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Value chain analysis of mud Crab (*Scylla* spp.) in southwest region of Bangladesh

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Abstract
This study has been undertaken to explore the insights of mud crab (*Scylla* spp.) value chain in southwest region of Bangladesh. A total of 160 samples was surveyed for this research as they are likely to have the greatest control over the overall system. Crab catcher, farmer, faria, depot owner, supplier, exporter was identified as the key actor of mud crab value chain. The results showed that about 78.4% of wild catch was undertaken to upper market for export purpose. About 3.1% of low-quality crab was domestically consumed and rest 18.5% of wild underweight crabs was taken to farmer for further fattening. The study revealed that the value addition was found 3%, 7%, 6%, 39%, 16%, and 29% respectively for the catcher, depot, faria, farmer, supplier, and exporter. The highest gross profit margin (19%) and the highest markup (23%) was observed for the farmer. *Dadon* system, ransoms for robbery in Sundarbans, low harvest, virus attack, lack of crab hatchery etc. were observed the main hindrance of mud crab value chain. Ultimately, the work is convenient here to apprehend the value chain performance and identifying critical factors to support the sectoral improvement in a sustainable manner in southwest region of Bangladesh.

Keywords: value chain, mud crab, actor, wild catch, gross profit

1. Introduction
The mud crab (*Scylla* spp.) is a commercially important crustacean aquatic species after tiger shrimp (*Penaeus monodon*; Fabricius) in Bangladesh which is locally known as 'Kakra', 'Shilla Kakra', 'Habba kankra' (Jahan and Islam, 2016) [1]. In Bangladesh, mud crabs occur abundantly in the tidal rivers of Khulna, Bagerhat, Satkhira, Cox's Bazar, Chittagong (DoF, 2017) [2]. It is harvested from the coastline of the Bay, in the creeks and canals of the brackish water estuaries (Khan and Alam, 1992) [3]. It is also harvested from shrimp farms of southern coastal districts of Bangladesh. Although 16 crab species are available on the coast of Bangladesh only 6 genera of them are used as food. Out of these 16 species 4 of them are freshwater species and 12 are marine/brackish water species (Ahmed, 1992) [4].

Although earlier crab was a trivial product in shrimp and other fin fish farms in Southeast Asian Countries, has now emerged as an alternative and profitable livelihood and potentially exportable commodity (Ali *et al*., 2004) [5]. Mud crab is being cultured in pen, cage or even simultaneously with shrimp in shrimp farms (Chakraborty *et al*., 2018) [6]. Therefore, shrimp farmers are shifting to crab farming as it is less susceptible to disease, easy to culture, more adaptable to climate change and has a good market price comparison to shrimp (Salam *et al*., 2012) [7].

Crabs are second most exported crustacean product from Bangladesh (Molla *et al*., 2009) [8]. Since the mid 70s, the crab marketing system has developed in Bangladesh with a view to export mud crab to foreign markets. According to Export Promotion Bureau (EPB), Export of mud crab from Bangladesh started in 1977 and the first consignment was worth $2,000 only. The export volume grew over the years and Bangladesh shipped crabs worth $23.82 million in 2015-16 (EPB, 2017) [9].

The value chain of mud crab is composed of a series of intermediaries like the crab catcher, farmer, foria, depot/aratdar, supplier, exporter and the consumer. In southwest coastal belt of Bangladesh, 0.25-0.3 million people, mainly landless poor collectors, crop farmers, traders and suppliers are directly or indirectly dependent on the crab fishery (FRSS, 2017) [10]. The presence of too many actors makes the value chain a complex system to exploit crab farmer.

A well structured marketing system for mud crab is yet to develop despite the demand and export potential is significantly higher. So, it is essential to identify major actors of mud crab value chain, their roles and interrelationship, constrains inside the value chain in order to make mud crab a sustainable export commodity for increasing national export earnings. Studies regarding value chain of mud crab in the southwestern part of Bangladesh are inadequate. Regarding the aforesaid circumstance the present study was undertaken as a preliminary survey to identify actors of mud crab value chain, their roles and interrelationships, cost-benifit analysis etc. This research work also showed how the marketing network extent over the country and to some extent what challenges encountered the value chain of mud crab.

2. Materials and Methods
2.1 Study area
This research was conducted from September, 2017 to

August, 2018 in the Southwest region of Bangladesh. Mongla and Rampal Upazila of Bagerhat District were purposively selected as the study area for this research. Mongla is located in between 21°49' and 22°33' north latitudes and in between 89°32' and 89°44' east longitudes. Rampal is located in between 22°30' and 22°41' north latitudes and in between 89°32' and 89°48' east longitudes.

