Food and Agriculture Organization of the United Nations

FI:MTF/BGD/046/STF
Terminal Report

FAO/MULTILATERAL TRUST FUND

BUILDING TRADE CAPACITY OF SMALL-SCALE SHRIMP AND PRAWN FARMERS IN BANGLADESH - INVESTING IN THE BOTTOM OF THE PYRAMID APPROACH

BANGLADESH

PROJECT FINDINGS AND RECOMMENDATIONS

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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PROJECT FINDINGS AND RECOMMENDATIONS

Report prepared for
the Government of Bangladesh
by
the Food and Agriculture Organization of the United Nations

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2016

The Food and Agriculture Organization is greatly indebted to all those who assisted in the implementation of the project by providing information, advice and facilities.

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LIST OF ABBREVIATIONS

BAA	-	Bangladesh Aquaculture Alliance
BEST	-	Better Work and Standards Programme (projects)
BFFEA	-	Bangladesh Frozen Foods Exporters Association
BFRI	-	Bangladesh Fisheries Research Institute
BMP	-	Better Management Practices
BPC	-	Business Promotion Council
BSFF	-	Bangladesh Shrimp and Fish Foundation
CCRF	-	Code of Conduct for Responsible Fisheries
DDT	-	Dichlorodiphenyltrichloroethane
DFO	-	District Fisheries Officer
DO	-	Dissolved oxygen
DoF	-	Department of Fisheries
EF	-	Extension Facilitator
ERD	-	Economic Relations Division
EU	-	European Union
FGD	-	Focus group discussions
FVO	-	Food and Veterinary Office
GAP	-	Good Aquaculture Practices
GHP	-	Good Hygienic Practices
GPS	-	Global Positioning System
HACCP	-	Hazard Analysis and Critical Control Point
ICS	-	Internal Control System

ID	-	Identification (card)
IFOAM	-	International Federation of Organic Agriculture Movements
IMED	-	Implementation Monitoring and Evaluation Division
IPM	-	Integrated Pest Management
LoA	-	Letter of Agreement
MoFL	-	Ministry of Fisheries and Livestock
NFSL	-	National Food Safety Laboratory
NGO	-	Non-governmental Organization
NRMP	-	National Residue Monitoring Programme
NFSL	-	National Food Safety Laboratory
PCR	-	Polymerase Chain Reaction
PKSF	-	Palli Karma-Sahayak Foundation
PL	-	Postlarvae
PM	-	Project Manager
PSC	-	Project Steering Committee
PTC	-	Project Technical Committee
RASFF	-	Rapid Alert System for Food and Feed
SaFaL	-	Sustainable Agriculture, Food Security and Linkages
SOP	-	Standard Operating Procedure
SPF	-	Specific Pathogen Free
SPS	-	Sanitary and phytosanitary
STDF	-	Standards and Trade Development Facility
SUFO	-	Senior upazila fisheries officer
ToT	-	Training of Trainers
UFO	-	Upazila Fisheries Officer

WF	-	WorldFish
WTO	-	World Trade Organization

A. OVERVIEW

A.1 PROJECT PROFILE

Country	Bangladesh
Project Symbol	MTF/BGD/046/STF
Project Title	Building trade capacity of small-scale shrimp and prawn farmers. Investing in the bottom of the pyramid approach
Resource Partner	Standards and Trade Development Facility
Actual EOD	1 April 2012
Actual NTE	30 June 2016
Participating Organizations (e.g. Ministry of Agriculture, etc.)	The project was implemented by FAO in close coordination with the Department of Fisheries (DoF), under the Ministry of Fisheries and Livestock (MoFL) .

Implementing Partners (List):

Name	Type (NGO/Community- Based Organization/Govt.)
FAO	
DoF	Government
WorldFish (WF)	
Bangladesh Shrimp and Fish Foundation (BSFF)	NGO

Contribution to FAO's Strategic Framework ***Indicate the title of each higher-level result to which the project contributes***	
Organizational Outcome (s)	
Regional Priority Area/Initiative	
Country Programming Framework Outcome(s)	
UNDAF Outcome(s)	

A.2. FINANCIAL DATA in USD[1]

(as at: 29 November 2016)

Budget	USD 637 000
Cash received	USD 636 985
Delivery	USD 636 235

A.3 EXECUTIVE SUMMARY

The project was funded by the Standards and Trade Development Facility (STDF). The objective of the project was to improve international market access for shrimp and prawn products originating from the small-scale farming sector in Bangladesh, by building the capacity of aquaculture stakeholders, and implementing international standards for aquaculture products, and, in particular, by addressing the issue of antimicrobial contamination, and residues in shrimp and prawn products.

The project assisted 1 000 small-scale farmers, who followed Best Management Practices (BMP)/Good Aquaculture Practices (GAP), by adopting a cluster approach, with increased market access through improved compliance with international trade requirements. The project addressed the problem at grassroots level, finding the reasons for disease incidents in shrimp farming, and applying BMP to minimize them, reducing the use of antimicrobials, and other therapeutic agents, which could result in residues and contaminants in internationally traded shrimp and prawn products. Significant progress was made during the project, particularly regarding the increased volume of good quality products.

The following activities were carried out: i) the development of a database for the project, including baseline data analysis; ii) the registration of farms, and distribution of farmers identification (ID) cards (with barcodes) for cluster members; iii) the organization of initial and refresher training sessions, GAP module-based training courses, training on food safety, and a Hazard Analysis and Critical Control Point (HACCP) system for cluster leaders, as well as exchange visits, contributing significantly to increasing the capacity of the farmers.

In addition, increasing the depth of ghers (ponds); Polymerase Chain Reaction (PCR)-tested postlarvae (PL) stocking; setting up pond nurseries, and the introduction of a simplified supply chain considerably increased production, in comparison to base year 2013. Intensive monitoring, strong coordination among the stakeholders, positive motivation at stakeholder

[1] Data source: FPMIS/Data Warehouse

level, and the creation of better traceable products chains contributed to the successful implementation of the project.

In consultation with the relevant stakeholders, a cluster-specific crop calendar for the whole production cycle was also established, which included plans for prawn and shrimp farming activities that were applicable to the project locations. A network of service providers was also established, and the mobile phone numbers of all key stakeholders were made readily available.

An extensive farmers' record book for improved traceability was produced and distributed to all beneficiaries, maintaining all physical and financial records. A total of 40 demonstration ponds were established to share the modalities and process of GAP, in order to achieve better production; and cluster members, as well as neighbouring farmers, attended the demonstration sessions. In addition to farmers' basic training, a total of six module-based farmer field schools were conducted for the beneficiary farmers.

On the basis of the report of the international GAP expert, and the consultation of four existing manuals (by DoF, WorldFish [WF], the Bangladesh Shrimp and Fish Foundation [BSFF] and Katalyst), a comprehensive GAP manual for cluster farmers was prepared, customized and validated by the farmers. A total of 12 district-level consultation and coordination meetings were held at Khulna, Bagerhat and Satkhira districts, at the respective District Fisheries Officers' (DFOs) Offices, where cluster leaders, officials from the project, DoF, WF, BSFF, Bangladesh Frozen Foods Exporters Association [BFFEA], and the FAO technical team participated actively, and contributed to the smooth operation of the planned activities.

Under a Letter of Agreement (LoA), a value chain study (an update of shrimp and prawn supply chain initiatives in Bangladesh) was conducted at the beginning of the project, in the southwest region of the country. After studying the shrimp supply chain, efforts were made to develop a premium supply chain from 11 to 19 February 2014.

The BMP/GAP mission, with the active participation of cluster members, developed GAP guidelines, which focused on reducing the risks of disease in shrimp and prawn aquaculture. As per the guidelines, 51 percent of the cluster farmers prepared earthen nurseries, and 98 percent of the farmers nursed their PL before stocking them in the ghers, by 2014. Farmers were regularly communicated with, and motivated to stock PCR-tested PL in their ghers, and 70 percent of the farmers used PCR-tested PL, hence the stocking density was reduced by 33 percent.

In order to ensure the sustainability of capacity and awareness among cluster farmers on the various project interventions on GAP, supply chain posters, leaflets on GAP in grow-out, nursery, post-harvest handling, and cluster operation and management were also prepared, and distributed to the cluster members. In addition, a comprehensive manual, Shrimp farming through cluster approach in compliance to GAP was developed and distributed to all the farmers.

A total of eight local study trips (exchange visits) were organized, covering 25 percent of the cluster farmers, as well as the DoF upazila team. The main purpose of the study trips was to share and learn from each other about the problems related to GAP, and its solution and management. The major learning points that were experienced were GAP in the clusters, the scarcity and quality of water, nursery and feed management, and related technical issues.

At the end of the project, a performance assessment of the adoption of BMP, and other activities for the years 2014 and 2015, was completed. The performance was assessed by determining the changes in the target indicators as a result of project interventions, through a straightforward comparison between pre and post-intervention situations and practices. Three broader indicators with 14 specific subindicators were taken for assessment. The data were collected from 400 sample farmers, of 1 000 project farmers.

The project achieved most of its objectives, especially regarding GAP, developing nurseries, increasing water depth, and ensuring quality inputs, such as PCR-tested PL.

DoF, with technical assistance from FAO, and in association with WF, sought to establish a sustainable supply and market chain involving the relevant value chain actors. National and local newspapers focused on the project's success story. However, more time and effort is needed to improve the economies of scale, in order to address market access through an improved value chain, and the development of a fully functioning web-based traceability system.

B. RELEVANCE

The problem

Shrimp and prawn products from Bangladesh are regularly rejected at international borders, because of the detection of contamination and residues, particularly those deriving from banned antibacterials. As a consequence, the country has been subject to the Rapid Alert System for Food and Feed (RASFF) of European Union (EU) notifications for many years, for

residues of veterinary medicinal products in aquaculture products traded with the EU. This has caused serious problems in the trade of aquaculture products with the latter, in particular, shrimp and prawn products, and led to economic losses throughout the value chain, affecting not only the processors and exporters, but also a large number of small-scale farmers, and women and men employees in the aquatic food business.

