquaculture. A priority for this purpose continues to be the immediate need to be addressed for the infrastructure developments in the coastal regions of Bangladesh to correct improper inlet and outlet facilities and other interventions needed to help develop sustainable aquaculture practices. Proper planning,

designing and implementation for aquaculture-friendly infrastructure should be given high priority to realize the rich potential of all the deserving target areas including the coastal areas.

Promotion of Investment Friendly Water-bodies Leasing System will help

The example of China, which has done exceptionally well in developing the aquaculture sector, shows that a grower and investment friendly water-bodies leasing system can also make a major contribution to growth and development. A holistic perspective on encouraging aquaculture growth may also be inclusive enough to see whether Bangladesh may also make sufficient improvements in this key area.

Critical Need for management, development and making provision for Adequate, Timely and Affordable Quality Seed must be met

Pursuit of a comprehensive brood development and management policy needs to receive continuous priority attention, research investment and public - private cooperation to meet the country's need. Ongoing works in this area deserve all support and where Bangladesh can benefit from cooperation with regional and international development partners and international organizations such cooperation should be encouraged and fast tracked in the sector specific development plans and programs. During the field survey undertaken as part of the study the stakeholders at the grassroots level have all underscored the need for quality seeds and their timely availability at affordable price. Making available good seed is a precondition and vital necessity for all future development initiatives in the sector. This should also thus continue to receive priority attention. The need for training and making available the necessary manpower for the production of good seed both in the public and private sector continues to be a much felt need. From consultations, it also emerged that enhancing awareness on the need for use of quality seed and motivation to use them should also form a high priority for development plans for the sector.

Making Available Affordable Quality Feed is equally important

Increasing availability of quality feed in Bangladesh for the sector is another need which has to be ensured through effective implementation of relevant Acts and Rules and other support measures as was done by most of the countries which have done well in developing their aquaculture sector.

Bangladesh may consider a Comprehensive Package of Investment and Production Incentives

In Bangladesh in the agricultural sector, significant subsidies on fertilizer and other production inputs and equipment made them available to the growers more affordable. According to policy documents and survey reports, no such equivalent support measures presently benefit the aquaculture production, primarily feed and seed production. The matter needs further examination and similar support may be extended, including in the form of reduced tariffs on imports, concessional land rent, electricity and diesel prices, for fast growing aquaculture sector of Bangladesh.

The necessary steps for strengthening public-private collaboration in these key areas of seed and feed as well as specific measures that would help private entities to come forward to increase production of these key inputs and ensure quality and affordability should also be given priority.

Enhance Capacity of Department of Fisheries Extension Staff

The proactive initiatives of the Government immensely benefited the growth performance of the agriculture sector, particularly the resources made available for research, introduction of new high yielding varieties and other technological interventions. The sector also benefited from well functioning institutions, extension services up to the doorstep of the growers and effective information campaigns. The need for support for the aquaculture sector in this particular regard is no less important. In fact, enhancing capacity of Department of Fisheries to carryout extensive extension works should be an important area where priority Government attention and support will be of critical importance. Several models are available now to collectively promote training, dissemination and other extension works through public-private collaboration and through Government/ business support organization in Bangladesh like Bangladesh Shrimp and Fish Foundation (BSFF)/ development partners and NGOs. Bangladesh will definitely benefit from making better use of these possibilities and synergies thereof.

Enhancing Access of Farmers at the Grassroots Level to Affordable, Appropriate and Timely Credit will help modernize the sector

It is evident from the study findings that the use of improved seed and feed increases is an indispensible part of modernization of the aquaculture sector. The growers whether small, medium or large will all benefit from a supportive system where they will have credit at reasonable rate with repayment cycles coinciding with their production cycle with reasonable grace period. The risk aversion propensity of Government Banks, specialized Government financial institutions and private Banks in many cases stand in the way of these institutions forthcoming to meet the credit needs of growers, particularly the ones with no collateral to offer.