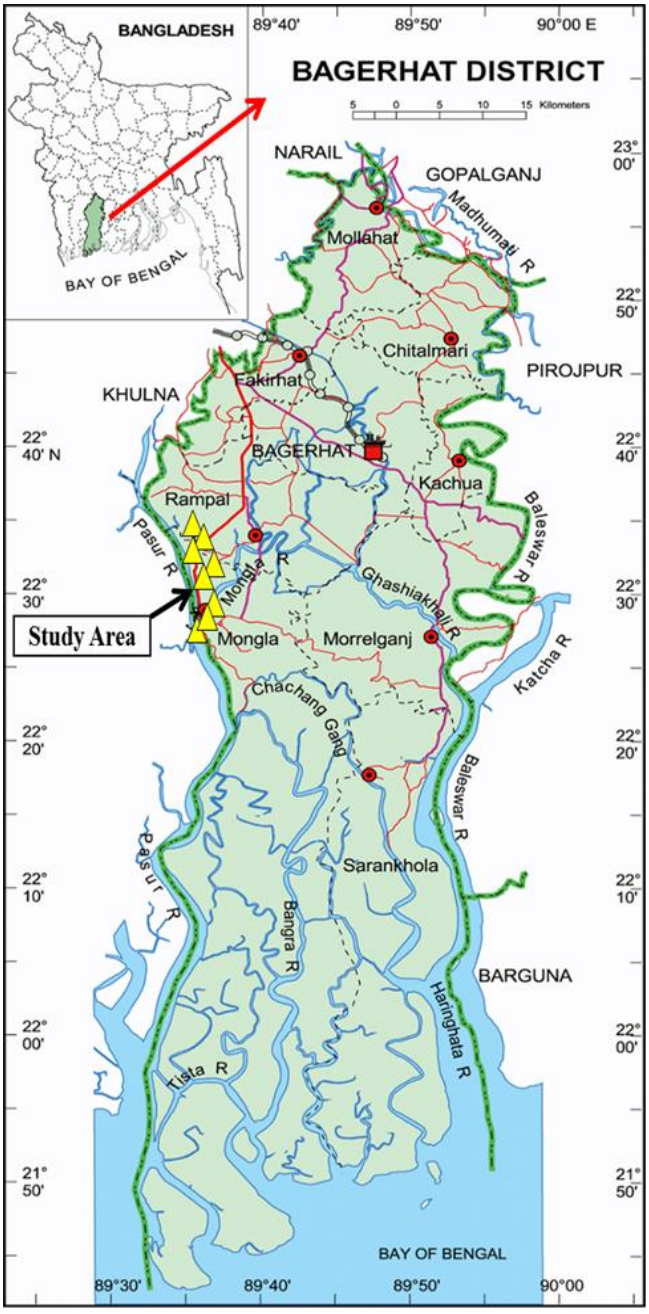


Fig 1: Location of the study area

2.2 Sample size and sampling technique

The samples in this study are- crab catcher, farmer, Faria, depot, supplier, and exporter. Moreover, Key Informant i.e, Professor of Khulna University, Director of Bangladesh Frozen Foods Exporters Association, Upazila Fisheries Officers were also interviewed for this study. Thus the sample size was 160. The random sampling technique has been applied as a sampling procedure for conducting the survey.

2.3 Data Collection

Both structured and semi-structured questionnaire were used to collect primary data from crab catcher, farmer, faria, depot owner, supplier, and exporter by direct personal interview. Key Informant Interviews (KII) were also used in order to collect information from a wide range of expert people. Focus Group Discussion (FGD) was also done with farmer, faria and depot with a view to gathering collective opinion and views that is representative of the fisher community of the study area. All the sessions were recorded and note keeping was done too. Direct observation of the activities of depot owner and faria was done in order to gather data and have a clear idea about how existing market dynamics work. It was also observed that how grading, pricing, and payment was performed by faria and depot owner.

Secondary data have been collected from research article, Fisheries Statistical Yearbook of Bangladesh, Export Promotion Bureau of Bangladesh (EPB) etc. These secondary data provided all the general information regarding value chain actors, their roles, and interrelationships among themselves, export trends etc.

2.4 Data processing and analysis

The collected raw data from each actor were carefully inserted in Microsoft excel sheet. Necessary pre-tabulation tasks were accomplished before the final tabulation and analyzed on the basis of the preset objectives. After processing of the collected data, it was analyzed using Microsoft Excel of office 2010 version.