According to the latest report of the Food and Veterinary Office (FVO) issued in mid-2010, between November 2008 and March 2010, there were 54 RASFF notifications for residues of veterinary medicinal products in aquaculture products traded between Bangladesh and the EU. All notifications were for findings of the marker residue (semicarbazide) for the nitrofuran drug nitrofurazone in freshwater crustaceans. Based on the results of an FVO mission in 2009 and these RASFF notifications, Bangladesh imposed a voluntary ban on the export of freshwater prawns to the EU, resulting in the complete stoppage of the trading of freshwater prawns and prawn products between Bangladesh and the EU. Following negotiations with the EU, the ban was partially lifted in early 2010, and a few processors have been allowed to export to the EU. Similar rejections have also taken place in the United States of America.

In 2010 there was a reduction of RASFF notifications, as a result of some changes in the analytical procedures used by EU laboratories. However, notifications still persist, and only very few processing plants are approved for exporting shrimp and prawn products. As a result, Bangladesh shrimp and prawn exports to the EU have been drastically reduced. An essential part of the strategy to reduce the use of antimicrobials, and other veterinary drugs in freshwater crustaceans, is the application of best practices to ensure a healthy product, and therefore eliminate the need to use veterinary medicines.

Even after improved efforts by the competent authorities, the national quality control management for the contamination of aquaculture products and their compliance with international trade standards is still inadequate. Most efforts are targeted towards improving and strengthening National Residue Monitoring Programme (NRMP) capacity through improved detection procedures, laboratory testing methodologies, and stringent rules and regulations. However, given that the effective enforcement of regulations is generally weak, owing to inadequate resources, both human and financial, the problem of contamination and residues in shrimp and prawn products continues to persist. Furthermore, there have not been any organized, comprehensive, targeted and sustained efforts to address the problems related to residues in shrimp and prawn products at grassroots level, i.e. farmer and farm levels.

Many small-scale farmers face increasing problems in participating equitably in modern value chains in international trade, owing to, among other things, difficulties in complying with increasingly high production standards, and food safety and quality assurance requirements. The small-scale aquaculture sector is weak, and continuously faces pathogen incursions and disease threats. This is mainly because of a lack of organization, good production management, and adequate technical knowledge and know-how. As a result, small-scale farmers tend to find quick-fix solutions to disease problems, such as the irresponsible use of antimicrobials and veterinary drugs.

It is also evident that in Bangladesh some veterinary drugs are incorporated into shrimp and prawn feeds for various reasons, and that ingredients used in feed preparation are not up to the required standards. Thus, feeds have also become a source of antimicrobial residues in shrimp and prawn products.

The response

The expected impact of the project was to increase the incomes of small-scale aquaculture farmers and value chain partners, and reduce poverty in Bangladesh. The expected outcome was to increase international market access for shrimp and prawn products originating from small-scale farmers in the country.

The overall objectives of the project were as follows:

- improved compliance by small-scale aquaculture producers with food safety, and other international sanitary and phytosanitary (SPS) measures that deliver better market access and increase household incomes;
- enhanced human health through safer and higher quality food products for export and domestic markets, and consumers; and
- greater public and private institutional capacity, organizational arrangements and investment in food safety, and other SPS improvements in farmed seafood supply chains.

The immediate objectives of the project were to:

- increase the capacity of small-scale shrimp and prawn producers to meet international food safety and SPS requirements;
- improve organizational arrangements and services that enhance SPS compliance, and access to international markets for small-scale shrimp/prawn producers (e.g. farm clusters, better traceability, fewer rejections, better compliance to SPS, certification, etc.); and

– strengthen public and private institutional capacity, partnerships and investments that support improvements in food safety and other SPS measures throughout shrimp/prawn value chains, from producer to markets.

The project was implemented by FAO, in coordination with DoF, and in collaboration with WF and BSFF, and other stakeholders. The project interacted, communicated and collaborated with relevant private-sector value chain partners (seed and feed producers, veterinary drug and chemical suppliers, small-scale farmers, processors, exporters).

The Project Steering Committee (PSC) was the prime authority in charge of project management, which was chaired by the Secretary of the Ministry of Fisheries and Livestock (MoFL), and composed of MoFL, DoF, FAO, WF, BSFF, the Bangladesh Fisheries Research Institute (BFRI), the Implementation Monitoring and Evaluation Division (IMED), the Economic Relations Division (ERD), the Planning Commission, and private sector representatives. FAO served as the lead technical and administrative agency, in close cooperation with DoF, for the implementation of the project.

A Project Technical Committee (PTC), which was chaired by the Director-General of DoF, coordinated the project activities where all stakeholders were involved. The main purpose of the PTC was to monitor and advise on the day-to-day technical activities; as well as provide additional technical guidance in all aspects of the implementation of the project.

C. ACHIEVEMENT OF RESULTS

Results achieved

The project addressed the problem at grassroots level, finding the reasons for disease incidents in shrimp farming, and applying BMP to minimize them, and reduce the use of antimicrobials, and other therapeutic agents that could result in residues and contaminants in internationally traded shrimp and prawn products. The project encouraged small-scale farmers to adopt new science-based approaches, and strengthened the capacity of small-scale farmers to better manage their farms. Small-scale farmers were grouped into clusters, to bring about a practice and attitude change in an organized and consolidated manner. Farmers and buyers were linked by assisting farmers to certify their products on the basis of FAO guidelines, which would, in turn, further increase market access and economic benefits for rural communities.

The project focused on increasing productivity, and improving overall production by promoting GAP, which included the use of good quality seeds; the establishment of nurseries; the implementation of reasonable stocking densities and quality grade feeds; and the improvement of management practices and yields, without increasing disease and mortality rates; and the strengthening of simplified value chains and cluster management. The specific outputs and activities are outlined below.

1. Output 1: Implementation plan is finalized and the detail value chain analysis is completed

A project inception workshop was held in January 2013 with the participation of DoF, MoFL, ERD, WF, WB, BSFF, STDF, and FAO. Through this workshop a number of changes that had been brought into the project were followed during implementation.

1.1 Value chain study

A study was conducted in the southwest region of Bangladesh in 2014, "An update of shrimp and prawn supply chain initiatives in Bangladesh" (see Appendix 4), focusing on improving small-scale shrimp and prawn producers' livelihoods, and facilitating sustainable market access. The report provided the STDF project team with recommendations for achieving its objectives during the short project time frame.

1.2. PTC meetings

A total of three PTC meetings were held during the project. The PTC discussed the overall progress of the project, covering important issues such as GAP implementation guidelines; national certification guidelines; the endorsement of the revised work plan; and a knowledge dissemination plan.

1.3 Important training sessions

- Training for trainers (ToT) course for field supervisors, 19-21 February 2014;
- ToT for field level DoF officers on BMP/GAP, Khulna, 2-4 March 2014;
- inception training sessions for all 40 cluster members, at different cluster locations, March-May 2014;
- advanced ToT for Extension Facilitators (EF), Bagerhat, 10-12 May 2014;
- three regional field coordination and consultation meetings were held on 25-27 April 2014 at Khulna, Satkhira and Bagerhat DoF Offices;

- a partners consultation meeting was held on 14 March 2014 at the DoF conference room, Matshya Bhaban, Ramna, Dhaka, where project activities and progress were reviewed, and recommendations were made for future remedial actions; and
- two training courses on cluster management and operations for 40 cluster leaders were conducted at Satkira, 14-15 May 2014, and at Khulna, 9-10 June 2014.

2. Output 2: Small-scale shrimp and prawn farmers are organized into registered clusters

2.1 Selection of cluster farmers, cluster formation, and training

2.1.1 Selection of cluster farmers

A total of 1 000 farms/farmers were selected on the basis of specific selection criteria, as follows:

- geographical proximity, and use of common water source;
- suitable farming area (tides, pH, salinity);
- farmers share some common interests/concerns;
- the presence of moderately experienced farmers, but no dominant/major differences;
- the presence of a model farmer to lead the cluster;
- the farming area is less than two ha per farm;
- not more than three ponds owned by a farmer;
- practising extensive or improved extensive farming;
- good access/communication to the farming area; and
- prospective farmers are willing to: i) increase the depth of water to 1.2-1.5 m; ii) set up a nursery system; and iii) stock PCR-tested shrimp PL.

2.2.2 Formation of clusters

- Transect walk in the villages for identification of the potential cluster area;
- focus group discussions (FGD) with cluster farmers to explore the key constraints related to their shrimp farming and marketing systems;
- individual farm and farmer visits to know the interest of farmers in being part of a respective cluster; and
- village-level meetings to reform cluster, and enrolment as cluster members.

Table 1: Cluster location

District	**Upazilla**	**Clusters**	**Farmers**	**Cultured species composition**
Khulna	Dumuria	12	300 (25 × 12)	75% golda, 25% bagda, fish
Satkhira	Satkhira Sadar	10	250	5% golda, 95% bagda, fish
	Debhata	10	250	
	Shyamnagar	Four	100	
Bagerhat	Fakirhat	Four	100	60% golda, 40% bagda, fish
Three districts	Five upazila	40 clusters	1 000 farmers	

*Golda is a freshwater prawn while Bagda is a brackish or saltwater shrimp.

2.2.3 Cluster farmers training

A total of 320 hours of inception training was provided for farmers at all (40) cluster levels, which started on 18 March 2014, and was completed on 7 May 2014. The FAO technical team, together with the DFO, the senior upazila fisheries officer (SUFO), the assistant fisheries officer, the field assistant, and WF Extension Facilitator (EF) facilitated the hands-on participatory training sessions.

A cluster farmer six-module-based training course for all 40 clusters started on 28 May 2014, and was completed on 25 September 2014. A six-module-based (two and a half hours each) refresher training course of 1 000 farmers under 40 clusters was conducted from 8 December 2015 to 26 February 2016. This was an on-farm participatory hands-on course, where farmers could revisit their learning from the module-based training course.

The main purpose of these courses was to observe the compliance level, the nursery and grow-out management marketing system, as well as the problems encountered, and how farmers solved them. They covered the whole range of GAP, shrimp/prawn nursery management, pre-stocking, stocking and post-stocking management, disease prevention and control, etc.

On 7 March 2015 hands-on practical training sessions were held, with the support of WF, DoF and the FAO technical team, on post-harvest handling for shrimp and prawn value chain actors, including cluster members, ice plant owners, depot owners, and representatives from collection centres. A second training course was organized on 7 April 2015, which was attended by the same participants, and facilitated by the same team. The two training courses lasted a total of ten hours (five hours each). The courses helped the participants to learn and acquire skills on post-harvest handling and hygienic practices.

