Value chain of pangas and tilapia in Bangladesh

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Abstract

The study assessed pangas and tilapia value chain, and analyze the internal and external governance of the market actors at different levels. Two hundred samples (100 for each of pangas and tilapia fish) were included in the study from selected areas of Bangladesh. A combination of descriptive statistics and mathematical analysis were used to analyze the data. GAMM analysis was used to address the actors and their functions, product flow, information flow and governance of pangas and tilapia value chain. The study reveals that among all the actors, processors added the highest value and farmers followed it. The internal and external governance issues followed by different actors could be ranked as average, which reveals the improvement issue through intervention from respective authorities. SWOT analysis indicated high demand for pangas and tilapia in domestic and international markets, inadequate market infrastructure and increasing cost of feed as major strength, weakness and threat, respectively. The study recommended that good governance should be ensured from the production point to consumer along all the actors of value chain. Government should step about monitoring the feed quality and improvement of pangas and tilapia value chain governance. Moreover, DoF, BFRI and NGOs should play the assigned role to train up the chain actors and provide extension services in order to explore the export potential of pangas and tilapia fishes in Bangladesh.

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Introduction

Bangladesh has achieved remarkable progress in the fisheries sub‑sector since its independence. The contribution of fisheries sub-sector to national GDP and agricultural GDP were 3.65% and 23.12%, respectively (MoF, 2016). Bangladesh has the third largest aquatic biodiversity in Asia behind China and India with about 800 species of fresh, brackish and marine waters having world's largest flooded wetland and three main river systems Ganges, Brahmaputra and Meghna (Hussain *et al.*, 2009). Among the various species of fish, pangas and tilapia are particularly important because of its size and taste. In recent years, pangas and tilapia have become the most popular commercial cultivable species due to high yield, higher response to external feeding and availability of seeds to meet up the farmer's demand (Razeim *et al.*, 2017; Rahman *et al.*, 2012).

Pangas and tilapia production were 510097 and 370017 metric tones, which was 12.34% and 8.95% of total fish production, respectively (DoF, 2017). In total aquaculture production, greater Mymensingh area (i.e., Mymensingh, Sherpur, Jamalpur, Kishorganj and Netrokona) has got significant advancement regarding pangas and tilapia fish production commercially (Islam, 2009). The pangas and tilapia value chain is totally controlled by the private sector. A large number of market actors are associated with pangas and tilapia farming activities like hatchery and nursery owners, fry/fingerling traders, producers, fish traders (*paiker, faria, aratdar*, retailers, etc.), etc who receive a large amount of profit in the total market share (Ayubu, 2017; Loc, 2009).

However, competition is minimal at wholesale level, there is an informal restriction on new entrants to the wholesale market due to the presence of a strong wholesale traders' association. On the other hand, at retailers' level, competition is high and open, both in fingerling and in fish selling; anybody can join the retail market and contact wholesalers or their agents directly using cash purchases or credit contracts with wholesalers. Usually credit-retailers initially get low-value fish from wholesalers for marketing with trust being built up over time; they are then allowed to sell high value fish (Apu, 2014).

Moreover, there is no particular policy for upgrading pangas and tilapia value chain. There are very limited active organizations for fish farmers, which have resulted in exploitation by the well-organized and influential actors such as fish traders, feed companies and so on. Although the fisheries sub-sector has experienced significant growth, the livelihoods of small actors have not been improved much, while the principal

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actors (i.e., traders) of the fish value chain have accumulated the lion's share of the profits. That is why there is need for a justified upgradation of pangas and tilapia value chain in order to improve the positions of actors along the value chain. The potential for upgrading the activities of pangas and tilapia market actors include: (i) high levels of competition and participation at each node of the value chain; (ii) lack of institutional organization and coordination among actors at individual value chain nodes; (iii) the exclusion of smallholder fish farmers from higher value markets due to limited access to information; (iv) lack of formal capital appropriate for the fish production system; (v) lack of enforcement of standards and policies to enhance fish production; and (vi) widespread use of low quality inputs (Apu, 2014).