However, following equations have been used for cost-benefit analysis.

$$\text{Gross profit} = \text{Revenue} - \text{Cost}$$

$$\text{Gross margin (\%)} = \frac{\text{Gross profit}}{\text{Revenue}} \times 100\%$$

$$\text{Mark up (\%)} = \frac{\text{Gross profit}}{\text{Cost}} \times 100\%$$

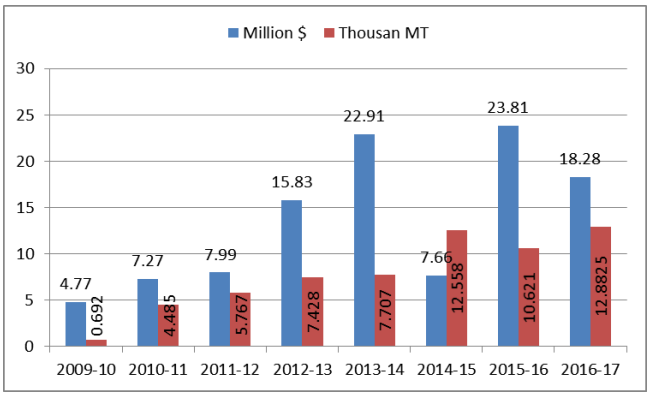
3. Results

3.1 End market analysis

3.1.1 Market segments and export trends

Mud crab is an exclusively export-oriented product of Bangladesh for its high market price and demand across the world. However, the majority of the crab from Bangladesh is being exported to China. Apart from China crabs are also exported to the USA, Australia, the UK, Taiwan, Thailand, Hong Kong, etc. Data from DoF (2017) revealed that both the volume (MT) and value ($) of exported crab was

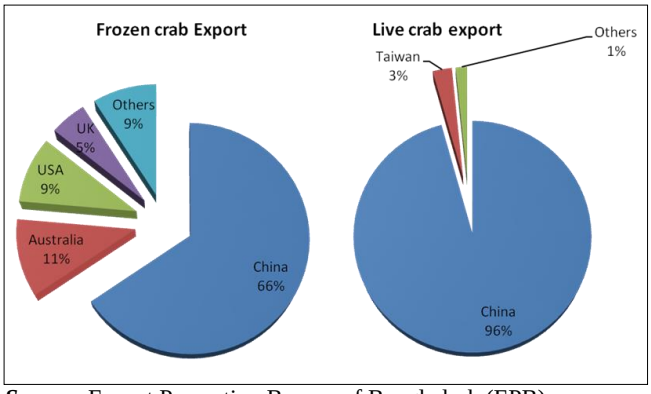
gradually increased from the fiscal year 2009-10. In the year 2009-10 the export volume of crab was 692 MT and the export value was 4.77 million $ which was gradually increased and accounted for 7,707 MT and 22.91 million $ in the year 2013-14 (Figure 2). In the year 2014-15, Bangladesh shipped crabs which worth $23.81 million, which was the highest ever for Bangladesh. But after that year's export earnings from the crab industry was gradually decreasing and accounted for 18.28 million and 17.38 million $ in $ in 2016-17 and 2017-18 fiscal year (Figure 2).



***Source*:** Do F, 2017

Fig 2: Annual export of crab by value and by volume

According to Export Promotion Bureau (EPB), it was observed that in the year 2017-18 the total export value of live crab was 7.91 million ($) whereas it was 9.47 million ($) for frozen crab. Figure 3 shows that 96% live crab (by value) was exported to China, which worth $7,567,649 whereas 65% of frozen crabs were exported to China which worth $ 6,200,533 in the year 2017-18. After China, Australia, the USA, the UK and Taiwan (Province of China) are the next largest market for crab accounting11%, 9%, and 5% of total frozen crab export in the last fiscal year that is worthy of $ 1,033,706, $ 891,440 and $ 491,399 respectively.



***Source*:** Export Promotion Bureau of Bangladesh (EPB)

Fig 3: Country-wise export of frozen and live crab ($) in 2017-18

3.1.2 Opportunities and challenges for market development

The demand and higher market price of crab across the world are the main driving force for developing a strong market. In Bangladesh, the mud crab industry is solely export-oriented. According to field survey, it was observed that most of the local consumers were non-Muslims. Due to the religious barrier, a strong local market was yet to develop. The main destination of Bangladeshi crab is south Asian countries and Australia, the USA, the UK, etc. Bangladeshi crab is being exported as either live or as frozen. Live crab is being exported mainly in neighboring countries as it is feasible to reach end user as live. Taiwan (Province of China), Hong Kong, Thailand can be a potential market for live crab as the demand for crab is higher there. Australia, the USA, and the UK are a potential market for frozen crab as the demand is higher in those countries. But, Key Informant Interview (KII) reveals that long distances, lack of frozen industry, lack of crab exporting regulation are the main challenges to increase export and make a sustainable crab industry in Bangladesh although the production of crab is increasing year after year.