A total of eight exchange visits (local study trips) were organized from each of the working upazilas, which included upazila team members, and interested cluster farmers.

2.3 Follow-up and monitoring field activities

EF visited every cluster once a week, as well as carrying out a fortnightly informal gher (pond) visit, and a monthly cluster-level meeting. The upazila fisheries team, and other important personnel also visited the project site. The records of these visits were mostly maintained in the register book; and observations and recommendations were documented.

During the routine field visits, the EF assisted cluster farmers to monitor the soil, water pH, salinity, dissolved oxygen (DO), alkalinity, etc. As a result of continual practice and some training, the women and men cluster farmers became capable of carrying out such tests by themselves.

Every cluster farmer maintained a record of the costs and returns, the volume of input used, and output obtained for the total production cycle for future reference, analyses, and guidelines for decision-making. The record books were regularly monitored by the project and DoF team. Farmers were facilitated by the respective EF and the upazila team, to ensure smooth and uninterrupted record-keeping in a total of 2 100 record books.

2.4 Control and inspection of biochemical hazards

The project established a systematic approach to control and inspection activities, through a managed programme based on proper scientific principles and appropriate risk assessment, leading to careful targeting of inspection and control resources.

Considering recent food safety issues, the project identified a number of test items periodically (bimonthly) to confirm the residual compliances in shrimps/prawns produced by the STDF beneficiary cluster farmers - which are outlined below.

Laboratory test to check food safety issues:

- Pesticides: dichlorodiphenyltrichloroethane (DDT), heptachlors, eldrin/dieldrin, chlorodon;
- antibiotics: chloramphenicles, nitrofuran, metronidazole, tetracycline/ oxytetracyclines;
- heavy metals/chemicals: chromium, arsenic, lead, cadmium, mercury and malachite green.

Initially, in February-March 2015, three samples were collected (three bagda and two golda) for the three above-mentioned category tests. The collected samples were sent to the National Food Safety Laboratory (NFSL). As per the analysis results, no harmful level of pesticides, heavy metals and antibiotics were found.

Concentrations of the common pesticides studied in shrimp samples were found to be safe for human consumption. Residual concentrations of chloramphenicles, chlorotetracycline, oxytetracyclines, tetracycline and malachite green were below the permissible limits set by the international food safety guidelines. In addition, testing of other alleged banned/harmful antibiotics (nitrofuran, metronidazole) was carried out in separate facilities. The residual concentrations of the common pesticides studied in shrimp samples were found to be safe for human consumption. Concentrations of DDT, heptachlors, eldrin, dieldrin, chlorodon and malachite green were below the permissible limits set by the international food safety guidelines. Concentrations of the heavy metals studied in shrimp tissues were found to be safe for human consumption. Concentrations of chromium, arsenic, lead, cadmium, and mercury were below the permissible limits set by the international food safety guidelines. It is increasingly important that farmers understand the regulations for the use of all chemicals, and that farm workers comply with these rules in their day-to-day activities.

2.5 Workshops

2.5.1 STDF policy workshops

Two policy workshops were held. The first one was organized by DoF, FAO and BSFF on 16 March 2015, in order to:

- build a national consensus for the improvement and expansion of shrimp cluster farming through framework guidelines, the introduction of group certifications, and the responsible use of common property resources, to increase international market access for shrimp and prawn products originating from small-scale farmers in Bangladesh; and

– to support and introduce GAP, in order to reduce the risks of diseases in shrimp/prawn aquaculture, and a national code of conduct for responsible aquaculture.

2.5.2 Second Policy Workshop:

Second Policy Workshop on Clustering of small scale fish/shrimp farmers, opportunities for improving market linkage and access to credit was held in PKSF Bhaban on 05 May 2015, organized by Shrimp and Fish Foundation (BSFF) and Palli Karma-Sahayak Foundation (PKSF) in collaboration with FAO and DoF. The workshop was attended by various government and non-Government agencies, research organizations, exporters, hatchery owner, academicians, UN partners etc.

Major Decisions:

- Importance of introducing Agricultural subsidy of Government to aquaculture sector especially for quality fish seed and quality fish feed purpose was highlighted as it does not get any special support from the Government, although, aquaculture is a major sub-sector of agriculture;
- Timely and easy access to credit facilities will be important to ensure optimum aquaculture production, especially in stocking time.
- Timely and availability of virus-free PLs at the cluster/farmers' level is utmost important and needs to be ensured;
- A functional and effective value chain model needed to be developed;
- All stakeholders namely cluster members, processors, depot owners to be trained on a regular basis on quality and safety of their product;
- Introduction of micro-insurance for shrimp and prawn farmers to empower them to absorb the disaster shocks.
- Continuation of existing intensive monitoring of the clusters would be needed to ensure sustainability;

2.5.3 Consultation meetings at STDF command area

As part of regular monitoring, a consultation workshop was held in Khulna on 23 May 2015, with the participation of DoF, FAO, PKSF, WF, BSFF, processors, Non-governmental Organizations (NGO), cluster farmers representatives, collection center representatives, etc. The salient features of the session were as follows:

- developing an effective supply chain multiple layer of middlemen, as well as backward and forward linkage with relevant stakeholders, which will ease market access;
- providing and facilitating credit support to cluster farmers, for purchasing inputs such as PL, feed, etc; ensuring the quality of post-harvest shrimp at supply level;
- supplying quality ice to maintain hygiene and food safety;
- upscaling the project activities, and covering a wider geographical area; and
- providing more technical and training support to the farmers.

2.6 Stakeholders workshop

The workshop held on 20 August 2015 was attended by participants from FAO, DoF, research institutions, the shrimp industry, fish feed suppliers and depot owners, Palli Karma-Sahayak Foundation (PKSF), the Business Promotion Council (BPC) under the Ministry of Commerce, former Secretaries of the Health and Agriculture Ministry, BFFEA, the Bangladesh Aquaculture Alliance (BAA), representatives of BSFF, WF, Solidaridad Asia Network, FAO, and some beneficiaries from small-scale shrimp and prawn farms of Khulna/Bagherhat/Satkhira areas.

2.6.1 Findings and recommendations of the workshop

- Replicate/adapt cluster-based STDF model in potential shrimp/prawn and fish farming areas, further in-depth study including cluster dynamics should be undertaken;
- produce safe and quality aqua food, more emphasis on the implementation of BMP/GAP, including appropriate biosecurity measures;
- organize clusters into federation/cooperative/association, enabling them to access credit; procure quality inputs (PCR-tested PL, quality feeds, etc.); maintain biosecurity, and ensure compliance with required standards;
- introduce product certification system, and exporters should make necessary efforts to brand their products in the international market;
- increase motivational activity among clusters' members to fulfil the basic needs of shrimp farming, such as increasing adequate depth, nursery operations, introducing GAP/Good Hygienic Practices (GHP), etc.;

- review the existing cluster dynamics for developing an appropriate model for contract farming, addressing the present situation, problems and challenges, and way forward;
- easy access to microfinance support should be ensured and institutionalized, especially during the time of pond/gher preparation, and stocking;
- undertake necessary studies for ensuring the sustainability of the project outcomes, including the effects of the use of pesticides, and other agrochemicals in paddy-cum-fish/shrimp culture in cluster farms; and
- share the sectoral knowledge with financial institutions, to enable them to extend necessary financial support.

Major decisions

- A functional and effective value chain model needed to be developed, encompassing all stages, from seed to consumption;
- all stakeholders, namely processors, depot owners and farmers needed to be trained on quality and food safety issues;
- the importance of the introduction of microinsurance for shrimp and prawn farmers to empower them to absorb disaster shocks; and
- it was observed that strengthening the intensive monitoring of the existing cluster farming groups would be needed to ensure GAP.

2.7 Reviewing the cluster approach and market chain development

The EF held meetings with all 40 STDF cluster leaders and their members. Through discussion, they checked the organization and activities of clusters in the following six topics: i) institution; ii) stocking; iii) fees/inputs; iv) training and extension services; v) marketing; and vi) finance. Each topic had five criteria, and one point was allocated per criteria. Thus, there was a maximum of five points per topic, and an overall score of 30.

The result showed an overall score of clusters ranging between 14 and 20, and an average of 18 points, out of a maximum of 30 points. The institutional arrangements of all clusters were at the same level, and the next step would be to formalize the clusters into legal entities. Training and extension capacities were well developed among all clusters. The capacities related to stocking practices of PL varied significantly. Three clusters scored two points; they had not identified reputable hatcheries for their stocking, and did not use PCR-tested PL. On the other hand, two clusters scored five points by achieving 100 percent use of PCR-tested PL for every stocking they conducted during 2014.

2.8 Cluster performance review criteria and results

A second review of the STDF clusters was subsequently conducted, to assess the status and their activities, following the same format that was used previously, in August 2015. Thus, the same methodology was applied through STDF EF to 40 STDF cluster leaders, whereby the capacities for cluster organization and activities were assessed under the six above-mentioned topics.

Table 2: The criteria for assessing activities of shrimp and prawn cluster

Topic	**Criteria**
1. Institution	1) Cluster members are all registered under DoF
	2) Cluster is formed, committee are elected, and regular meetings in place
	3) Cluster is maintaining a visitor book and a resolution book
	4) Cluster is registered as legal entity to Dep.Cooperative/ Dep. Social Welfare
	5) Cluster establishes its own office facilities
2. Stocking	1) Implementing crop calendar that has been developed by the cluster
	2) Frequency of stocking is less than four times for all members
	3) Identified list of reputable dealers/hatcheries for high quality PL
	4) Stocking PCR-tested PL (but not all farmers are practising every stocking)
	5) Stocking PCR-tested PL for all members for every stocking
3. Feed/inputs	1) Members are all trained for feed management
	2) Members are sharing information about good quality feed (other inputs)
	3) Cluster makes own farm-made feeds
	4) Cluster purchases bulk of formulated feeds (other inputs) and distributes them among members

Topic	Criteria
	5) Cluster establishes and operates its own feed mills
4. Training and extension service	1) Members are sharing farming knowledge with each other
	2) Members are sharing farming knowledge with farmers outside the cluster
	3) Cluster has a lead member who has good knowledge on farming, and is able to use water quality monitoring equipment
	4) Cluster has protocol for handling acute problems, such as disease outbreak, and has (external) contact for further assistance
	5) Cluster employ technical support team that provides services to the members
5. Marketing	1) Members are sharing sales/price of products with each other
	2) Members are jointly selling products to a selected depot/wholesale
	3) Cluster is obtaining fair sales/payments
	4) Cluster is obtaining premium price
	5) Cluster coordinates harvests, and participates in a premium supply chain
6. Finance	1) Number of members relying on local credit systems is less than 50%
	2) Number of member relying on local credit systems is less than 10%
	3) Cluster members are jointly negotiating to access a better credit scheme
	4) Cluster has established and operates its own saving system for members
	5) Cluster saving/credit system is well established, and non of the members rely on an external credit system

The results showed that the total average score of clusters increased from 18 points in August 2015 to 24 points in April 2016 (see Figure 1 below), indicating improved capacities of the clusters during the following eight months. The results were also presented by topics (see Figure 2 below), and the key improvements are summarized below.