The present study is linked in some extent with other few studies, which are: Neela (2015) conducted a study on value chain and governance analysis of tilapia and found that wholesalers added highest value to tilapia and value chain governance was very weak in the study area. Hossain *et al.* (2013) reported that in case of small, medium and large fish, value addition occurred 14.0% to 23.0%, 17.0% to 23.0% and 52.0% to 69.0%, respectively. Maurice *et al.* (2010) conducted a study on the value chain of farmed African catfish and the main findings indicated that lack of cooperation in the domestic value chain, which had led to vulnerability of farmers though the chain had potential for higher income. Navy *et al.*, (2012) conducted a value chain research on five key fishes in Cambodia and found that the main players in the fisheries marketing system comprise fishermen, collectors, wholesalers and retailers. Simpson (2012) explored the opportunities for small scale suppliers within the tilapia value chain in Achavanya of Dangme West District, Ghana and found that the value chain activities had no value addition since there was no processing factory in Achavanya to add value to the fish before it reaches the final consumer.

The above literature reviews indicate that a few studies were performed on pangas and tilapia value chain analysis with governance. This study analyzed value chain and governance of pangas and tilapia altogether, which will help to identify the problems of the value chain actors that are important for government, non-government organizations, business people and policy makers. The specific objectives of the study are: i) to develop pangas and tilapia value chain map and estimate the value addition by different actors; and ii) to address the governance structure of pangas and tilapia value chain actors. The findings from this study will help to make the policy options about pangas and tilapia fish culture and its extension.

Materials and Methods

Study Areas and Sample Size

The pangas and tilapia farmers and other actors were selected purposively from different study areas. Total sample size was 200, of which 100 were involved with pangas fish and remaining 100 were involved with tilapia fish (i.e., hatcheries and nurseries, farmers, input suppliers, *aratdars*, wholesalers, processors, retailers and consumers) (Table 1). The study was based on both primary and secondary sources of data and information. Researchers collected first-hand data and related information through direct interview and 09 focus group discussions (FGDs) using different types of questionnaire. The findings from FGDs were incorporated in value chain mapping and assessing governance issues. Secondary data and information having relevancy with this study were also collected for the purpose of analysis.

Table 1. Sample size distribution in the study area

Fish spices	Target groups	Sample size	Study areas
Pangas	Hatcheries and nurseries	10	Bailar and Dhanikhola village of Trishal upazila under Mymensingh district
	Farmers	30	
	Input suppliers	20	
	Aratdars	10	
	Wholesalers	10	
	Processors	2	
	Retailers	10	
	Consumers	8	
	Total	100	
Tilapia	Hatcheries and nurseries	12	Fulbaria, Tarakanda, Bhaluka, Trishal and Sadar upazila from Mymensingh district; Tongi upazila from Gazipur district
	Farmers	20	
	Input suppliers	20	
	Aratdars	10	
	Wholesalers	10	
	Processors	6	
	Retailers	12	
	Consumers	10	
	Total	100	
	Total sample size	200	

Analytical Techniques

GAMM analysis
Gendered and Adapted Market Mapping (GAMM) analysis was used to examine the value chain map and value chain governance of pangas and tilapia. GAMM analysis incorporated a series of subsector mapping for purposes of analyses (OXFAM, 2013). Three parts of GAMM analysis are: Part I: Assessing and mapping value chain; Part II: Assessing and mapping service market; and Part III: Assessing and mapping of (dis) enabling environment.

Part I: Assessing and mapping value chain
GAMM starts with identifying the core value chain and includes respective value additions and issues observed at each level. Different types and number of actors are identified first based on their respective roles relative to the product along the value chain. Once identified, these actors are placed along the chain according to the sequence of the flow of the product. The dynamics and issues associated with every type of actor are then articulated. Value additions of different stakeholders were estimated using the following equations (Acharya and Agarwal, 1987):

Gross margin = Sales price – Production cost/Purchase price;
Value addition by pangas and tilapia producers = Gross margin – Production cost;
Value addition by individual actors = Gross margin – Purchase price;
Price spread = Consumers' purchase price – Producers' sales price;
Producers' share to consumers' Tk. = (Producers' sales price ÷ Consumers' purchase price) × 100

Part II: Assessing and mapping service market
Along any product value chain, a network of actors termed the service market supports the core actors of the chain. The types of services and their providers vary across areas, products and time. As such, service market mapping incorporates a wide range of components related to this aspect i.e., starting from embedded services, free-based services, their payments, to service delivery mechanisms, and flow of benefits, amongst all other related factors.