It could be explored by the Bangladesh Bank whether some support mechanism could be developed so that this particular problem could be overcome. The Agricultural and Rural Credit Policy and Program of Bangladesh Bank may be suitably reoriented for the purpose and modalities developed either by the Bank itself or with support of the international financial institutions interested to extend support to Bangladesh with resource replenishment, technical advice and support. Developing counter guarantee arrangements for the Banks and financial institutions which decide to extend credit to small aquaculture farmers who are not in a position to offer any traditional collateral may be also actively considered.

Where the small growers cannot access credit because they cannot develop appropriate Bankable business plans, models could be developed involving growers, processors and interested national business support organizations as well as development partners which would help small farmers to overcome this particular problem. Already many organizations including Katalyst are actively working with some sector specific arrangements replication and up-scaling of which may prove to be of particular help. Many of the financial institutions also shy away from extending credit to small aquaculture farmers as they do not have necessary sectoral knowledge and as such, extension officials of Department of Fisheries and business support organizations may help to bridge the knowledge gap of the concerned financial institutions though appropriate interactions, trainings and collaborations.

During multistakeholders consultations undertaken as part of the present study, it was pointed out that providing credit alone in a high risk sector as fisheries, particularly the aquaculture sector, may not help the small farmers much if they are not enabled to access supplementary affordable good seed, feed, training and information on available technologies.[34] A credit plus policy may thus be the need for growers at the grass root level more than an exclusive policy on credit itself. This particular suggestion also merit due attention.[35]

Explore Possibility of Developing an Aquaculture Insurance Scheme

Lack of insurance coverage for aquaculture production was identified as one of the major constraints to access credit by over half of the survey respondents. Similar views were expressed by some participants at a consultation workshop arranged for this study. While the demand for insurance to share the risks associated with aquaculture practices, such as loss of stocks due to outbreaks of fish disease or to impacts of floods, is understood, it needs to be recognized that worldwide examples of viable aquaculture insurance schemes, particularly for small farmers, that Bangladesh could build on is very limited.

[34]Imtiaz U. Ahmad, 2013. Improving access to financial services by small-scale aquaculture producers: challenges and opportunities.

[35]FAO, 2013 Enhancing the contribution of small-scale aquaculture to food security, poverty alleviation and socio-economic development.

The aquaculture insurance market at the global level is still at a preliminary stage, given that commercial aquaculture is a relatively new sector.[36] A global review of the aquaculture insurance markets in 2006 by FAO reported that less than one percent of the estimated 11 million farmers were insured. Small farmers in Asia and other regions had little or no access to insurance while the export-oriented, more industrialized sector, was somewhat better covered.[37]In the Bangladesh context, even in the agriculture sector, there is limited knowledge and experience. A number of countries, particularly Thailand, with FAO support, have recently been piloting aquaculture insurance schemes. In the long-term, Bangladesh could consider learning from the experiences of such countries in designing a scheme suitable for the Bangladesh context.

Bangladesh Stands to Benefit from Developing and Implementing a Credible Traceability System

Some new areas of cooperation are also important from the perspective of the growth and development of the sector. These are related to ensuring greater transparency on the quality of products from the sector. Bangladesh Government has already committed to develop a credible traceability system for the sector and implementation efforts in this regard through Government, other stakeholders in the sector and possible collaborations of development partners may be high on the future plan of action for development of the sector.

Adopt Measures to Address Emerging Challenges

During consultations with stakeholders, the impact of climate change on the aquaculture sector was identified as an emerging challenge. Climate change phenomena broadly include flash floods, increase in sea levels, and increase in temperature, stronger waves, and longer dry seasons. Bangladesh is recognized as a country that is highly vulnerable to the adverse effects of climate change. The 7th FYP recognizes climate change as a major long-term challenge that will likely have a negative impact on its poverty alleviation and environmental management programs and, in particular, poise a threat to the livelihoods of resource poor farmers.