3.2 Actors, their roles and interrelationships

Table 1

Actors	Roles and interrelationships
Crab catcher	The Crab catchers are the main driving force of crab industries and therefore play a vital role in the supply of crabs in the market as well as to the farmers. From the survey, it was found that most of the crab catchers (100%) harvested the crabs from the Sundarban Forest throughout the year except January and February as wild harvesting is restricted to natural breeding. Out of 30 catchers, 73% of catchers worked as day labor to others farm to harvest crab and 27% worked as day labor to Depots at restriction period. On each fishing trip catchers usually stayed out for 8 to 9 days with small boats using very primitive types of traps and bait for catching crabs. They got 7 days catch permit from the forest department by paying 200 BDT for each catcher while additional charge had to pay for the additional day. From the field survey, it was observed that about 76% of the catchers took *Dadon* (Loan) from Depots owner and yet to pay back the money. Moreover, about 87% catchers took on an average 2807±319 Tk BDT advance locally called *Calan Kharoc* from Depots owner for each fishing trip. After the return, the catcher adjusted the advance money during selling the crab. That's why; the catchers were bound to sell 100% of their product to respective Depots at 20/30 BDT less than the market price.
Farmer	Farmers are the main producers who buy undergrad/underweight crabs *(*8-12 PCs/kg*)* usually soft shelled crabs or water crabs from either Depots or Farias and cultured up to 60-75 days. It was found that 37% Farmers purchased soft-shelled crabs (locally called Pich Kakra) from Depots owner and 43% Farmers purchased it from Farias (middleman) and rest 20% Farmers purchased from both Depots and Farias. The Farmers, who purchased *Pich Kakra* on credit, were bound to sell their product to respective Farias or Depot owners at 20-50 Tk less than the market price. About 37% farmers took a loan (locally called *Dadon*) from either depot or faria for managing capital to culture crab in their farm in a condition to sell their entire product to them.
Faria	Farias or Middlemen purchase undergrad/underweight crab from the depot and sell it to the farmer. Again, they buy fattened crab from the farmer and sell it to the depot. Thus, they make a bridge between farmers and depot. Most of the farias (87%) were found to do crab farming along with the profession as faria/middleman. Both give and take pattern was

	observed in case of the loan (locally called *Dadon*). About 57% of Farias gave *dadon* to Farmers whereas only 13 % of them took *dadon* from the Depot owner. This financial transaction was done by only a verbal agreement with the condition to sell the entire product to respective faria or depot. Farias was found to purchase crabs from the *dadon* taker at a price of 30-50 Tk/Kg less than the regular market price.
Depot Owner	Depot owner is one of the important actors in the mud crab value chain in Bangladesh. They purchased wild crab from catchers, followed grading and supplied grade crab to suppliers for upper market. The remaining undergrad/underweight crabs were the main source of crab culture/fattening. Depots provided these undergrad/underweight crabs to farmer either directly or through faria and later purchased it either directly from the farmer or through faria. From the survey, it was estimated that 70% of depot owners involved in crab farming along with the crab business. Depot provided financial support to catcher, farmer, and faria through the means of *Dadon*. About 73% depot owner provided *Dadon* whereas only 23% of them maintain written document and the rest of them had only a verbal agreement with loan receiver to sell the entire product to them. The depot owner adjusted their due money and payback remaining money instantly or within 2-3 days later of purchasing crabs.
Suppliers	Suppliers purchase live crabs from small and large Depots and sell it to the exporter as live. They transported live crab to Dhaka by exporter's truck, but bear the transportation cost.Prior to transport the crab sorting, grading, and packaging was done at suppliers own establishment. They separated them grade wise and packed into different bamboo made basket. Each basket contains 60-80 Kg crab according to the size of the basket. The mode of transaction depends on the Exporter.
Exporters	Exporters are the last stage of the domestic marketing channel and play a significant role in the uplifting of the price. From the survey, it was found that 78% of exporters purchased crab from Suppliers both in cash and credit basis. After procurement, crabs were finally sorted, graded and packed in bamboo baskets in the Exporters processing centers. It was reported that 100% of them had fixed offices which were located in different areas of Dhaka city like Mirpur and Uttara etc. An export was done on a consignment basis. The Exporters get order from buyers at previous evening and able to know the grade wise quantity to be sent on the following day.