The capacities related to the stocking practices of PL improved significantly, whereby all members of 11 clusters stocked PCR-tested PL for all the multiple stockings, while none of the clusters had achieved this during the last assessment period.

For feed and other farm inputs, most of the clusters coordinated the purchase of the feed (39 of 40 clusters), and four clusters were formulating their own feeds.

All clusters were marketing/selling their products in a coordinated manner to local buyers/collection points (previously only 28 of 40 clusters).

Fig. 1: The performance score of 40 STDF clusters in August 2015 (blue) and in April 2016 (red)

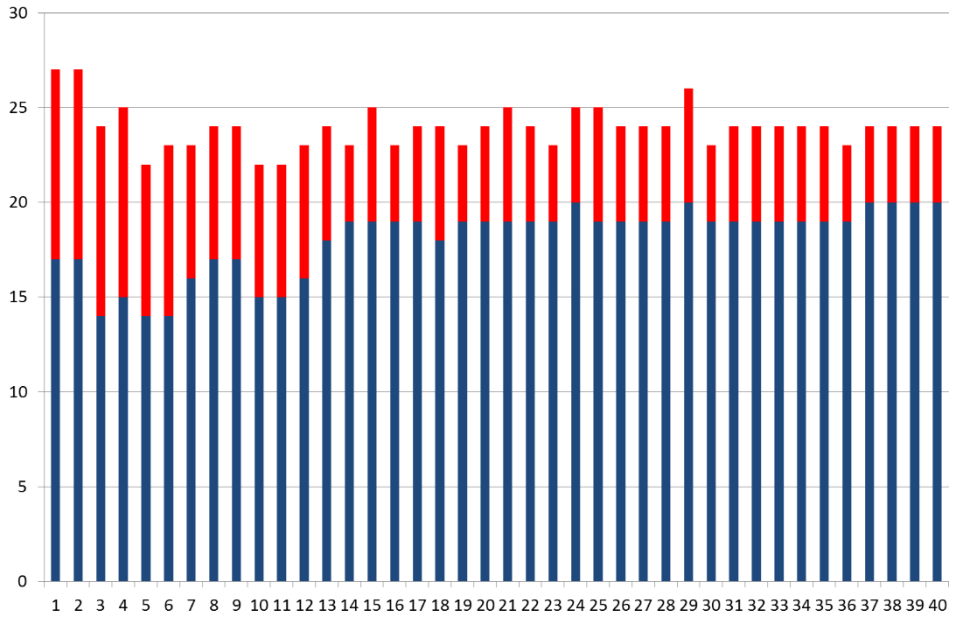
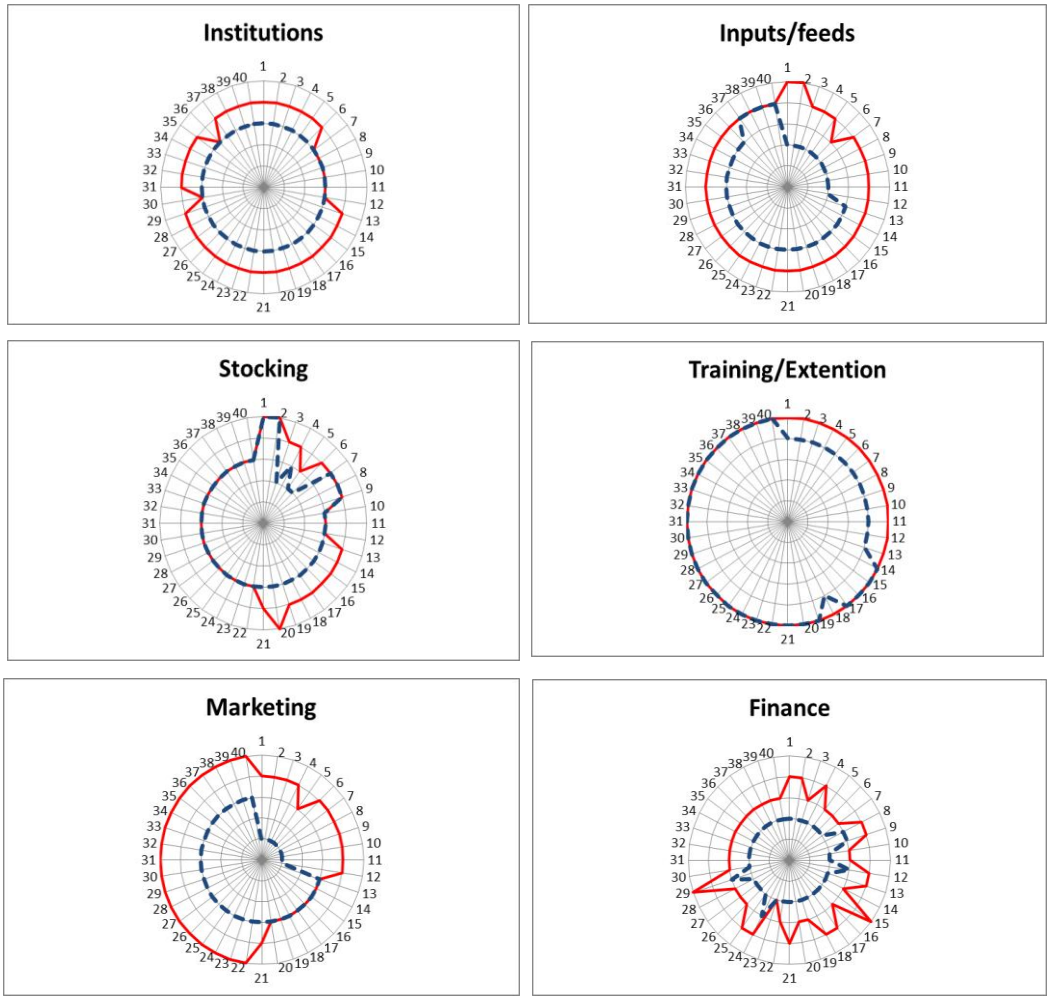


Fig. 2: The performance score of 40 STDF clusters for six topics (institution, stocking, inputs/feeds, training/extension, marketing, and finance) in August 2015 (blue line) and in April 2016 (red line)



2.9 Strengthening the cluster activities that resulted in economic benefits

There were a number of clusters that developed good organizational skills, and established several coherent activities that lead to economic benefits (e.g. bulk purchase of feeds/inputs, the development of a saving system, etc.). These benefits were important factors for the sustainability of clusters, and the basis for expanding their activities to more advanced stages, such as organizing harvests, and marketing the products.

Although the average production at the farm level increased by more than 500 kg/ha/year, their farming practices were based on multiple stockings and harvests. Shrimp harvests were spread over a few days before and after full moon and new moon, from July to September. Therefore, the coordination of harvests among cluster members, and across the different clusters in the vicinity, needed to reach the minimum volume for a processing plant to engage directly, and send refrigerated trucks (i.e. size ranges of capacities of three, seven, ten tonnes).

2.10 Market access

Currently, the products of project farms were sold to local traders and/or collection points. The quality of the products were good, as a result of their extensive culture system. In addition to the increased quality of production, the farmers achieved lower disease prevalence, and hence lower risk of food safety incidents. The test result analysis of products (residuals for antimicrobials, pesticides and heavy metals) from randomly selected samples of the clusters were negative, indicating that the project was successful as a result of following all the compliances (i.e. improving food safety through capacity development at the farm level). However, interventions for improving market access for the country's shrimp and prawn sector could be conducted in i) value chain improvement; and ii) engaging international buyers.

2.11 Other activities

Cluster level demonstration pond

EF in association with upazila teams selected 40 demonstration farmers at different clusters. The prime objective of the demonstration ghers and farmers was to create direct learning opportunities for the clusters and neighbouring farmers.

Farmers' Savings

Five clusters set up their own cluster saving account to support their cash flow of the farm operations. The majority of clusters affirmed that access to a sound finance institution was an important issue, and they were interested in setting up their own cluster savings account, or seeking institutions that offered better interest rates than those they were currently using.

Atshatabigha women's cluster, Debhata, Satkhira had a savings amount of BDT 76 000; and Baradanga Cluster, Dumuria had a savings amount of BDT 200 000 at the end of the project. They are providing credit support to the cluster farmers for purchasing inputs.

Institutional shape

DoF will assist the farmers to obtain their registration from the Social Welfare Department, the Government of Bangladesh. All STDF farmers were given a unique registration number from DoF, and an ID card from the project.

Shrimp Farming through the cluster approach

The following activities ensured a smooth cluster operation to achieve the goal and objectives of the project: i) motivating the farmers to form clusters; ii) developing farm surveys and identification; iii) implementing cluster operations; iv) creating an enabling environment for establishing traceability; v) establishing an internal control system; and vi) creating a cluster certification system.

Use of water testing kits

For the smooth implementation of BMP/GAP, the project distributed some minor water testing kits, such as a refractometer, water pH and dissolved oxygen (DO) kits, and thermometers to the Upazila Fisheries Office and eight EF, enabling them to efficiently check and monitor water quality parameters.

3. Output 3: BMP for reducing the risks of diseases in shrimp and prawn aquaculture are developed

3.1 BMP

BMP/GAP for reducing the risks of diseases in shrimp and prawn aquaculture were developed for the project, which complemented the FAO aquaculture certification guidelines, the FAO Code of Conduct for Responsible Fisheries (CCRF), and the Bangladesh National

Code of Conduct on Responsible Aquaculture. Farmers' active participation; and their subsequent implementation led to a successful production cycle. As a result of the BMP, 82 percent of farmers did not use any pesticides or banned chemicals, and 28 percent of the farmers followed Integrated Pest Management (IPM). Ninety eight percent farmers used the nursery to raise PL up to juvenile; and 51 percent of farmers renovated/constructed permanent earthen nurseries.