Part III: Assessing and mapping of (dis) enabling environment
Issues such as government rules and policies, social norms and practices, infrastructure, topology, natural ambience and other underlying factors typically are not emphasized in core value chain frameworks. Despite their profound influence on the core value chain, these aspects are conventionally considered as 'extraneous' factors, and their primacy of being significant determinants in the power dynamics and structures of product markets are dismissed as secondary. These phenomena are labeled as (dis) enabling environments.

Value chain governance
Main issues in value chain governance include coordination, communication or transmission of information, distribution of (market) power, and collaboration. Governance tools in value chains include rules (or standards), which may be product standards (e.g., food hygiene standards) or process standards (e.g., health and safety standards for employees). Internal or formal governance refers to food safety and quality standards that buyers make on producers and exporters and change behaviour in supply chains. External or informal governance is the institutional framework that governs how the chains operate (Kruijssen and Young, 2012).

SWOT Analysis
SWOT is an acronym for Strengths, Weaknesses, Opportunities and Threats. By definition, Strengths (S) and Weaknesses (W) are considered internal factors over which people have some measure of control. In addition, by definition, Opportunities (O) and Threats (T) are considered external factors over which we have essentially no control. SWOT analysis guides to identify the positives and negatives inside of the organization (S-W) and outside of it, in the external environment (O-T). Developing a full awareness of the situation can help with both strategic planning and decision making (Kotler *et al.,* 2009). The SWOT analysis will give some insight to positive and negative sides of pangas and tilapia value chain.

Results and Discussion

GAMM Analysis: Part I - Assessing and Mapping Value Chain
The first part of Gendered and Adapted Market Mapping (GAMM) analysis includes respective value additions and issues observed at each level and sketch out the value chain map. Different types and number of actors are identified based on their respective roles along the value chain.

Involvement of actors and activity flow in pangas and tilapia value chain
Value chain analysis involves analysis of all supporting and primary activities in the process of transforming input into output which gives greater sense of value to the customer. There are three stages of pangas and tilapia value chain in the study areas. The primary/operational service providers are the main actors of value chain. Primary activity operators include hatchery, nursery, feed and medicine supplier, ice supplier, farmer, *aratdar,* wholesaler, processor, retailer, etc. Secondary/support service providers are passively involved with value chain actors. Training providers, credit organizations, transporters, etc. are secondary service providers (Fig 1).
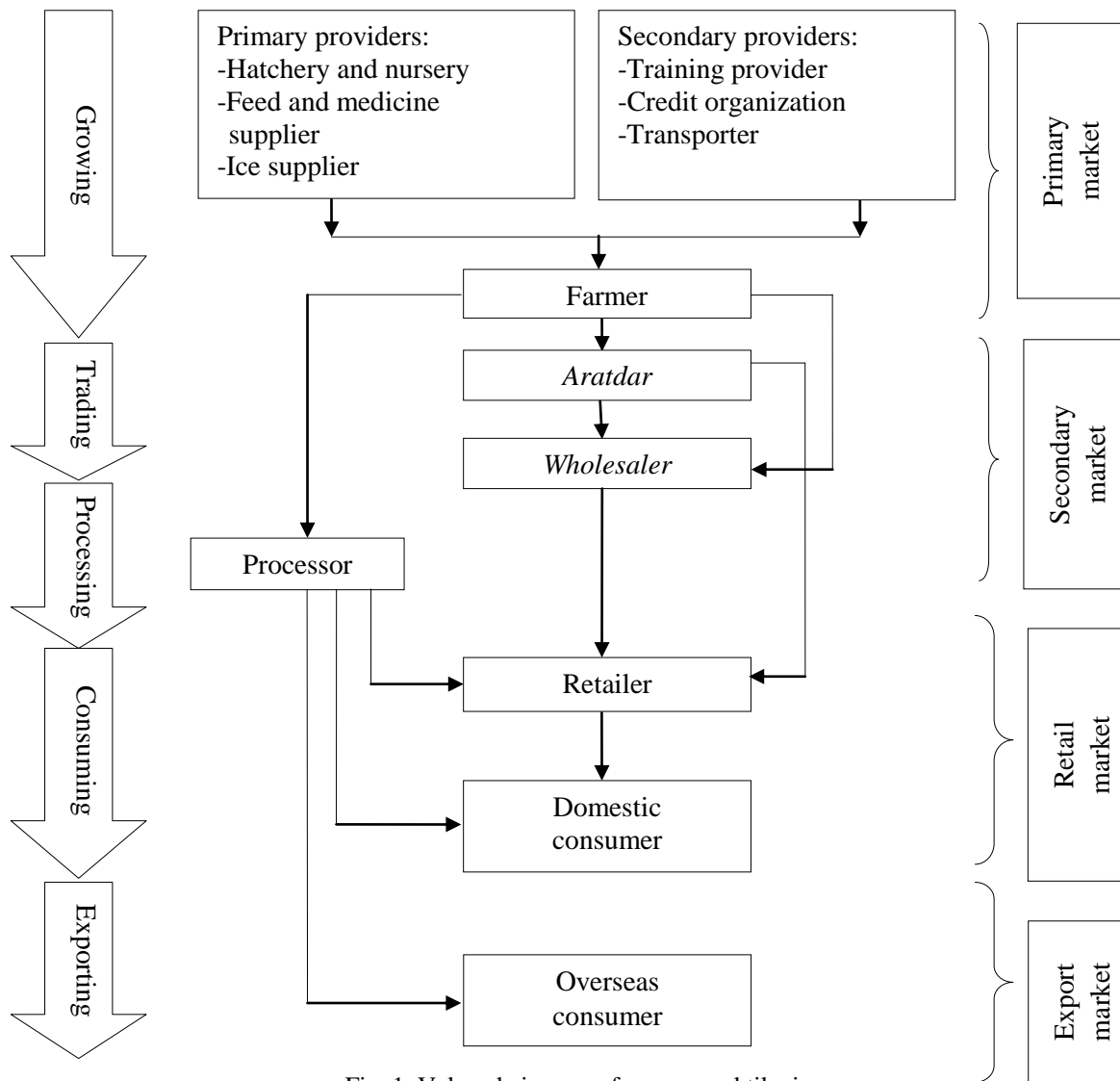
Fig. 1. Value chain map of pangas and tilapia