For the fisheries sector, the 7th FYP states that "both coastal and freshwater fisheries are likely to be affected by changing temperature, siltation, inundation and salinity regimes". Public support is needed to have a better understanding on the impact of climate change on the fisheries and

[36]Imtiaz U. Ahmad, 2013. Improving access to financial services by small-scale aquaculture producers: challenges and opportunities

[37]FAO, 2013 Enhancing the contribution of small-scale aquaculture to food security, poverty alleviation and socio-economic development.

aquaculture sector by undertaking scientific studies and research that will look into issues, including suggesting adaptation and mitigation measures.

On the whole, Bangladesh can hope to realize the significant growth potential of her fisheries and aquaculture sector through pursuing a comprehensive policy paradigm in which important public support in all the above areas will be of crucial importance. The broad policies of the Government of Bangladesh generally address many of the areas highlighted above. There is however considerable scope to add finer details with additional ties as mentioned above which would translate the stated policy priorities of the Government into actionable plans and programs. The team working on the present study is hopeful that findings of the study and the observations by way of recommendations in this concluding section of the study will help in a meaningful way to do so.

The study team and all major stakeholders taking part in the Focal Group Discussions (FGDs) recommended that to implement the above recommendations as well as to promote sustainable development of the aquaculture sector of Bangladesh, a comprehensive road map could be developed by the competent authority with support and collaboration of major stakeholders including development partners.

9. Bibliography

1. DOF, Annual Reportsfor the years 2010-2015
2. Fisheries Statistical Report of Bangladesh (2014-2015)
3. Presentation on Fisheries Statistics in Bangladesh: Issues, Challenges and Plans - Department of Fisheries, Bangladesh" made by *KaziMofizulHoque and Umma-un-Arifa, Fisheries Resources Survey System in Bangladesh (FRSS), Department of Fisheries* at a Workshop to Establish a National Agricultural and Rural Survey Calendar based upon Integrated Planning of Agricultural Census and Surveys held from July 30 – August 05, 2016 at Pattaya, Thailand
4. Bangladesh Bureau of Statistics – Statistical Year Books for various years
5. Bangladesh Economic Review 2015, Ministry of Finance, Government of Bangladesh
6. Sixth Five Year Plan of General Economic Division, Planning Commission, Government of Bangladesh (2011-2015)
7. Seventh Five Year Plan: Accelerating Growth, Empowering Citizens" published by General Economic Division, Planning Commission, Government of Bangladesh (2016-2020)
8. General Economics Division (GED) of Planning Commission: "Bangladesh Input-output table 2012: Methodology and Results", Background Paper: 7FYP Technical Framework, March 2014.
9. National Fisheries Policy (1998)
10. The National Aquaculture Development Strategy and Action Plan of Bangladesh (2013-2020)
11. Bangladesh Country Investment Plan - A road map towards investment in agriculture, food security and nutrition (2011-2015)
12. National Food Policy of Action and Country Investment Plan Monitoring Report 2015 prepared by *Food Planning and* Monitoring Unit, Ministry of Food, Government of Bangladesh
13. Bangladesh Bank, The Agriculture and Rural Credit Policy and Program for the FY 2014-15
14. Bangladesh Bank, The Agriculture and Rural Credit Policy and Program for the FY 2016-17
15. Bangladesh National Conservation Strategy (2016-2031)
16. The State of World Fisheries and Aquaculture 2016
17. The FAO Bangladesh Fisheries and Aquaculture Country Profile (2014)
18. FAO Fisheries Technical Paper 427 'Aquaculture Development In China The Role Of Public Sector Policies (2003)' by *Nathanael Hishamunda and Rohana P. Subasinghe*
19. FAO Fisheries and Aquaculture Technical Paper (509) prepared by Hishamunda, Bueno, Ridler and Yap entitled Analysis of Aquaculture Development in Southeast Asia-Policy Perspective
20. Aquaculture Seed and Feed Production and Management in Bangladesh – Status, Issues and Constraints (FAO 2015) edited by *Mr. R. Hasan, J. Richard Arthur*
21. FAO, 2013 Enhancing the contribution of small-scale aquaculture to food security, poverty alleviation and socio-economic development
22. Presentation on Review and Recommendations on Country Investment Plan Relating to Fisheries and Aquaculture" made at MOFL-FAO Stakeholders Consultation by *MahmudulKarim, Director, Bangladesh Shrimp and Fish Foundation* on February 27, 2011 at Department of Fisheries
23. Imtiaz U. Ahmad, 2013. Improving access to financial services by small-scale aquaculture producers: challenges and opportunities.
24. EU Seventh Framework Program, AFSPAN Work Package 3: Review and Assessment of National and International Cooperation, 2014 by *Dr. Imtiaz Ahmed*
25. BSFF (February, 2016): A preliminary study on Support to Bangladesh Aquaculture Sector Existing Reality and Scope for Improvements" by *Md. Abdul Quasem, Prof. BazlulHaqueKhondker, IftekherHossain, AbulKalam Azad*