3.3 Mapping of mud crab (*Scylla* spp.) value chain

In the study area, the main source of mud crabs was tidal rivers, Sundarban mangrove forest and traditional shrimp and crab farms. Both matured crabs (gonadally developed) and underweight crabs (locally called *pich kakra*) are harvested simultaneously by the catcher. It is observed that 100% of the wild crab was landed to the depot by the catcher. The initial sorting, weighing and grading was done at the depot. After that, the matured crab was found to send upper market through supplier and underweight crab was found to send to farmer directly or through faria. About 78.4% crab of entire wild harvest was accounted to send to the supplier. As each fishing trip was 8-10 days long, some crabs were found to be rejected as either leg was broken or carapace was broken or dead too. It is estimated that about 3.1% of mature low quality crabs were sent to local market due to chance of rejection.

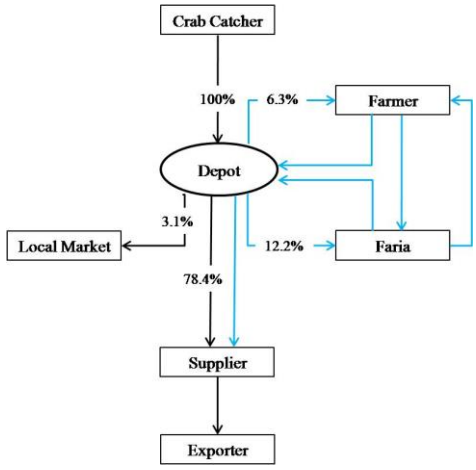


Fig 4: Mapping of mud crab (*Scylla* spp.) value chain

About 18.5% of entire wild catches reached to farmers either directly or through faria. About 6.3% wild crabs were accounted to go farmer directly from the depot whereas 12.2% wild crabs were accounted to go farmer through faria. After farming/fattening crabs farmers sell their products to respective depot or faria from whom they purchased *pich kakra*. It was estimated that about 37% of the Farmers collect mud crab from Depots, 43% collect it from the Farias and 20% collect it from both depot and faria. It is also observed that, larvae crab entered into shrimp farms along with the tidal water through inlet channels. Those crabs were cultured simultaneously with shrimps and after maturation; it was harvested from the farms.

3.4 Business dynamics of mud crab

3.4.1 Grading and pricing system

From the survey, it is revealed that the price of the mud crab depends on sex, size, gonadal development and international demand. Therefore, mud crab traders used 5 types of grading for the male crab, namely extra-extra-large (XXL), extra large (XL), large (L), Medium (M) and small (SM), whereas 4 grades were observed for female crab namely FF1, F1, F2 and F3. The market price was determined by exporter based on international demand and international market price, and this price was transferred to the depot through the supplier. The fluctuation of price varies from 300 to 2800 Tk/Kg depending on sex, size, season and international demand. Field survey revealed that the highest price was 2800 Tk/Kg for FF1 crab in January and February of 2018. During New Year of China the price goes apex as China is biggest importers of Bangladeshi crab. The price of both male and female crab according to different grade was observed and displayed in the following table 1.

Table 1: Current market price (Depot price) in the month of July-August/2018

Sex	Size	weight	Depot Price (Tk/Kg)
Male	XXL	>500	700
	XL	>400	600
	L	>300	500
	M	>200	400
	SM	<200	300
Female	FF1	>200	700
	F1	>180	600
	F2	>150	500
	F3	>120	400
Pich kakra		8-12 pcs/kg	180-200

3.4.2 Value addition and Cost-profit analysis

Table 2 demonstrates that with the increase of intermediaries, the average selling price and total cost had been increased. Figure 5 shows the distribution of value addition (%) for farmed crab by all actors of mud crab value chain. Here, the value was accounted for *pich kakra* and XL crab as pich kakra grew to on an average XL size after farming 60-75 days at farm level. From the study, it was found that the undergrad/underweight crab (locally called *pich kakra*) was harvested as a kind of by catch during wild crab harvesting. The analysis has shown that the total value added by different actors was 767 Tk/Kg.

Table 2: Distribution of value addition, gross profit margin and mark up

Particulars	Catcher	Depot	Faria	Farmer	Faria	Depot	Supplier	Exporter
Selling price(Tk/kg)	153.67	179.33	201.67	498.00	524.00	554.67	674.33	898.00
Input cost	131.00	153.67	179.33	201.67	498.00	524.00	554.67	674.33
value addition (Tk/Kg)	22.67	25.67	22.33	296.33	26.00	30.67	119.67	223.67
value addition (% of total)	3%	3%	3%	39%	3%	4%	16%	29%
Others Cost	0	3.73	2.70	202.00	3.90	9.73	20.67	146.00
Total cost	131.00	157.40	182.03	403.67	501.90	533.73	575.33	820.33
Gross profit (Tk/Kg)	22.67	21.93	19.63	94.33	22.10	20.93	99.00	77.67
Gross profit margin (%)	15%	12%	10%	19%	4%	4%	15%	9%
Mark up (%)	17%	14%	11%	23%	4%	4%	17%	9%