Value addition by different actors of pangas and tilapia value chain

Table 2 reveals that the gross margin of farmers was Tk. 33 per kg pangas. The marketing cost of farmers was Tk. 3 per kg pangas. So, the value addition of pangas farmer was Tk. 30 per kg. The gross margin of *aratdars* was Tk. 5 per kg pangas. *Aratdars'* marketing cost was Tk. 2 per kg pangas and so, the value addition was Tk. 3 per kg pangas. Similarly, the gross margin and value addition of wholesaler and retailer were Tk. 12 and Tk. 5, and Tk. 13 and Tk. 9 per kg, respectively. Processors generally purchase large size of fish. Because to get 1 kg fillet, 3-4 kg (size per piece is more than 1.0 kg) fish is needed on average. The purchase price of per kg pangas fillet was Tk. 345 and the sales price was Tk. 450. The gross margin was Tk. 105 per kg and the marketing cost of per kg fillet was Tk. 50 and thus the value addition of processor was Tk. 55 per kg.

On the other hand, tilapia farmers' gross margin and value addition was Tk. 34 and Tk. 32 per kg, respectively with a marketing cost of Tk. 2 per kg.

Likewise, the gross margin and value addition of *aratdar*, wholesaler and retailer were Tk. 5 and Tk. 4, Tk. 16 and Tk. 6, and Tk. 17 and Tk. 14 per kg, respectively. Processors' gross margin was Tk. 120 per kg tilapia. The marketing cost was Tk. 55 per kg fillet and thus the value addition of processor was Tk. 55 per kilogram.

Total value addition by all the market actors was Tk. 102 and Tk. 121 per kg pangas and tilapia. Value addition was highest by the processor (53.9% and 53.7% for pangas and tilapia, respectively). It was followed by farmer (29.4% and 26.4%), retailer (8.8% and 11.6%), wholesaler (4.9% and 5.0%) and *aratdar* (2.9% and 3.3%) for pangas and tilapia, respectively (Table 2). The findings of INNOVISION (2013) were quite different where the study depicted that in Bangladesh, on an average, the percentages of total value addition by pangas and tilapia farmers, *aratdars*, *paikers*, and retailers were 30.0, 6.0, 34.0 and 30.0 percent; and 54.1, 4.1, 14.9 and 27.0 percent, respectively.