26. Policy Working Paper: Dynamic Agribusiness-Focused Aquaculture for Poverty Reduction and Economic Growth in Bangladesh (March 2006) by *M. Karim, M. Ahmed, R.K. Talukder, M.A. Taslim, H.Z. Rahman*
27. Hilsa and Hilsa Fishermen-exploring conservation-livelihood win-wins by *Dr. HossainZillurRahman, Dr. Md. Abdul Wahab, Mr. Liaquat Ali Choudhury*
28. IUCN Bangladesh 2000. Red book of Threatened Fishes of Bangladesh. International Union for Conservation of Nature, Dhaka, Bangladesh
29. IUCN Bangladesh 2015: Red list of Bangladesh, A brief on assessment result 2015. International Union for Conservation of Nature, Dhaka, Bangladesh
30. Rahman, A.K.A. 2015. Freshwater Fisheries of Bangladesh, 2nd edn. Zoological Society of Bangladesh, Dhaka, Bangladesh and BSFF Website
31. Final Report of an Audit Carried out in Bangladesh from April 20-30, 2015 in order to Evaluate the Control System in Place Governing the Production of Fishery Products Intended for Export to the European Union by European Commission Directorate-General for Health and Food Safety, Directorate F-Food and Veterinary Office, DG (SANTE) 2015-7569-MR
32. Guideline of Central Sector Scheme on Blue Revolution-Integrated Development and Management of fisheries, Government of India, June 2016
33. Indian Central Government's Notification Number: 31013/1/2007-Fy(3), July 02, 2015
34. Report on the Katalyst First Phase 2003-2008
35. Report on the Katalyst Second Phase 2008-2013
36. Report on the Katalyst Third Phase 2014-17

10. Annexure

Annexure 1: Recommendations from Dissemination Workshop on the study held on October 15, 2017