3.2 Source PCR-tested PL for the cluster farmers

Owing to the scarcity of rain, and unavailability of water, the stocking of PCR-tested PL was sometimes late. Cluster farmers were communicated with, and were well motivated to stock the PCR-tested or Specific Pathogen Free (SPF) PL in their respective ghers. The project took the initiative to supply PCR-tested PL at the market price of quality non-PCR PL. After the field activities were implemented, and experience had been acquired, it was decided by FAO, WF and DoF that the cluster farmers would be provided with an incentive, through WF, for their purchased PCR-tested PL, at the rate of BDT 30 per 1 000 PCR-tested PL.

Source of PCR-tested PL for the cluster farmers

The farmers were motivated to stock PCR-tested PL in their ghers. The project helped to link farmers with a supply line of PCR-tested PL. Seventy percent of the farmers used PCR-tested seeds, and also reduced stocking density by 33 percent.

3.3 Training activities

The concerned DFOs, SUFO, and technical experts held two hands-on training courses on post-harvest handling for shrimp and prawn value chain members in Debhata and Dumuria on 7 March and 2 April 2015, respectively. The team advised the cluster leaders and depot owners on how to: i) maintain temperatures; ii) avoid spoilage during the post-harvest period; and iii) protect prawn and shrimp from bacterial contamination.

An international BMP/GAP expert acted as resource person at the cluster-level training activities, and contributed to developing a BMP/GAP training manual for the cluster farmers, on the basis of the CCRF, as well as through visits with the STDF clusters, and meetings with the implementers and counterparts.

An international cluster management and market linkage specialist strengthened cluster management in order to implement GAP, Internal Control System ([ICS] a mechanism for

local control bodies, which checks and documents members' farming activities), and market access.

During the project the cluster management and market linkage specialist carried out five missions, as follows: i) assistance to the inception workshop in January 2013; ii) recruitment of the project manager, and setting up the criteria for the selection of beneficiaries in August 2013; iii) conducting BMP/GAP and cluster approach training sessions in April 2014; iv) strengthening the cluster approach, and market linkages in August 2015; and v) conducting ICS training courses and market linkages in April 2016. More specifically, two training courses on ICS were provided for all STDF cluster leaders and DoF district officers. The practical steps to developing ICS for shrimp and prawn clusters in Bangladesh were included in the report that was produced by the specialist.

3.4 GAP

Regarding GAP implementation following the crop calendar, a cluster specific production cycle plan was done, with the active participation of the cluster members. The upazila team, with all the project implementation team helped to ensure that the planned activities were carried out. Gher preparation, including a nursery, and a plan for the demand for the required inputs was done in the monthly cluster meeting. Respective cluster leaders played a key role to implementing the planned activities.

In order to develop the awareness and capacity building of the stakeholders, a poster on the GAP supply chain was printed out and distributed among them, to be put up in important public places. In addition, a GAP manual on shrimp farming through the cluster approach, which was a joint effort of DoF, FAO, WF and BSFF, was distributed to the cluster members.

3.5 Performance assessment (2014-2015)

A performance assessment for the years 2014 and 2015 was completed, as per the activity plan. The major objectives of the performance assessment were to assess GAP compliance, the production cycle, and the cluster operation. The report contained an analysis and assessment of the performance of the adoption of BMP at farm level by the farmers supported by the STDF project.

The broader objective of the study was to assess the performance of the project implemented by WF in achieving the wider goal and objectives of the project. The specific objectives were to: i) determine the level of adoption of BMP in shrimp farming by the project supported farmers; ii) assess the benefits gained by the farmers through the adoption of BMP;

and iii) assess how the cluster approach implemented by the project contributed to adopting BMP by the farmers, and fostering benefits for them.

The performance was assessed by determining the changes in the target indicators, as a result of the project interventions, through straightforward comparison between pre and post-intervention situations and practices. Three broader indicators, with 14 specific subindicators, were taken for assessment. The data were collected from 400 sample farmers out of 1 000 project farmers. The baseline data was collected in 2013. The findings of the study and achievements are presented below.

Shrimp farmers adopted BMP in shrimp farming by changing practice and operations

- 98 percent of farmers nursed PL in nursery before stocking, of which 51 percent prepared permanent earthen nurseries;
- 72 percent of farmers increased gher water depth;
- 70 percent of farmers used PCR-tested and SPF shrimp PL, and bagda stocking density was reduced by 33 percent as a result;
- >95 percent farmers in Khulna and Bagerhat used commercial feed, which helped them to stop feeding snail meat;
- 87 percent of farmers used plastic containers, of which 21 percent used plastic drums. All farmers sold their shrimp in < 45 minutes (time at farm + transport), many farmers sold the live shrimp to depots/auction market. Therefore, farmers did not use chill water or ice for processing;
- 82 percent of farmers of did not use any pesticides or banned chemicals, 28 percent of farmers followed IPM for rice and vegetable pest/disease management; and
- 97 percent of farmers regularly kept records of inputs and activities in the record books supplied by the project.

Shrimp farmers gained benefits from the adoption of BMP

- The total bagda and golda yield (610 kg/ha) increased twofold (210 percent), the fish yield remained the same;
- individual household total bagda and golda production in 2015 (342 kg/ha) increased twofold (199 percent) from baseline (172 kg/ha);
- household consumption of fish remained the same;

- seed cost was reduced by 37 percent, which helped to keep the total cost almost at the same baseline, although the other costs increased by 102 percent; and
- no farmers reported disease outbreaks in their ponds, while 54 percent of farmers had a disease outbreak in baseline.

The cluster approach contributed to the adoption of BMP by the farmers

- All 1 000 participating farmers were organized into 40 clusters;
- 85 percent of farmers synchronized water management (supply and draining);
- 70 percent of farmers collectively purchased inputs (PL, feed and lime), thus reducing costs;
- 62 percent of farmers perceived that they were benefited by collectively purchasing inputs;
- 29 percent of farmers perceived that the cluster approach enhanced their learning process, through training together, and sharing after the training;
- a system and discipline in farming was established by enhancing farmers' meetings, introducing record-keeping, decision-making, information sharing, collective crop planning, collective sourcing of inputs, and collective marketing of products.

Overall, it can be concluded that the project achieved its targets and objectives. However, the project worked with only 1 000 farmers in 40 clusters, while there are about 200 000 shrimp farmers in the southwestern coastal zone. In order to achieve impact at scale, this model needs to be extended to wider areas, to cover more farmers.

3.6 Gher yield

The other main objective of the introduction and promotion of BMP at farm level was to increase the productivity of the shrimp ghers. As a result of the adoption of BMP at different scales, in general, gher productivity (biomass) increased significantly. The total yield of two targeted gher commodities, bagda and golda (610 kg/ha) in 2015, increased more than twofold (210 percent), compared to the baseline yield (224 kg/ha). The contribution of bagda in the total yield was much higher (63 percent) than that of the golda (37 percent). The bagda yield increased to almost double (198 percent) from the baseline, while the golda yield increased to more than double (236 percent) from the baseline. However, there was no notable change in fish yield compared to the baseline (see Table 2 below).

Table 3: Bagda, golda and fish yield

Shrimp-prawn –fish yield (kg/ha)	**2015 District wise details yield (kg per ha)**			**All project area yield (kg per ha)**		
	Bagerhat	Khulna	Satkhira	2015	2014	2013 (Baseline)
Shrimp and prawn						
Bagda sold	269	81	544	385	355	193
Bagda consumed	11	1	0	1	4	2
Total bagda	280	82	544	386	359	195
Golda sold	447	576	21	223	162	94
Golda consumed	7	1	0	1	3	1
Total golda	454	577	21	224	165	95
Total bagda and golda	734	659	565	610	524	291
Fish						
Fish sold	543	430	326	379	326.9	357
Fish consumed	61	143	76.5	93.1	100.3	118
Total fish	604	573	402.5	472	427	476

3.7 Input use, cost and profitability

The total cost of shrimp farming BDT 1 45 255/ha remained similar to the baseline (BDT 1 40 381/ha). However, it is important to note that seed costs in 2015 decreased by 37 percent, compared to baseline seed costs. The seed costs at baseline were 71 percent of the total costs, which were reduced to 42 percent in 2015. This was the result of stocking a lower number of seeds, particularly bagda PL, as the farmers stocked PCR-tested and SPF bagda PL, which were believed to result in higher survival rates, i.e. requiring a lower number of PL. On the other hand, the variable costs without seed costs in 2015 increased by 90 percent compared to the baseline, owing to the increase in the cost of inputs (Table 3).

Table 4: Cost of gher farming for STDF supported farmers

Fixed cost items for gher farming	**2015 District wise details fixed costs (BDT/ha)**			**All project area fixed costs (BDT/ha)**		
	Bagerhat	Khulna	Satkhira	2015	2014	2013 (Baseline)
	BDT/ha	BDT/ha	BDT/ha	BDT/ha	BDT/ha	BDT/ha
Fixed costs	27 263	17 363	13 626	16 199	16 026	6 804
Operation and maintenance costs	167 070	83 979	16 696	52 283	39 300	27 535
Seed costs	140 182	70 868	43 788	62 147	69 774	99 388

Labour	29 088	18 606	10 313	14 726	2 001	6 654
Total	363 603	190 816	84 423	145 355	127 101	140 381

3.8 Income and profit from gher for STDF farmers

The total income from ghers in 2015 (BDT 434 539) increased by 70 percent, compared with the baseline in 2013 (BDT 255 736). The increase in yield in 2015 mainly contributed to increasing the income. Although the income amount from bagda and golda in 2015 was similar, the contribution of golda (BDT 117 285) in total income increase (BDT 178 803) was more than double (66 percent) compared with bagda (BDT 55 637 [31 percent]). Income from golda in 2015 increased by 192 percent, compared with 2013. This is because the bagda price (BDT 512/kg) in 2015 decreased by 23 percent from the baseline price in 2013 (BDT 666). On the other hand, the golda price slightly increased from the baseline (Table 4).