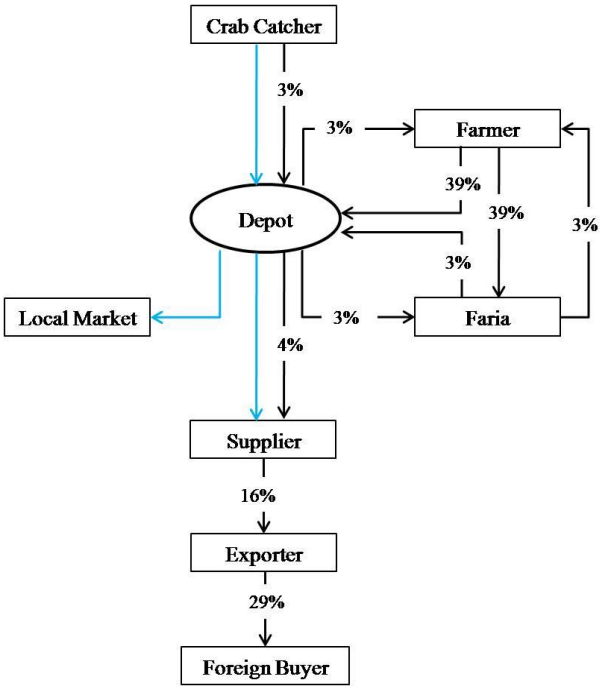


Fig 5: Percentage of added value in mud crab value chain

The highest added value was 296.33 Tk/kg (39% of total value addition) which was added by Farmers.The lowest added value was 22.67 to/Kg which was added by Crab catcher. Value was added twice at depot and faria; at first when *pich kakra* goes to farmer and secondly when farmed crab comes after farming. Here others cost is composed of labor cost, rent of depot/supplier/exporter, netting cost, feeding costs, fuel cost etc. at different stages. About 3% of value was added by Faria when underweight crab went to Farmers for fattening as well as when fattened crab was returned depot.

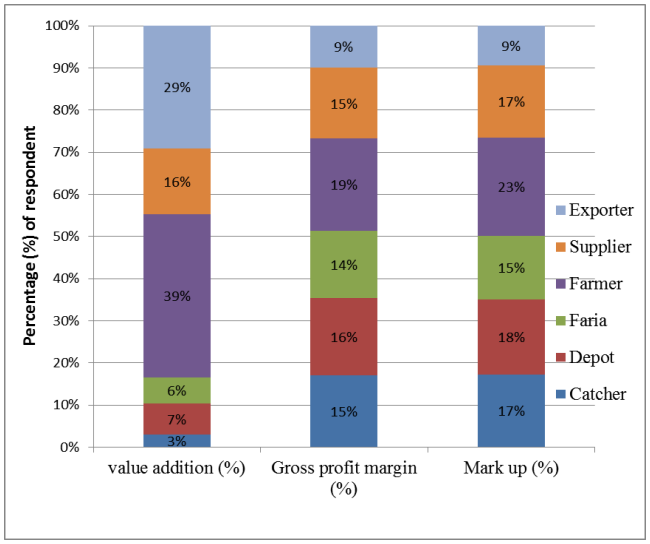


Fig 6: Value addition, gross profit and markup

Figure 6 shows the percentage of value addition, gross profit margin (%) and markup (%) in the value chain of mud crab. The study reveals that, the highest value addition (%), gross margin (%) and markup (%) was observed 39%, 19% and 23% respectively at farm level. About 3%, 7%, 6%, 16% and 29% value was added by catcher, depot, faria, supplier and exporter respective. The gross profit margin was observed 15%, 16%, 14%, 15% and 9% at catcher, depot, faria, supplier and exporter level respectively. But the markup (%) was observed 17%, 18%, 15%, 17% and 9% at catcher, depot, faria, supplier and exporter respectively.

3.4.3 Mode of payment and transportation

In the research area, the payment activity was found to depend on the mutual understanding among the actors of the mud crab value chain. Both cash and credit payment was existed in mud crab trading. About 64% crab catchers were found to get payment in cash and the rest of them got payment within 2-3 days after the transaction. Prior to payment, the advance money was deducted from total revenue. Only 13% farmers purchased *Pich kakra* on a cash basis and rest and 67% was accounted for partial cash-credit transaction. It was observed that, only 17% faria paid cash during buying *pich kakra* and 53% farias were found to provide payment in partial cash and credit to the depot. While selling crabs, 13% and 50% of the ferries were found to get payment in cash and credit respectively, and rest 37% of them got it in both cash and credit basis. In the study areas, about 70% depot provided immediately or cash payment to buy crabs, but 30% of them also provided payment after 2-3 days. The similar pattern of payment was also observed in Supplier and Exporter level.