Mr. Kazi M. Aminul Islam, Executive Chairman, Bangladesh Investment Development Authority was the chief guest on the occasion. Mr. Syed Mahmudul Huq, Chairman of BSFF presided over the workshop proceedings and discussants from the Government, academia, financial institutions, professional bodies, development partners and stakeholders in the sector, the workshop was specially addressed also by Mr. Hedayetullah Al Mamoon, former Senior Secretary, MoC & Finance, Mr. Eunusur Rahman, Senior Secretary, Financial Institutions Division, Mr. Md. Azizul Alam, Additional Secretary, Ministry of Finance, Mr. Tapan Kanti Ghosh, Additional Secretary, Ministry of Commerce, Syed Arif Azad, Director General, DOF, Mr. GB Banjara, General Manager, Katalyst, Mr. Md. Nurul Amin, Managing Director, Meghna Bank Limited. Other workshop discussants included Dr. Mahfuz Uddin Ahmed, formerly of Asian Development Bank, Mr. Shyamal Kanti Ghosh, former Secretary, Ministry of Agriculture, Dr. A.H.m. Kohinoor, Principal Scientific Officer, Bangladesh Fisheries Research Institute, Mr. Naseem Ahmed Aleem, Deputy Chief of Party, World Fish, Mrs. Nurun Naher from FAO Representation in Bangladesh, Dr. Md. Sainar Alam from Department of Fisheries, Mr. Aktar Hassan Panna, President, Semi-intensive Shrimp Farmers' Association of Bangladesh, Mr. Manoj Kanti Bairagi, General Manager (Agriculture Credit Department), Bangladesh Bank, Mr. R.Q.M. Forkan, Managing Director, Bangladesh Commerce Bank Limited (BCB), Mr. Main Uddin Ahmed, Managing Director, MKA SPF Hatchery Limited, Mr. Md. Golam Mostafa, Director, Bangladesh Frozen Foods Exporters' Association (BFFEA), Dr. Craig A Meisner, Aquaculture Supply Chain Specialist, NSF International and Senior Research Fellow, IFPRI, Mr. Moin Uddin Ahmed, Team Leader, Sustainable & Inclusive Shrimp Business Promoted Project, Solidaridad Network Asia. Syed Arif Azad, Director General, Department of Fisheries was a special speaker on the occasion.

Following the introductory remarks of the chairperson of the workshop Syed Mahmudul Huq, in which he highlighted the importance of the fisheries and aquaculture sector in the Bangladesh economy, several challenges facing the sector were also stressed. Mr. Huq noted that the sector was one with great growth potential and continued and enhanced support to the sector would be needed to fully realize the same. He noted that there was considerable scope for policy improvement in this regard as the sector is yet to benefit from similar support extended to other important sectors of the economy, especially the broader agriculture sector.

The introductory remarks of the chairperson were followed by a comprehensive presentation by Mr. GB Banjara, General Manager, SwissContact Katalyst on the context in which the study on the sector was undertaken by BSFF and also the general thrust of his organization's ongoing and planned important activities in the fisheries and aquaculture sector. He noted that Katalyst was a partner with the Government of Bangladesh in making available quality brood, feed, aqua products and farming know-how in the fisheries sector. The organization's wide ranging activities also included initiatives to minimize post harvest losses, market development and policy support.

The main findings on the study was presented by Dr. Bazlul Haque Khondker, the study team leader and Professor of Economics of the University of Dhaka. The presentation was made under 3 sub-heads and it included detailed survey findings on the production and financing realities in the sector, the extent of support extended to the sector in other major fisheries and aquaculture practicing countries, the state of public support to the fisheries and aquaculture sector in Bangladesh with scope for further improvement and a comprehensive set of recommendations for follow-up initiatives.

In the general discussions, the following main points were stressed with remarkable unanimity:

- **Continued fisheries and aquaculture sector development in Bangladesh will be critical for future development of the country and the achievement of the SDGs in the widest sense**
- **The growth of the sector will have to be supported with pro-growth enabling policy environment and budgetary support commensurate with the relative importance of the sector in the national economy and investment requirement and institutional strengthening imperatives needed to help the sector**
- **The main initiative for the development of the sector should be undertaken in the private sector supported by the Government and development partners and all policy lacuna impeding growth in the sector will have to be addressed and overcome**
- **Particular attention will have to be given to macro structural factors likely to influence the growth of the sector in future and specially crafted micro interventions needed to face specific challenges**
- **Need for credit and finance for a small farmer will have to be met ensuring greater support of and involvement of the Bangladesh Bank and financial institutions**
- **The policies of the Bangladesh Bank and Government of Bangladesh should be more closely aligned with the requirements of farmers at the growers level, particularly the small farmers, risk mitigation and enabling the interested financial institutions to undertake risk**
- **Unaddressed investment requirement for infrastructure development, capacity building and institutional improvement particularly of research labs will have to be addressed**
- **Special attention will have to be given to making available good seed and feed and ensuring steps to avoid diseases and contain the adverse impact thereof**
- **The growth efforts should be innovation based and good lessons both from within the country and abroad should be duly internalized in the development efforts of the sector**
- **Bangladesh will need a pro-growth import regime to meet specific requirements of the sector and to enable fish feed and seed producers to minimize cost for fish farmers**
- **Quality control should continue to be a key area of concern and Bangladesh will definitely benefit from the introduction of a credible E-Traceability system, clusters based production arrangements and continued efforts to impart know-how on Good Aquaculture Practices and Better Marketing Practices**
- **Future growth initiatives for the sector should adequately prioritize development initiatives for comprehensive marine fisheries resources conservation, sustainable exploitation and scientific approaches for the same**