Table 2. Value addition of pangas and tilapia value chain actors

Particulars	Pangas fish						Tilapia fish					
	Farmer	*Aratdar*	Wholesaler	Processor	Retailer	Total value addition	Farmer	*Aratdar*	Wholesaler	Processor	Retailer	Total value addition
i. Production cost/ Purchase price (Tk./kg)	52	-	90	345	102		48	-	87	340	103	
ii. Marketing cost (Tk./kg)	3	2	7	50	4		2	1	10	55	3	
iii. Sales price (Tk./kg)	85	-	102	450	115	102	82	-	103	460	120	121
iv. Gross margin (iii – i)	33	5	12	105	13		34	5	16	120	17	
v. Value addition (Tk./kg) (iv – ii)	30	3	5	55	9		32	4	6	65	14	
vi. % of total value addition	29.5	2.9	4.9	53.9	8.8	100.0	26.4	3.3	5.0	53.7	11.6	100.0

Source: Authors' estimation based on field survey, 2016.

Note: Processor sold directly to the export market and local consumers. A small portion also goes to retailers which is negligible. Hence, sales price of wholesaler is equal to purchase price of retailer.

Producers' share (73.9% and 68.3% for pangas and tilapia, respectively) was moderate which is considered as an indicator of increase in the efficiency of the marketing system in favor of the traders. It is also found that price spread (Tk. 30 and Tk. 38 per kg for pangas and tilapia, respectively) was high which indicates the lower efficiency of the marketing system (Table 3).

Table 3. Producers' share to consumers' Tk. and price spread

	Particulars	Pangas fish	Tilapia fish
i.	Producers' sale price (Tk./kg)	85	82
ii.	Consumers' purchase price (Tk./kg)	115	120
iii.	Price spread (ii – i) (Tk./kg)	30	38
iv.	Producers' share to consumers' Tk. (in %)	73.9	68.3

Source: Authors' estimation based on field survey, 2016.

GAMM Analysis: Part II - Assessing and Mapping Service Market
The second part of GAMM analysis discussed about the service market mapping incorporates a wide range of components related to this aspect from embedded services, free based services, delivery mechanisms and flow of product and information.

Product flow
In the study areas, feed were mainly supplied from Trishal, Bhaluka, Maona, Savar, Dhaka and Chittagong districts. There were different feed companies such as Index Feed Ltd., Aftab Feed Products Ltd., Krishibid feed Ltd., Mega Feed Ltd., Quality Feed Ltd., ACI Feed Ltd., etc. There were also different feed shops which supplied loose feed or the inputs of loose feed. They brought these inputs from different districts. Private sector companies provided different types of technical information and supports through their retailers and distributors. These supports include training sessions, demonstrations, water and soil test, feed test, information availability, etc. Business incentives of the private sectors motivated them to do this type of activities.

In the study areas, only a few hatcheries produced pangas and tilapia fingerlings. Most of the farmers collected fingerlings from Bogra district. Hatcheries supplied fingerlings to nursery, farmers or fry traders. Farmers sold marketable size of pangas and tilapia at *arat. Arat* is the place where the market agent (*aratdar*) arranges or negotiates sales for the sellers on a commission basis, including financing of suppliers and buyers and often dealing on their own account (Goswami, 2016). From *arat*, one portion of pangas and tilapia was mainly supplied to Sherpur, Jamalpur, Netrokona, Mymensingh sadar and different upazilas of these districts, and another portion was supplied to Chittagong, Maona, Savar, Gazipur and different markets of Dhaka by different modes of transportation. So, these were the major demand centers of pangas and tilapia fish. From local *arat,* pangas and tilapia were purchased mainly by wholesaler of these districts.

Information flow
Different input suppliers such as feed and medicine supplier, fingerlings trader and other input supplier mainly provide information about their inputs like price, quality, availability, source, volume of inputs, etc. to farmers. Farmers provided information about price and volume of marketable pangas and tilapia fish to *aratdar,* processor and wholesaler. *Aratdar* and wholesaler provided information about price, quality, availability, source, volume, size of marketable fish to retailers. Retailers provided the same information to the consumers. All of the market actors circulated the information mostly by mobile phone.