Table 5: Income from ghers

	2015 District wise details return (BDT per ha)			**All project area returns (BDT per ha)**		
	Bagerhat	Khulna	Satkhira	2015	2014	2013 (Baseline)
Shrimp and prawn						
Bagda	177 791	40 718	275 062	199 088	232 894	143 451
Golda	366 573	460 627	15 265	178 375	127 429	61 090
Total bagda and golda	544 364	501 344	290 326	377 463	360 324	204 541
All fish (tilapia+whitefish)	90 840	70 735	44 636	57 076	56 100	51 195
Grand total (bagda, golda and fish)	635 204	572 079	334 962	434 539	416 424	255 736

Table 6: Farmers selling price of bagda, golda and fish

	2015 District wise details selling price			**All project area yield**		
	Bagerhat	Khulna	Satkhira	2015	2014	2013 (Baseline)
	BDT per kg	BDT per kg	BDT per kg	BDT per kg	BDT per kg	BDT per kg
Bagda	631	503	504	512	644	666
Golda	811	801	723	798	765	769
Fish	149	129	114	123	131	264

Table 7: Net profit from ghers and cost-benefit in 2015 for STDF-supported farmers

	2015 District wise details profit (BDT per ha)			All project area profit (BDT per ha)		
	Bagerhat	Khulna	Satkhira	2015	2014	2013 (Baseline)
Total return	544 364	501 344	290 326	377 463	360 324	255 736
Total cost	363 603	190 816	84 423	145 355	127 101	140 381
Net profit	180 761	310 528	205 903	232 108	233 223	115 355
Cost-benefit	1: 1.50	1: 2.63	1: 3.44	1: 2.60	1: 2.83	1: 1.82

3.9 Summary of performance assessment

Table 8: Summary of achievements against performance indicators

Broader indicators 1: Shrimp farmers adopted BMP in shrimp farming by changing practice and operations	
Subindicators	**Achievements**
Farmers adopted/adapted PL nurseries	98% farmers nursed PL in nurseries before stocking, of which 51% prepared permanent earthen nurseries
Farmers increased gher water in depth	72% farmers increased gher water depth
Farmers stocked PCR-tested and SPF shrimp PL	70% farmers used PCR-tested and SPF shrimp PL, bagda stocking density was reduced by 33% as a result of using PCR-tested and SPF shrimp PL
Farmers use recommended feed and feeding practices	>95% farmers in Khulna and Bagerhat used commercial feed, which helped them stop feeding snail meat
Farmers followed harvest and post-harvest quality maintenance/recommendations	87% farmers used plastic containers, of which 21% used plastic drums. All farmers sold their shrimp in <45 minutes (time at farm + transport), many farmers sold the shrimp live to depots/auction market. Therefore, farmers did not use chill water or ice for shrimp
Farmers avoided using banned chemicals	82% farmers did not use any pesticides or banned chemicals, 28% farmers follow IMP for rice and vegetable pest/disease management
Farmers kept record of inputs and activities in record books	97% farmers regularly kept records of inputs and activities in project-supplied record books.
Broader indicator 2: Shrimp farmers gained benefits from the adoption of BMP	
Gher yield (bagda, golda and fish) increased	The total bagda and golda yield (610 kg/ha) increased more than twofold (210%), fish yield remained the same.
Household production and consumption increased	Individual household total bagda and golda production in 2015 (342 kg/ha) increased twofold (199%) from baseline (172 kg/ha). Household consumption remained the same.
Income and profitability increased	Seed costs reduced by 37% ,which helped to keep the total cost almost the same as the baseline, although the other costs increased by 102%
Disease incidents/outbreak reduced	No farmer reported disease outbreak, while 54% farmers got disease outbreak in baseline
Broader indicator 3. The cluster approach contributed to the adoption of BMP by the farmers	

Broader indicators 1: Shrimp farmers adopted BMP in shrimp farming by changing practice and operations	
All farmers organized in clusters	All 1 000 STDF participating farmers were organized in 40 clusters
Farmers synchronized their management, input purchase and marking of products	85% farmers synchronized water management (supply and draining) 70% cases farmers collectively purchased inputs (PL, feed and lime) 62% farmers perceived that they benefited from collectively purchasing inputs Synchronized marking under the cluster approach did not work
The approach enhanced farmer's learning and knowledge sharing	29% farmers perceived that the cluster approach enhanced their learning process through training together and sharing
	Enhanced farmers' meetings, record-keeping, decision-making, information sharing, collective crop planning, collective sourcing of inputs, collective marketing of products

Reference: Performance Assessment Report, 2014-2015

4. Output 4: A web-based traceability system is developed and operationalized

Farmers registration was completed with the assistance of DoF and FAO coding of clusters, and collection centres, and farmers' ID was completed and distributed to the cluster farmers. Every STDF cluster farmer was registered, and received an individual registration number. In addition, for easy identification the project supplied a separate ID number for every cluster member.

- A database including basic farming information of all cluster farmers was prepared;
- Farmers' ID cards and record books were prepared and distributed to individual cluster members, and are now in operation. These are the prerequisite for the preparation and establishment of an e-traceability system facilitating international market access; and
- a compliance testing and monitoring plan was prepared, which included testing the residues of antibiotics, pesticides and heavy metals periodically in farmed shrimp products in the project locations, and taking measures accordingly.

During the value chain analysis it was observed that this was a short-term project, and that it might not have been possible to establish a web-based (e-traceability) system with the limited resources and short project life cycle. However, it could work jointly with other GAP implementing projects, such as the Aquaculture for Income and Nutrition project, and the Solidaridad Network Asia assisted Sustainable Agriculture, Food Security and Linkages (SaFaL) project.

In spite of the challenges and issues that were encountered during this output, the project made efforts to develop a web-based (e-traceability system) through the following :

- farmers baseline data was prepared;
- DoF issued farmers ID cards, and registered all cluster farmers;
- every cluster received a different ID number;
- a clusters map had already been developed, including Global Positioning System (GPS) data, which could be used for developing the web-based system at the cluster level;
- in order to keep records and data, 2 100 record books were reprinted and distributed to the cluster farmers;
- a web-based traceability mission was carried out by a consultant hired by FAO, in order to study, establish, and recommend a web-based traceability system. This was carried out in two phases, on 12 August 2015, and from 28 April 2016 to 4 May 2016 in different STDF working areas; and the consultant met with potential stakeholders, such as cluster farmers, collection centres, DoF officials, processors, buyers, BFFEA representatives etc.;
- cluster farmers electronic database and baseline report: an electronic database (production and products data) was developed for the year of 2014, by using the pond record book. Record books for the year of 2015 were collected, and an electronic database was developed

Baseline Report

A farmers primary database was completed, and a baseline report (December 2014) was prepared. The baseline survey was conducted to trace out the socio-economic conditions of the rural shrimp/prawn farmers with firm practices and profitability aspects, as well as their practical conditions, and other related and important issues.

A total of 298 farmers were selected randomly, and a direct questionnaire method was followed. It was found that the majority (82 percent) of male dominant households had an education level of high school grade (80 percent), and the average family member was found to be 5.08 among the samples. The average farm size was 228.95 decimal (i.e. 0.229 ha). Landowners with under 50 decimal of land were only 11 percent of the sample farmers; most of them owned medium-sized land, of 101 to 300 decimal.

New farmers were very few (two percent with experience of less than two years), most of them had ten years of experience, although they had not had any formal training (96 percent). The average depth of the ghers was three feet, which was an average of the whole year. The farm soil type was mostly loamy (76 percent), which was suitable for shrimp production. Only 22 percent of the sample farmers used agrochemicals for their fish/prawn/shrimp farms. The majority of them did not keep records, or use any formal credit to operate the farms.

Nurseries were a very important part of shrimp production. The farmers normally used earthen nurseries for their ghers, and preferred the application of lime and fertilizer in order to increase production. They did not like using feed, auto polish, bleaching, yeast or rice bran, and rarely utilized medicines, as disease was not regular in those districts. The marketing system was good, as they managed to sell their harvest very quickly, generally in cash, within one hour of harvesting. Although they complained about local intermediaries dealing with grade weight and pricing, they made good profits from the ghers. The average investment per ha was estimated at BDT 77 246.65, and the return was estimated at BDT 296 413.50. All three district farmers showed positive and good returns from their investment.

5. Output 5: Clusters of small-scale farmers have the skills and knowledge to apply BMP/GAP

In addition to several of the capacity building activities described under Output 1 and 2, local exposure trips for cluster leaders (two from every cluster) were organized, with the objectives of the sharing and learning of knowledge of farming and cluster management systems. Two cluster farmers' leaders from every cluster visited the clusters and potential clusters, and, where available, they also visited Closed System Technology ghers.

6. Output 6: Project results and lessons learned are disseminated at national and regional level

- Two national workshops on policy were conducted, involving all project partners.
- A proposal for upscaling cluster management in small-scale shrimp and prawn farming in Bangladesh was produced.
- A final project review by the Government, FAO and STDF was carried out at the end of June 2016.

D. IMPLEMENTATION OF WORK PLAN AND BUDGET

Work plan and budget

The implementation of project activities was delayed during the initial stages of the project, because of law and order issues in the country, and prolonged *hartals* (strikes). A no-cost extension was implemented in order to complete project activities.

All activities were implemented within the planned budget. However, a minor internal adjustment was made to the budget, to ensure that all intensive field level activities were carried out within the project time frame.

Risk Management

In 2014, as a result of changes in the weather and high temperatures in the region, giving rise to drought, several district-level and FAO meetings were held on a regular basis, to discuss necessary precautions.