- **Fisheries and aquaculture sector in Bangladesh is particularly susceptible to unfolding adverse climate change related impacts and consequences. Future development programs for the sector should duly factoring the need for special initiatives needed to overcome these challenges**
- **All the participants were of the view that the close collaboration between GoB, DoF, all the relevant Ministries, entities like BSFF and development partners will be especially helpful for the sector**
- **The participants also lauded the achievements of the Fish Component of the Agri-Business Trade Competitiveness Project (ATC-P) and highlighted that a follow-up project will be most appropriate**

The participants in the workshop generally endorsed all the recommendations in the study with the suggestions that their implementation should receive attention that they deserved. **They noted that future activities intended to support the sector should give due attention to gender concerns, enhance support for research in the sector and field level application of positive growth enhancing research findings, extension work as in the crop sector and governance issues.**

Annexure 2: Statistical Tables

Table I: Percentage Share of total cost of production by species in Bangladesh (Traditional Farming)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	4.0	NA	6.3	31.9	42.0	32.2	11.6
Pond Preparing Cost	7.4	NA	5.7	1.4	16.5	7.3	2.4
Seed Cost	19.6	NA	19.6	25.5	37.2	36.9	36.2
Feed Cost	61.0	NA	67.3	6.8	1.2	4.9	36.2
Fertilizer Cost	0.3	NA	0.0	0.0	0.0	0.0	0.0
Labor Cost	7.5	NA	0.9	34.1	2.9	18.2	12.0
Other Cost	0.0	NA	0.0	0.0	0.0	0.2	1.2
Total Cost	100.0	NA	100.0	100.0	100.0	100.0	100.0

Source: Field Survey

Table II: Percentage Share of total cost of production by species in Bangladesh (Semi Intensive Farming)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	11.2	NA	21.2	0.0	13.9	24.6	11.7
Pond Preparing Cost	12.8	NA	3.9	2.1	11.0	12.8	9.9
Seed Cost	25.4	NA	23.6	59.4	34.8	31.4	15.9
Feed Cost	40.5	NA	50.2	11.1	33.6	23.0	50.7
Fertilizer Cost	2.4	NA	0.0	2.1	0.3	0.3	0.0
Labor Cost	6.0	NA	0.0	25.0	5.6	5.4	11.6
Other Cost	1.5	NA	0.8	0.0	0.5	2.1	0.0
Total Cost	100.0	NA	100.0	100.0	100.0	100.0	100.0

Source: Field Survey

Table III: Percentage Share of total cost of production by species in Bangladesh (Intensive Farming)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	16.0	6.8	9.0	12.1	35.6	23.6	8.3
Pond Preparing Cost	5.2	2.8	4.6	3.5	3.6	4.7	3.9
Seed Cost	18.9	8.0	13.1	11.9	14.6	21.1	13.9
Feed Cost	52.4	75.9	66.8	66.2	37.5	40.3	68.6
Fertilizer Cost	1.0	1.9	1.0	0.2	0.7	0.1	0.2
Labor Cost	4.8	3.4	4.4	4.7	6.3	5.4	4.3
Other Cost	1.3	1.0	0.8	1.0	1.5	4.4	0.5
Total Cost	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Field Survey