Backward linkage actors and their safety compliances

Backward linkage actors such as hatchery, nursery, feed supplier, transporter, credit organization, etc. of pangas and tilapia value chain, their different services and performance in safety compliances along these services are presented in Table 4.

Forward linkage actors and their safety compliances

Forward linkage actors such as farmer, *aratdar,* ice supplier*,* wholesaler*,* processor, retailer, etc. of pangas and tilapia value chain, their different services and performance in safety compliances along these services are presented in Table 5.

Table 4. Backward linkage actors' services and performances in safety compliances

Actors	Services	Performances in safety compliances (%)
Hatchery	Brood collection, hatching and fry trading	82
Nursery	Nursing and fry trading	80
Feed supplier	Feed retailing, distributing, information providing and supplying credit	59
Transporter	Loading, unloading and transporting	65
Credit organization	Providing credit and providing technical service	**-**

Source: Authors' estimation based on field survey, 2016.

Table 5. Forward linkage actors' services and performances in safety compliances

Actors	Services	Performances in safety compliances (%)
Farmer	Assembling of inputs, production of pangas and tilapia, harvesting and selling to traders	76
Aratdar	Wholesales facilitation, bidding, weighting and advancing short-term credit	68
Ice supplier	Supplying ice	72
Wholesaler	Transporting, bulk selling, grading, watering, storing, icing	63
Processor	Receiving, grading, washing, beheading, processing, packaging, storing/preserving and exporting	88
Retailer	Retailing, storing, icing, packaging and removing scales and cutting into pieces	72
Consumer	Consuming	-

Source: Authors' estimation based on field survey, 2016.

GAMM Analysis: Part III –Assessing and Mapping of (Dis) Enabling Environment

Third part of the GAMM analysis discussed about rules and policies regarding quality improvement of product, social norms and practices, infrastructure, etc. and the perception of different actors about performance to maintain these rules and policies.

Internal and external governance followed by different actors

Internal or formal governance means buyers demand on food safety and quality standards of product from producers and exporters; and external or informal governance means rules and regulations like social and business norms, relationships between buyers and sellers, political issue, etc. All the actors of value chain have some standard governance issues which they maintained individually as a part of value chain. Table 6 reveals the perception of different actors on different indicators of internal and external governance. Five categories were formed such as 'high', 'medium', 'low', 'rarely' and 'never' to measure the perception on different indicators under internal and external governance of value chain.

It was found that the high extent internal governance was followed by hatchery and nursery to develop good quality of pangas and tilapia brood stock and fry and likely, 100% hygiene and bio-security were maintained. Quality feed, hormone and medicine were supplied for pangas and tilapia brood stock and fry. Hatchery and nursery farm had no technical limitation but number of skilled labor was medium. From the external governance point of view, it could be developed more if the farm get high environment of marketing facilities, outside financial support and export certificates because they have no scarcity of inputs. Farmers were highly concerned about improvement in quality of product (100%). In addition, they were 90% concerned about price reductions, and 80% about buyers' rejection system. There was a little provision of technical assistance by DoF in case of farmers. Input suppliers were 100% concerned about the hygiene and bio-security, timely deliveries and medicinal use. Externally, they were 80% concerned about ensuring quality inputs. *Aratdar* had low restriction on hygienic and bio-security (70%) during marketing functions. They do not take responsibility directly for marketing functions because they act as a middle man for fish marketing. Based on internal and external governance factors of wholesaler, it points out that they are not concerned about hygiene and bio-security at all (0%), and they have rare improved storage and refrigeration facility (10%). Processors maintain commendable performance in case of improving grading system, and storage and refrigeration quality. Retailers were highly concerned about quality of product, buyers' rejection system and marketing facilities (70%, 80% and 80%, respectively).