In addition, in Townghona cluster, cases of stolen shrimps were recorded. The cluster members called for meetings, and resolved the issue by taking turns in groups to guard their resources/ponds. The wrongdoer was punished accordingly by the village council

E. SUSTAINABILITY

a. *Capacity development*

Under the capacity-development activities of the project, all the EF received ToT training. The creation of a database for the project, including baseline data collection and analysis; the registration of farms, and the distribution of ID cards (with barcode) for cluster members; the organization of inception training, GAP module-based training activities, training on food safety, HACCP for cluster leaders, refresher training, and exchange visits made a very effective contribution to the capacity development of the farmers. In addition, the EF, in association with the upazila teams, selected demonstration farmers from different cluster levels, who created learning opportunities for the clusters, as well as for the nearby community farmers.

b. Gender equality

The women in the beneficiaries' families benefited from better clothing, access to nutritious food, and improved child nutrition and education; and are now more involved in the family decision-making.

c. Environmental sustainability

The project adopted improved extension methods, and used no artificial processes or harmful chemicals; and all the guidelines complied with international standards of shrimp farming.

d. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

The project adopted a non-discriminatory approach, whereby all men and women had access to all the support. No child labour was appointed; and the project enhanced the opportunity for farmers to become self-employed, and to redeploy the future generation for shrimp farming.

e. Technological sustainability

BMP/GAP proved to be very effective for the cluster farmers, as it helped them increase their production by reducing stocking density and costs. Farmers are now capable of testing soil, water pH, and salinity by themselves; as well as using PCR-tested and SPF shrimp PL, and nursing PL in the nursery before stocking, leading to a reduction in shrimp disease rates.

f. Economic sustainability

The project provided technical support to trainers and farmers through intensive training sessions, and the regular monitoring of project activities. No additional financial resources were allocated to the project. The project facilitated hands-on training to the farmers, and regular technical backstopping and exposure trips increased production and economic efficiency.

F. LESSONS LEARNED

LESSONS LEARNED– elements of success

- STDF cluster farmers were highly motivated to form clusters, and to cultivate prawn and shrimp following GAP.

- Farmers were provided with need-based training on a regular basis. As a result, they were more efficient in managing their ponds/ghers, nursery preparation, and stocking PCR-tested PL.
- Almost all farmers increased their pond/gher depth (some portion of the pond/gher) up to 1.0-1.5 metres; almost all farmers established a PL nursery in their ponds/ghers, or in nearby small ponds, and continue to obtain good results.
- It is evident that production per ha increased 50 percent–200 percent, in comparison with the baseline production data in 2013.
- Farming patterns and biosecurity measures adopted by the cluster members were in compliance with GAP modalities.
- Farmers are now better organized, and are practicing group purchase, group harvesting, and group sale, which is cost-effective and very useful.
- The enthusiasm and appreciation of the project approach was evident among the project farmers and neighbouring farmers.
- There was a significant increase in the crop success rate, which led to business sustainability and better livelihoods.
- The coordination among the relevant stakeholders, particularly FAO and DoF operations and implementation, was excellent.
- Cluster farmers were enthusiastic to welcome the cluster farming methodology, as per the suggested supply chain (physicochemical parameter testing, use of quality seed and feed, etc.).
- Collection centres hold a critical role for the establishment of simplified supply chains, as suggested by the project. Shrimp collection centres were well motivated to maintain standard business ethics (right weight, cash prices, better product quality, etc.), and they now believe that if there is positive competition among them, these good practices will enable them to earn more, with better premiums/competitive prices.
- It is necessary to differentiate the products: create a shrimp brand for quality producers.
- Develop an efficient market channel from producer to consumer level.
- Cooperation among the stakeholders was strengthened and improved; DoF took proactive action whenever intervention or support was required.

- Indications showed that several farmers started to produce a higher quantity of shrimps in STDF regions, in addition to improving the quality by practising the suggested BMP/GAP guidelines.
- Some of the cluster farmers now act as trainers, and trained the neighbouring farmers, as well as local extension agents for fisheries from other districts.

LESSONS LEARNED – impediments/constraints

- The actual costs during implementation were higher than those estimated during the formulation period, which brought additional challenges during the project.
- There was a limited price difference in international markets (with existing buyers) for the better quality traceable products.
- The total number of small-scale beneficiary farmers in the process (1 000 cluster farmers) produced 360 tonnes throughout the year, which could be difficult for sustaining several processing industries establishing separate production lines.
- There was an expectation that the prices of premium quality products would provide at least a minimal incentive for the farmers and collection centre operators, but it did not happened. Regular motivational intervention may bring change in the traditional pricing system;
- Some farmers need cash capital during gher preparation, and the PL stocking season.
- Scarcity of water at the proper time was a regular issue, and nearby water sources, mainly canals, need to be excavated.
- The farmers are producing good quality products, but they only obtain the normal market price, not premium prices for their products, because of the lack of a dedicated market channel.

G. FOLLOW-UP ACTIONS

Steps for the development of Internal Control System (ICS)

Group certification, and an associated concept of ICS will enable clusters to access better market arrangements, such as participating in contract farming, or a premium supply chain. Group certification is a system that allows small-scale producers to comply with a selected certification scheme as a single entity, and is widely used in the organic certification of agriculture products worldwide, and an increasing number of schemes is used for

aquaculture products. In Bangladesh, the WAB Trading International organic shrimp business is a working model of group certification.

The basic requirements for group certification are: i) compliance to standards through the implementation of BMP/GAP; ii) documentation and traceability; and iii) functional ICS in place. The International Federation of Organic Agriculture Movements (IFOAM) defines ICS as "the part of a documented quality assurance system that allows an external certification body to delegate the periodic inspection of individual group members to an identified body or unit within the certified operator. This means that the third party certification bodies only have to inspect the well functioning of the system, as well as perform a few spot check re-inspections of individual smallholders". In short, ICS is a local control body that checks and documents members' farming activities. It provides information and guarantees to a certifier (or a buyer) on how members are producing products, without checking all farms. It will not only increase the organizational capacity of clusters to control their production (e.g. volume, biosecurity), but will also reduce inspection (or certification) costs, while attracting buyers who are more quality conscious. ICS is feasible when farmer clusters are well organized. For this reason, it is advised that funds be sought to provide support and training courses for this purpose. ICS can be sustainable when there is: i) a good organization of farmers; ii) common objectives; and iii) transparency in the relationship between cluster and certifier (or buyer).

Structure and operation

The structure and operation of ICS depend on the requirements of certification schemes (or buyers) that farmer groups are intending to comply with (see diagram on following page). These guidelines for ICS aim to provide common elements that are useful for seeking certification, and contribute towards building a common foundation. They are divided into three steps; preparation, organizational context, and internal monitoring/auditing process.

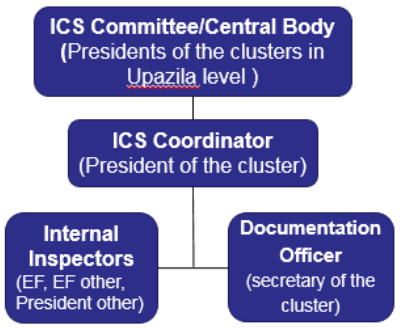
Step 1: Preparation: discussion and agreement amongst cluster members

The first step is to create awareness among cluster members, and to decide together to adopt a specific production system defined by a selected certification scheme's standards or buyer requirements.

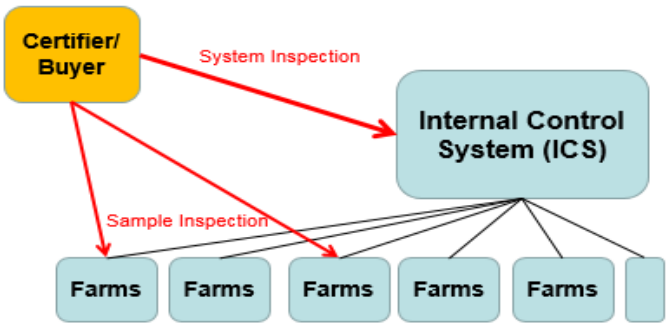
- Objectives: i) benefits of adopting group certification and ICS; and ii) descriptions of targeted markets and buyers;
- Goals: i) ensure compliance; and ii) continual improvements;
- Scope: i) definition of producer group and criteria; and ii) product scope, so that the group is homogenous;
- Resources: technical and financial resources.

Step 2: Development of ICS: Setting up organizational context

ICS is ideally operated by an independent body to ensure robust operation, without conflict of interests. However, when buyers and certification schemes have not yet been selected, ICS central body could be initially formed by the selected members from STDF cluster leaders, and the project's field assistants, to improve the capacities of STDF clusters, and develop foundations.



Each farmer needs to sign a contract with the central body to declare their commitment to follow the specific internal rule and regulations of the project. The central body maintains files and records of all producers, and inspects each member at least once a year.



The STDF's field assistants can serve as internal inspectors to inspect the farms, and swap inspection areas among other field assistants, to be more objective. Additional inspections, announced or unannounced, can be conducted. The central body decides procedures for non-compliances, and holds the right to decide whether a specific farm can be included for market access activities or not (e.g. non-compliant farmers can be removed from market access activities of ICS, but can continue to participate in other cluster activities).

In this context, the external certifier or buyer inspects only: i) the status and operation of ICS; and ii) a small number of randomly selected farms.

Table 9: The structure of ICS and its duties and responsibilities

Title	**Person**	**Duties and responsibilities**
ICS committee (Central body)	Presidents of the clusters (e.g. district level committee)	Manage the overall operation: – Overall responsibility of ICS; – Regular meetings; – Identification of buyers and certification schemes; – Coordination with internal inspectors; – Issue sanction notices regarding non-compliance; – Review productions, and recommend modification for improvements.
ICS coordinator	President of the cluster (seeking certification)	Support members of the cluster to ensure: – the culture operations are conducted as per the agreed farm practices outlined by the Standard Operating Procedure ([SOP] i.e. SOP is the checklist of key selected GAP/BMP); – All inputs documented on a daily basis; – There are no social issues related to farming; – Cooperation is maintained among and between the members of the clusters.
Internal inspectors	A team comprises four persons; 1) president of cluster, 2) farmers of the cluster, 3) internal inspector of another cluster, and 4) field facilitators of STDF.	Verifying the documentations and compliance: – Details of farms and farmers; – Seed stocking details (source, test reports, PL number and density); – Feed and feeding (ration, frequency, type); – Inputs (usage of chemicals, probiotics etc.); – SOP.
Documentation Officer	Secretary of the cluster	Reports to the President of the cluster: – Collect and archive pond record books from all members (minimum three years retention); – Maintain traceability records; – Maintain key documentations (SOP, GAP/BMP manuals, copy of certification standards, buyer requirements); – Present all the documentation to the ICS Committee, Programme Manager, Inspection team and the External Auditing, as per requirement.

Step 3: Operationalization: Initiate internal inspection/auditing process

The main purpose of the audit is to ascertain: i) the level of compliance of the operations to that of the standards of the certification programme (buyer requirements); and ii) whether the operating procedures have proven feasible, and produce the expected results. After the audit inspection has been done, a summary/inspection report in compliance to standards is

prepared, and forwarded to the ICS Committee. After the internal inspections, it is followed by external auditing conducted by the selected certification schemes and buyers.

