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Value Addition and Spatial Co-Integration Analysis of Shrimp in Some Selected Areas of Bangladesh

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Abstract
A study was undertaken to examine the marketing system value chin analysis of shrimp in selected areas of Khulna district of Bangladesh during the month of May-June 2012. The objectives of the study were to estimate costs and margins, and to test market integration of shrimp. Primary and secondary data were used for this study. The higher marketing cost was incurred by aratdars and the lowest by retailer. On the other hand, retailers earned the highest net marketing margins. Analysis of market integration shows that Shrimp market in Bangladesh was well integrated. The findings of the study revealed that the marketing of Shrimp was a profitable business and some recommendations were provided for the improvement of Shrimp marketing in the country.
Keywords: Engle Granger Co-Integration, Value Chain, Market Integration, Marketing Cost and Margin.

INTRODUCTION

The economy of Bangladesh has benefited enormously from the rapid development of the aquaculture production, in particular from shrimp cultivation. The economic benefits are paralleled with substantial environmental, natural resource and health effects that can be attributed to shrimp farming. The ultimate aim of our research program is to identify those types of shrimp enterprises that have large economic returns but modest environmental, natural resource and health impacts, so that they can serve as a model for sustainable development. The economy of Bangladesh can benefit enormously from increased shrimp cultivation. Therefore, the tradeoff between the micro and macroeconomic benefits and the environmental impacts of shrimp farming needs to be examined.The role of fisheries in Bangladesh in supplying animal protein, in providing employment, in earning foreign exchange and in supporting multifarious ancillary industries at the rural levels is well-known. The total annual fish production is estimated at 2.90 million tonnes in 2009-10 (Bangladesh fiscal year: 1 July-30 June), of which 1.35 million tonnes (46.62%) are obtained from inland aquaculture, 1.02 million tonnes (35.53%) from inland capture fisheries, and 0.52 million tonnes (17.85%) from marine fisheries (DoF, 2010). The main production systems for freshwater aquaculture in Bangladesh are extensive and semi-intensive pond poly-culture of Indian major carps and exotic carps, which account for 80% of the total freshwater aquaculture production. The remaining 20% are mainly from catfish, tilapia, small indigenous fish and rice-fish farming (ADB, 2005). PThe fishery-based economy will, no doubt, gain even greater importance in the future. Because of the limitations of capture fisheries and the vast potential for the development of culture fisheries, most of the additional fish production, necessary for domestic consumption or for export will have to come from aquaculture. It is also felt that a large part of the surplus labour could be productively absorbed through the development of aquaculture.

The increasing demand and steadily rising price of shrimp in the international market caused a Silent revolution in brackish water aqua farming development. Once a casual activity of little economic significance, brackish water aqua farming soon emerged as a multi-million taka farming industry in a few years.All these developments took place in the private sector with very little inputs from Government. It is only since 1980, the starting year of the Second Five-Year Plan, that the contribution of brackish water aqua farming has been officially recognized. With favorable environmental conditions for brackish water aquaculture and the existence of large areas with good potential for aquaculture, the Government has given high priority to brackish water aqua farming because of the urgent needs of export and rural employment. . Thus, the present study is conducted to examine the fish marketing system, supply chain and value addition to determine the pulling factors for enhancing production, processing and marketing of different species of fishes in Bangladesh. The specific objectives of the study were to examine the existing marketing system of Shrimp, to examine cost and margins at different stages of marketing channels, to examine the price behavior in terms of seasonal price variation, to analyse the market integration of shrimp to identify the major problems of Shrimp marketing and suggest some remedial measures. Thus the study was conducted for understanding the present situation of marketing system of Shrimp in different regions of Bangladesh with following objectives.

Objectives

- To identify different marketing channels and intermediaries involved of shrimp
- To determine the extent of value addition in terms of costs in successive stages of shrimp movement
- To examine the marketing cost and marketing margin of shrimp and
- To analyse the market integration of shrimp

MATERIALS AND METHODS

The present study was conducted based on field survey method wherein primary data were collected from the respondents. Secondary data was collected from journals, thesis and raw data from monthly bulletin of Directorate of Agricultural Marketing (DAM) and District Fisheries Office. In Khulna district there were a number of successful shrimp producers, trader's i.e.*Aratdar*, *Bepari*, LC (Letter of Credite) paiker**,** *Paiker* and retailer etc. The study area is confined to one Upazilas namely KhulnaSadar in Khulna district, where the cultivation of shrimp fish was concentrated. Purposive sampling techniques were used for selecting the sample. Total sample size of the study was 100 .Selected samples consisted of 20 fish farmers and 80 traders. The intermediaries dealing with shrimp marketing were categorized into three groups, namely, *Aratdar*, *Paiker Depot owner*, Processing *plant* and retailer. From different stages of fish marketing, 10 *Aratdar*s 8 LC (Letter of Credite) paiker, 5 *Depot owners*, 7 Processing *plant* 10 *Paiker*s and 40 retailers were selected as respondents for the study. The weekly average wholesale prices of Shrimpof various markets like Dhaka,Chittagong, Sylhet,Khulna,Rajshahi and Mymensingh during 1995 to 2012 were collected from Department of Agricultural Marketing (DAM). Latter it was converted into monthly figures.