Generally, the Farmers transported the crabs directly to Depots or farias at small amount by little or no transportation cost. As mud crab is able to survive several days it is not necessary to use any refrigeration or other facilities during transportation. Only water was sprayed over them to keep them moist and reduce mortality. All the crabs were transported through bamboo baskets to Dhaka by truck or van or pickup. Each bamboo baskets contain 60-80kg of crab. 100% of Suppliers shared that they are bound to transport crabs through Exporter's truck and bound to pay the high transport cost. Transportation cost usually depends on volume of transport basket. It is reported that the average transportation cost was 600-650tk/80 Kg product and 400-450tk/60 kg product.

From the study, it was surprisingly observed that some crab catchers also took advance money for the fishing trip and some farmers purchased *Pich kakra* on credit even though they were able to manage capital for a fishing trip and farming cost. It was a habitual fact of them to run own business by others capital. Although they sacrificed 20-50 Tk/Kg for their product, they didn't aware of it. Rather, they tried to avoid the risk and carry the day.

3.4.4 Economic development of the actors

Although the crab sector is an emerging sector in boosting exports earning, all actors are not equally benefited. From the study it was observed that; no economic development was occurring to 67% crab catcher by crab harvesting. Even though, they are still doing it as they have no better alternative and as they have a burden of *dadon*. Only 33% catcher expressed opinion that, to some extent they are being developed by crab catching (Figure 7).

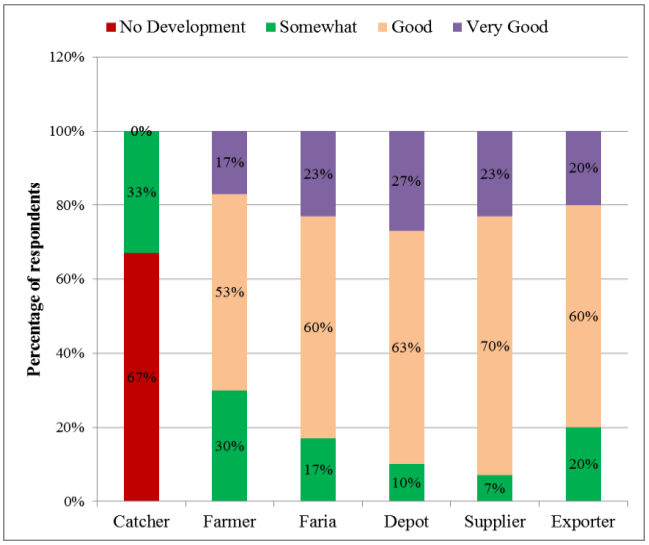


Fig 7: Actors response regarding economic development through crab business

About 30%, 17%, 10%, 7% and 20% of farmer, faria, depot owner, supplier and exporter expressed that to some extent their economic development was occurred by crab business. About 53%, 60%, 63%, 70% and 60% of farmer, faria, depot owner, supplier and exporter had a good experience as the economic development of crab sector. Only 17%, 23%, 27%, 23% and 20% of farmer, faria, depot owner, supplier and exporter expressed that crab business is very good to them for economic development. It was observed that; crab catcher was the worst sufferer in the mud crab value chain.

3.5 Constraints of mud crab (*Scylla* spp.) value chain

A couple of factors that is hindering the prospects of the mud crab industry are identified through direct interview and Focus Group Discussion (FGD) with farmer, faria and depot and Key Informant Interview (KII) with a wide range of expert people. Lack of capital, robbery, low price from faria/depot, no crab exporting regulation, no subsidy like shrimp were identified as the main challenge faced by the actors of mud crab industry. Table 3 shows the major constraints faced by actors in mud crab business in the study area.

Table 3: Major constraints of mud crab value chain

Value chain actors	Problems	Response
Crab catchers	Low harvest/low catch	77%
	Robbery/insecurity	100%
	Cheated in grading and pricing	67%
	Lack of market information	60%
	Lack of operational cost	87%
Crab Farmers	Low price from farias/depots	100%
	Lack of capital	67%
	Lack of technical knowledge	100%
	Lack of market information	40%
Farias	Lack of hatcheries	100%
	Lack of technical knowledge	83%
	Lack of government support	40%
Depot owners	High rate of rejection due to poor quality	77%
	Lack of government support	67%
	Ransom for robbery of Dacoit	77%
Suppliers	Lack of sufficient supply during high demand	67%
	High Transportation cost	90%
	High rate of Rejection	83%
Exporter	No crab exporting regulation	100%
	No subsidy like shrimp export	100%
	Fee 4 Tk/Kg to take NOC	80%
	Lack of processing industry and factory	60%
	High Transportation cost	70%