Below is the list of documents that should be recorded by clusters, and then checked by internal inspectors:

- farmer declarations for compliance (name, brief summary of ICS, signature);
- map of farm location of all group members (preferably over satellite map, name, size);
- farming records (pond book) with full details on feed, other inputs, and PL;
- sales and purchasing records (item, date, source, destination);
- internal product flow records;
- traceability – financial and product;
- sanctions (rules and list of sanctioned farmers);
- non-conformities;
- corrective actions;
- training, awareness raising and capacity building; and
- an improvement plan.

H. GOVERNMENT ATTENTION

- It is recommended that MoFL-DoF consider upscaling the number of beneficiaries reached during the project, to cover at least 20 000 small-scale farmers, starting from the year 2016-17, increasing the number gradually.
- The cluster approach established by this project should be considered for other ongoing and pipeline projects.
- It is advised that motivational activity be expanded for a large number of shrimp/prawn farmers, highlighting the criteria followed by the STDF project.
- It is recommended that funding be sought, in order to continue with technical support and intense monitoring, until the farmers organizations (clusters) are capable of running their own businesses.
- The value and supply chain should be linked, as a win-win basis for effective and functional supply chain processors and buyers (especially international buyers) involvement is very crucial.

- For the smooth and effective implementation of GAP, more shrimp/prawn farmers should be included in the cluster formation process.
- Establishing a system on cluster-based bulk inputs purchase, and selling the products with a fixed date, will facilitate the development of the purchasing and buying capacity of the cluster farmers.
- It is recommended that the clusters be institutionalized by involving all of the cluster members; and that the completion of registration with the competent authority be facilitated.
- It is advised that microfinance be ensured for the cluster farmers, especially during the stocking period.
- It is recommended that the cluster geographical system be reformed for further scaling up. Namely, instead of a scattered cluster selection, the one floodplain (depressed waterbody) should be considered, which includes all of the adjacent community farmers. It would create the opportunity to be involved with the cluster approach, compliance to GAP, and traceability. The cluster leaders concerned could act as the lead persons in all of the above-mentioned process. They could develop their own collection centres, and collection centre executive committee, and communicate with the potential processors/buyers.

I. HUMAN INTEREST STORY

On 14 June 2016, a joint STDF/FAO mission team, which was implemented in the project command areas of Khulna and Bagerhat districts, participated in the cluster farmers discussion meeting at Matiadanga. The farmers mentioned that they met twice a month to discuss individual activities, as a result of cluster formation. Now they are well organized and highly motivated, and technically very confident, as a result of being provided with repeated training, participating in motivational work, and receiving regular visits from the EF/upazila fisheries team. They are now able to advise their neighbouring farmers, and measure the pH and temperature of both their own, and nearby farmers' ghers. They also informed the visiting mission that their production had increased by more than two to threefold, as a result of the project intervention.

At Chandkhali cluster, the farmers informed the visiting team that they now purchased inputs together, and were obtaining discounts, and enjoying more negotiation power. The

cluster leader told the team that after being included in the project their production increased significantly, and thus their incomes. The farmers also informed the team that before the project intervention they did not know about nursery preparation, how much depth was required for stocking a pond, or where to procure the best quality PL; and even used banned and hazardous chemicals in their ponds. But after the project, they were well informed about proper farming, post-stocking management, and marketing. The farmers also mentioned that before the project they stocked 10-16 times more than now, and the PL survival rate was only 15-30 percent, while the survival rate had now increased by 80-90 percent. The cluster leader of Chandkhali, Mr Abu Bakkar Siddique, also mentioned that previously they could not purchase one kg of mango at the cost of only BDT 30 kg, but that now they had the capacity to purchase better quality mango at BDT 60-70 kg. They were also able to provide better food and clothes for their family members.

Appendix 1

LOGFRAME MATRIX - ACHIEVEMENT OF INDICATORS

Results chain	Indicators				If not achieved, explain why	If applicable/ follow-up action to be taken
	Indicators	**Baseline**	**End target (*expected value at project completion*)**	**Achieved**		
Impact[1]	Increased incomes of small-scale aquaculture farmers and value chain partners, and reduction of poverty in Bangladesh.					
Project Outcome Increased international market access for shrimp and prawn products originating from small-scale farmers in Bangladesh						
Output 1 Implementation plan is finalized and the detail value chain analysis is completed	Inception workshop held.	0	Inception workshop report approved.	100%	N/A	
	Project implementation plan available.	0	Approved and implemented.	100%	N/A	
	Detailed value chain analysis available.	Some secondary materials.	Report approved and used as reference document.	100%	N/A	
Output 2 Small-scale shrimp and prawn farmers are organized into registered clusters	Shrimp farmers identified, clusters formed, rules established, monthly meetings held.	0	1 000 shrimp farmers provided with ID cards with barcode; 40 clusters formed and registered with DoF, cluster rule established; monthly cluster meetings held and recorded.	100%		

[1] The impact level should always reflect the higher programmatic outcome to which the project contributes.
For example, at the country level, this is expressed as the CPF outcome to which the project contributes and can also reflect other elements of impact that are defined at a higher programmatic level (UNDAF/national goal/FAO Strategic Framework).

Results chain	Indicators				If not achieved, explain why	If applicable/ follow-up action to be taken
	Indicators	**Baseline**	**End target (*expected value at project completion*)**	**Achieved**		
Output 3 BMP for reducing the risks of diseases in shrimp and prawn aquaculture are developed	BMP developed, pilot tested, verified and implemented by the farmers with the assistance of field staff and the project team. Trainers have the capacity to conduct BMP training courses. Small-scale farmers receive training in cluster groups. Farmers in clusters are complying with BMP requirements.	0	BMPs developed, tested, verified approved and printed. Farmers trained by the trainers with the assistance of the project team. Trainers have the capacity to conduct the BMP/GAP training. All beneficiaries of the project received training in cluster management. Farmers in clusters are complying with BMP requirements.	100%		
Output 4 A web-based traceability system is developed and operationalized	Traceability system available. Cluster farmer information and data is included in the traceability system.	0	Traceability system developed all indicators and format finalized; DoF and other stakeholders received training. Cluster farmer information and data is included in the traceability system.	80%	To set up and launch the web-based traceability system, an amount of USD 40 000 was needed (hard and software), which was not available.	

Results chain	Indicators				If not achieved, explain why	If applicable/ follow-up action to be taken
	Indicators	**Baseline**	**End target (*expected value at project completion*)**	**Achieved**		
Output 5 Clusters of small-scale farmers have the skills and knowledge to apply BMP/GAP			Relevant DoF officials and value chain partners, farmers have improved capacities, and are contributing to the management of the small-scale farm clusters. All clusters received repeated training, developed their capacity, and became resource persons for neighbouring farms.	100%		
Output 6 Project results and lessons learned are disseminated at national and regional level	Project partners are engaged in policy reviews, discussions, debates and dialogues. Sshrimp/prawn industry personnel involved in evaluation of the project outcome. Draft national strategy for upscaling cluster management is available. Regional workshop held and countries in the region are developing similar programmes. Final project review and report to STDF completed.		Two national workshops at policy conducted, involving all project partners. A proposal for upscaling cluster management in small-scale shrimp and prawn farming in Bangladesh is available. Final project review by the Government, FAO and STDF madeat the end of June 2016.	90%	The project did not have the provisions for overseas travel, or regional meetings	.

Appendix 2

PROJECT STAFF

Name	Function	Dates of Service: Starting Date	Dates of Service: Concluding Date
Nurul Islam	Country Project Manager	2 Oct. 2013	15 March 2015
Ravi Kumar	Good Aquaculture Practice	24 Feb. 2014	16 March 2014
Koji Yamamoto	Aquaculture Cluster Management (1st Mission)	2 March 2014	25 March 2014
	Cluster Management & Market Linkage (2nd Mission)	14 Aug. 2015	3 Sept. 2015
Fazlur Rahman	Country Project Manager	1 March 2015	29 June 2016
Shafia Saki	Project assistance	1 July 2015	30 June 2016
Andre Vincent	Development of traceability system (1st mission)	2 Aug. 2015	12 Aug. 2015
	(2nd mission)	28 April 2016	5 May 2016
	(3rd mission)	9 June 2016	15 June 2016

Appendix 3

MAJOR ITEMS OF EQUIPMENT PROVIDED

Quantity	Description	Cost (USD)
2	Copier - Digital with ADF	7 115
1	Photocopier Canon 4245	6 213
3	Laptop Computer - HP Pavilion 14-E036 TX	3 729
3	Desktop Computer HP Compaq Pro 6300	2 767

Appendix 4

DOCUMENTS PRODUCED DURING THE PROJECT

Inception Workshop Report (13-14 January 2013) by project management team. It contains major decisions for the necessary changes recommended. It was attended by 25 participants including the representatives from Government, FAO, STDF, WF, BSFF, World Bank. 7 pp.

Mission of W. Van Der Pijl (11-19 February 2014): An update of shrimp and prawn supply chain initiatives in Bangladesh. 34 pp.

Mission report of R. Kumar (24 February-16 March 2014): Design, development and implementation of BMP/GAP guidelines. 15 pp.

Mission Report of K. Yamamoto (2-25 March 2014): Developed cluster farming manual, facilitate farms and clusters registration and provide guidance to the implementation of BMP, including the cluster approach. 14 pp.

End of assignment report of 1st CPM, Nurul Islam. April 2015. 25 pp.

Mission Report of A. Vincent (28 April-5 May 2015): Develop a traceability system for shrimp production and marketing in Bangladesh - developed guidelines, system structure and minimum requirement for traceability system. (49 pp)

Mission Report of André Vincent (2-12 August 2015): develop a traceability system for shrimp production and Marketing in Bangladesh - Initial assessment and stakeholder analysis. 18 pp.

Mission Report of A. Vincent (2-12 August 2015): Develop a traceability system for shrimp production and Marketing in Bangladesh - Practical training on methodology for implementation of a traceability system for shrimp production and marketing system. 55 pp.

Mission Report of K. Yamamoto (14 August-3 September 2016): Developed the guidelines for internal control system and review of the market access status. 27 pp.