Table 6. Internal and external governance followed by different value chain actors

i. Governance followed by hatchery and nursery											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Quality brood stock and fry	90	10	-	-	-	Transport facilities	-	60	-	-	-
Hygiene and bio-security	100	-	-	-	-	Requirement of export certificates	-	-	-	-	-
Timely deliveries	90	-	-	-	-	Electric power supplies and local marketing facilities	-	-	40	-	-

ii. Governance followed by farmer											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Improvement in quality of product	90	10	-	-	-	Provision of technical assistance by DoF	-	-	-	-	100
Price reductions	100	-	-	-	-	Technical extension service	-	-	10	20	60
Buyers' rejection system	80	10	10	-	-	Poverty reduction strategy	80	20	-	-	-

iii. Governance followed by input supplier											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Hygiene and bio-security	100	-	-	-	-	Checking feed contamination	-	90	10	-	-
Timely deliveries	100	-	-	-	-	Ensuring quality inputs	80	20	-	-	-
Medicinal use	100	-	-	-	-	Examining documentation	-	-	10	80	10

iv. Governance followed by *aratdar*											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Hygiene and bio-security	-	10	70	10	10	Provision of technical assistance by DoF	-	-	10	90	-
Buyers' rejection system	-	-	80	10	10	Technical extension service	-	-	10	90	-

v. Governance followed by wholesaler											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Hygiene and bio-security	-	30	30	40	-	Electric power supplies and local marketing facilities	70	10	10	10	-
Medicinal use	-	-	-	20	80	Technical extension services	-	-	-	20	80
Improved storage and refrigeration quality	-	-	-	10	90	Poverty reduction strategy	40	50	10	-	-

vi. Governance followed by processor											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Improved grading system	-	80	10	10	-	Dissemination of new aquaculture technologies	-	10	10	70	10
Improved storage and refrigeration quality	70	30	-	-	-	Requirement of export certificates	40	50	10	-	-

vii. Governance followed by retailer											
Internal governance						External governance					
Factors	Extent (in percentage)					Factors	Extent (in percentage)				
	H	M	L	R	N		H	M	L	R	N
Improvement in quality of product	70	20	10	-	-	Electric power supplies and local marketing facilities	80	10	10	-	-
Buyers' rejection system	80	10	10	-	-	Poverty reduction strategy	30	50	20	-	-

Source: Authors' estimation based on field survey, 2016.
Note: High (H) = 76 to 100%; Medium (M) = 51 to 75%; Low (L) = 26 to 50%; Rarely (R) = 1
to 25%; and Never (N) = 0%.

The findings are quite similar with Uddin (2009) where the author analyzed the food safety compliance performances of different stakeholders in value chains of Bangladesh and Thailand from mother shrimp collection to consumers' plate; and revealed that the competent authority monitored the hygiene and sanitation condition of the buyer-driven value chain activities, whereas processors-cum-exporters implemented HACCP procedures about 85.0% to 90.0% in all stages of production, distribution, processing and export of shrimp to assure the quality standards.

Key Factors and Outcomes of Governance
There are some factors which play a vital role in entire value chain governance. These factors are crucial because the condition of the value chain governance system of one product is comprehended by the outcome of these factors. Table 7 represents the key factors and outcomes of these factors in the study areas. The production potential of pangas and tilapia in Bangladesh is enormous but its export is constrained by quality and management. All the actors of value chain maintain some standards. Governance in pangas and tilapia value chain is not well developed due to low government inspection as well as lack of knowledge of respective stakeholders about the good governance practice. The governance issues followed by different actors could be ranked as average which reveals the improvement issue through intervention from respective authorities. Processing plants have generous capacity to export and a good aquaculture practices (GAP) associated with certification is required to develop. Hatcheries and nurseries should try to improve seed quality. Feed companies should try to improve their feed quality maintaining the international standard. Farmers' organizations need to be formed for producing pangas and tilapia in compliance with the demand of processors. Finally, interdepartmental committees should be established for monitoring good governance from the production point to consumer along the actors of pangas and tilapia value chain.

Table 7. Key factors and outcomes of governance

Factors	Outcomes
Power practice in terms of price setting	Relationships of power among all the actors were balanced. Price of the fish was determined by the bargaining power.
Driver of value chain	The value chain of pangas and tilapia was buyer driven where *aratdars*, wholesalers, processors, retailers, etc. precise the product specifications.
Information flow	Information flowed among the value chain of pangas and tilapia was crystalline. Information flowed within the actors mostly by mobile.
Relationship	Relationship among all the actors of pangas and tilapia was fair. The trust level was such high among the actors that sometimes the product transaction cost was paid later.
Mode of contract	Most of the contract done by actors within the chain was mutual. Very few contracts were made by written paper.