Table IV: Percentage Share of total cost of production by species with respect to farm size in Bangladesh (Small)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	10	12	0	2	26	NA	4
Pond Preparing Cost	5	1	3	3	5	NA	7
Seed Cost	19	11	17	16	26	NA	15
Feed Cost	59	73	75	68	33	NA	66
Fertilizer Cost	1	0	1	0	1	NA	0
Labor Cost	3	1	2	2	4	NA	3
Other Cost	2	2	2	9	5	NA	5
Total Cost	100	100	100	100	100	NA	100

Source: Field Survey

Table V: Percentage Share of total cost of production by species with respect to farm size in Bangladesh (Medium)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	11	3	0	14	16	19	8
Pond Preparing Cost	5	3	6	4	10	9	4
Seed Cost	17	10	13	12	35	37	13
Feed Cost	58	79	75	65	34	25	70
Fertilizer Cost	1	0	1	0	0	0	0
Labor Cost	5	4	3	2	4	8	2
Other Cost	2	1	2	4	1	2	3
Total Cost	100	100	100	100	100	100	100

Source: Field Survey

Table VI: Percentage Share of total cost of production by species with respect to farm size in Bangladesh (Large)

Item	Carp	Pangas	Tilapia	Koi	Golda	Bagda	Others
Establishment Cost	16	15	0	27	46	42	8
Pond Preparing Cost	3	3	4	3	6	6	3
Seed Cost	13	9	23	16	17	26	12
Feed Cost	66	69	70	51	27	20	73
Fertilizer Cost	0	1	0	0	0	0	0
Labor Cost	2	1	1	1	3	4	2
Other Cost	1	1	2	1	1	2	1
Total Cost	100	100	100	100	100	100	100

Source: Field Survey

Establishment cost includes lease value, payment for land tax, payment for electricity bill, fuel cost (diesel etc.), Interest payment for debt/ loan and etc.

Annexure 3: Bangladesh Bank indicative production of calendar for Credit Disbursement in the fisheries/ aquaculture sector

SL NO	Nature of Production	Head-Wise Production Cost Per Acre											Per Acre Loans		Remarks
		Calendar of Production	Pond Preparation	Pond Lease/ Rent	Fish Fries	Fertilizer (Organic/ non-organic)	Supplementary Feed	Drug/ Chemicals	Labour Wage	Electricity Cost	Miscellaneous Cost	Fish Capture and Sale	Per Acre Cost		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Mixed Production of Carp	12 months	5000	20000	35000	2000	291550	7000	120000	3600	10000	8000	502150	502150	Depending on the intensity of product and feed use production cost may vary
2	Mixed Production of Carp and Golda	12 months	5000	20000	54000	2500	280860	7000	120000	3600	8000	8000	508960	508960	
3	Production of Monosex Tilapia	4-5 months	5000	10000	37500	1500	249375	3000	40000	1200	8000	8000	363575	363575	
4	Production of Pangasius	12 months	5000	20000	36000	1500	453600	7000	120000	3600	8000	8000	664700	664700	
5	Production of Koi	4-5 months	700	10000	15000	2000	57600	5000	40000	1200	8000	8000	147500	147500	
6	Production of Shing	4-5 months	700	10000	30000	2000	103680	5000	40000	1200	8000	8000	208580	208580	
7	Production of Magor	4-5 months	7000	10000	80000	2000	92160	5000	60000	1800	8000	8000	233960	233960	
8	Production of Gulsha	4-5 months	5000	10000	10000	2000	23040	5000	60000	1800	8000	8000	132840	132840	
9	Production of Pabda	4-5 months	5000	10000	20000	2000	23040	5000	60000	1800	8000	8000	142840	142840	
10	Production of Bagda	4-5 months	1000	10000	40000	2000	158400	15000	40000	1200	8000	10000	285600	285600	
11	Fish Production through Cage Culture	7-8 months	200000 (10 number of Cage Established)		30000		424000		5800				659800 (10 number of Cage)	659800	

Source: Bangladesh Bank: The Agriculture and Rural Credit Policy and Program for the FY 2016-17