4. Discussions

The study was conducted to analyze value chain of mud crab *(Scylla spp.)*. It reveals that, China is the largest importer of Bangladesh mud crab (both for live and frozen crab). However, the market of Bangladeshi frozen crab is developing in Australia, the USA, the UK, etc. Several studies examined global crab markets and concluded that the market was very large and increasing. Brien and Miles (1994) [11] found that China, the USA, Japan, Korea, and Thailand are top five consumers of crab. Therefore, policy makers should ensure a good trade relationship with these countries to boost up export earnings.

This study helps to identify a series of actors in mud crab value chain in the study area, i.e. catcher, farmer, faria, depot owner, supplier, and exporter. The number of actors is proportionally related to end price of crab as value is added in each stage within value chain. Ladra and Lin (1991) [12] also concluded that end price of a product usually depends on number of actors involved in a value chain. Therefore, number of actors in mud crab value chain should be reduced to ensure better profit for producer groups.

This study also helps to map existing value chain of mud crab in the study area as well as distribution of profit margin among the actors. The actors were found to enjoy almost 15% gross profit in doing mud crab business. This study found that, the total cost was 403.67 Tk/kg and gross profit was 94.33 Tk/kg at farm level. Hasanuzzaman *et al*., (2014) [13] summarized that the net return was higher in Satkhira (12,379.38 Tk per acre) while 9,912.21Tk per acre in Bagerhat and 6,294.83 Tk per acre in Khulna. Therefore, this sector offers a new window for the progressive entrepreneur to invest in this sector which could boost up export earnings.

This study has identified where key intervention has to be taken to make a sustainable mud crab industry. The major constraints were insecurity, low price from farias/depots, virus attack, lack of hatcheries, no crab exporting regulation, no subsidy like shrimp export, dadon system etc. Islam *et al*., (2017) [14] identified natural disaster, virus attack, lack of training, lack of government loan, low-quality crab seeds as the main challenges in Khulna and Satkhira District. Technical knowledge gap of hatchery technology and farming systems and lack of entrepreneurship and investment were identified by Rahman *et al*., (2017) [15] as the major constraints of mud crab industry in Bangladesh. However, over exploitation, lack of capital, low demand in the domestic market are reported as major problems of mud crab operators of Bangladesh by Ferdoushi *et al*., (2010) [16]. All these constraints need to be addressed properly by policy makers.

This study noticeably found that, lack of operational costs forced catcher and farmers to do transaction on credit with either depot owner or faria. They are bound to make a mutual understanding with depot owner and faria and sacrificed 20-50Tk/Kg of crab. The government is enforcing Bank and other financial institution to provide loans and credit facilities to agribusiness. Whatsoever, the ultimate producer group is beyond the touch of easy credit facilities. Therefore, this study noticed policy makers to address this problem.

It was found that, catcher was the main actor of mud crab value chain as they are the only harvester from wild source and supply seed crab to farmers as well as mature crab to export market. Despite being the key actor, the catcher receives the lowest gross profit 22.67 Tk/Kg. Bain (2017) [17] also found that, catcher was unable to get actual market price and suffer most among all actors in mud crab value chain. However, they were facing some serious problems which need to be addressed soon. It is well explored that robbery and ransom during harvesting crab in Sundarban should be addressed by law and inforcing agencies. Information sharing regarding market price could be another encouragement to support crab catcher.

The findings of this study strongly indicated that increasing governmental support; formal as well as long-term policy can be an important approach to improve crab business and condition of poor crab catchers and farmers. Therefore, necessary supports from line agencies to overcome existing problems are inevitable while making formal as well as long-term agreements between crab farmers or collectors and depot owners are also required.

5. Conclusion

This research aimed to explore the insight into the value chain of mud crab. Through the value chain analysis, a framework has provided for coherent and integrated responses by actors as well as policy-makers. The value chain begins with crab catcher, farmer, moving through various intermediate trading and processing steps like faria, depot owner, supplier towards the exporter where the maximum catch is taken to them before send back the under grade catch to domestic market. The mud crab industry provides employment for many thousands of people as this sector offers a handsome rate of value added at each stage of the value chain. Due to virus attack, lack of crab hatchery, lack of knowledge and awareness etc. crab production becomes hampered. Multidimensional support should come from government, non-governmental organization, new and dynamic entrepreneurs, and research organizations to improve the sustainability of this sector in Bangladesh.

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