Source: Field survey, 2016.

SWOT Analysis for Pangas and Tilapia Value Chain
Table 8 represents the SWOT analysis for pangas and tilapia value chain which reveals that the major strength was peoples' preference for pangas and tilapia due to cheaper price and taste (stated by 90% respondents). Pangas and tilapia can be cultivated with other white fish which is stated by 90% respondents. According to 70% farmers, pangas and tilapia can be cultivated in the homestead ponds where women can play effective role. As major weaknesses, 90% respondents gave opinion about irregular supply of quality brood and poor socioeconomic condition of the farmers, respectively. Questionable quality of fry and lack of proper value chain governance were also identified as weaknesses with the response of 80% farmers, respectively. The major opportunities included high demand in domestic market as well as international market, and increase in income of farmers, traders and associated groups (according to 90% respondents, respectively). All the respondents (100%) identified increasing cost of feed as serious threat. Complex and traditional marketing system, and market control by powerful intermediaries were also identified as threats by 70% respondents, respectively (Table 8).

Table 8. SWOT analysis for pangas and tilapia value chain

	Strengths	% of responses		Weaknesses	% of responses
i.	Many people like tilapia and pangas due to cheaper price and taste also.	90	i.	Quality of the fry is questionable	80
ii.	Small farmers can cultivate it in their homestead ponds where women can play an effective role.	70	ii.	Irregular supply of quality brood	90
iii.	Tilapia can be cultivated with other white fish.	90	iii.	Tilapia production needs relatively high investment as it requires quality feeds	60
iv.	Considerable number of people involved in marketing (cheap labour)	60	iv.	Inadequate market infrastructure	40
v.	Strong network among value chain actors through mobile phone	60	v.	Lack of monitoring by concerned authority to maintain proper value chain governance	80

	Opportunities	% of responses		Threats	% of responses
i.	High demand in domestic market as well as international market	90	i.	Increasing cost of feed is serious threat	100
ii.	Greater employment opportunities	70	ii.	Non-availability of capital to small scale stakeholders	60
iii.	Increase in income of farmers, traders and associated groups	90	iii.	Complex and traditional marketing system	70
iv.	High demand for fillets and whole tilapia in international market is yet to be explored by Bangladeshi exporters	80	iv.	Market controlled by powerful intermediaries	70

Source: Authors' estimation based on field survey, 2016.

The findings are similar with Apu (2014) to some context where the author pointed on source of food and nutritional security, skilled work force and large domestic market as major strengths; lack of quality fingerlings, small profit margin in fish trading and poor pond management practices as major weaknesses; increasing income level, growing consumer demand and having capability of improving livelihood as major opportunities; and rising cost of feed and other raw materials, limited financial capital and high competition in retail fish markets as major threats of Bangladesh fisheries.

Conclusion

The study concludes that potential of pangas and tilapia production in Bangladesh is enormous and many farmers have devoted them in pangas and tilapia culture because of their high income from these. The primary market actors of pangas and tilapia value chain were farmer, *aratdar,* wholesaler*,* processor and retailer. Among all the actors, processors added the highest value which was followed by farmers. Moreover, processors were fully aware of importance of quality standard and maintained all the indicators of quality standard sincerely. As profit earners, traders were the most casual group of value chain actors and they were not so serious with governance issues. The study identified that major strength of pangas and tilapia production was peoples' preference for tilapia due to cheaper price and taste. Questionable quality of fry and lack of value chain governance were identified as one of the major weaknesses. The major opportunities included high demand in domestic market as well as international market, and increase in income of farmers, traders and associated groups. The study also identified increasing cost of feed as serious threat. Some recommendations are put forward with a view to improve the entire value chain of pangas and tilapia fishes. Good governance should be ensured from the production point to consumer along all the actors of value chain. Government should take step about monitoring the feed quality and improvement of pangas and tilapia value chain governance. Moreover, DoF, BFRI and NGOs should play the assigned role to train up the chain actors and provide extension services in order to explore the export potential of pangas and tilapia fishes in Bangladesh.

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