Analytical Techniques

The following techniques were used for the analysis.

Percentages of total value addition cost/net profit calculated =

$$\frac{\text{Marketing cost/ Net marketing margin}}{\text{Tota marekting cost/ net marekting margin}} \times 100$$

Determination of market integration through Engle and Granger co-integration method

Farmer's net prices were calculated by using following formulas:

Farmer's net price = Farmer's sale price - Farmer's marketing cost

Market Integration: The main objective of price policy is to safeguard the interests of producers and consumers. The producer's interest can best be safeguarded if he is paid appropriate price for his product. He gets fair prices if markets are well integrated. The basic idea behind the measurement of market integration is to understand the interaction among prices in spatially separated markets (Goletti and Babu, 1994, pp. 311-325). Thus integrated markets are defined as markets in which prices of differentiated products do not behave independently (Monke and Petzel, 1984, pp. 401-487).

If price movement of a commodity in one market is completely irrelevant to forecast price movements of the same commodity in other markets, the markets are characterized as segmented (Kumar and Sharma 2003, p. 203). In well integrated markets, middlemen's share should be reasonable and consumers get produce at fair price. So it is very important to understand whether commodity markets function efficiently. Markets function efficiently when these are integrated in price relationships and it is also imperative to see whether infrastructural and technological development in communication system has improved the functioning of commodity markets.

Measurement of Market Integration by Co-integration Method: The bulk of econometric theories have been based on the assumption that the underlying data process is stationary a) stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed (Gujarati, 2003, p.797). In practice, most economic time series are non-stationary. Applying regression models to non-stationary data may arise the problem of "spurious or nonsense" correlation (Gujarati, 2003, p. 792). If the time series data like prices, which are non-stationary, are used, it usually would yield a high R^2 and 't' ratios which are biased towards rejecting the null hypothesis of no relationship between the variables concerned. To overcome such problems, the concept of co-integration was used becauseit offers a means of identifying and hence avoiding the spurious.

In a high inflationary situation like Bangladesh, use of nominal price to use in estimation to correlation coefficient (pair wise) would be misleading as the force of inflation over the years for which, estimated coefficients may tend to show high degree of association between pair of prices of two markets. So, other advanced method of assessing market integration like co-integration method was also needed and that was used in this study. The underlying principle of co-integration analysis is that, although trend of many economic series show upward or downwards over time in a non-stationary fashion, group of variables may drift together.

Unit Root and Co-integrationTest: The individual price series were tested for the order of integration

to determine whether they are stationary which is known as the unit root test (Gujarati, 2003, p.799). A number of tests for stationarity are available in the literature; these include the Dickey-Fuller (DF) test (Dickey and Fuller,1979),the Augmented Dickey-Fuller(ADF) test (Dickey and Fuller,1981)and the Philips-Perron(PP) test (Perron,1988). For theoretical and practical reasons, the Dickey–Fuller test is applied to regressions run in the following forms:

$Y_t$is a random walk or without constant:

$$\Delta Y_t = \delta Y_{t-1} + e_t \quad \ldots\ldots (1)$$

$Y_t$is a random walk with drift or constant:

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + e_t \quad \ldots\ldots (2)$$

$Y_t$is a random walk with drift around a stochastic trend (constant plus trend):

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + e_t \ldots\ldots (3)$$

Where t is the time or trend variable.

In each case the *null hypothesis* is $\delta = 0(\rho = 1)$; that is, there is a unit root, that meanst the time series is non-stationary. The alternative hypothesis is that δ is less than zero; that is, the time series is stationary. Under the null hypothesis, the conventionally computed t statistics is known as the τ (tau) statistic, whose critical values have been tabulated by Dickey and Fuller. If the null hypothesis is rejected, it means that Y_t is a stationary time series with zero mean in the case of (1), that Y_t is stationary with a non-zero mean [$= \beta_1/(1-\rho)$] in the case of (2), and that Y_t is a stationary around a deterministic trend in equation (3).

It is extremely important to note that the critical values of the tau test to test the hypothesis that $\delta = 0$, are different for each of the preceding three specifications of the DF test. If the computed absolute value of the tau statistics (τ) exceeds the DF or MacKinnon critical tau values, we reject the hypothesis that $\delta = 0$, in which case the time series is stationary. On the other hand, if the computed (τ) does not exceed the critical tau value, we do not reject the null hypothesis, were the time series is non-stationary.

In conducting the DF test as in (1), (2), or (3), it was assumed that the error term $e_t$was uncorrelated. But in case the e_t are correlated, Dickey and Fuller have developed a test known as the augmented Dickey-Fuller (ADF) test.

This test is conducted by "augmenting" the preceding equation by adding the lagged values of the dependent variable ΔY_t. The ADF test here consists of estimating if the error term $e_t$is auto correlated, one modifies (4) as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad \ldots\ldots (4)$$

where ε_t is a pure white noise error term and where, $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, etc., that is, one uses lagged difference terms. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (4) is serially uncorrelated. The null hypothesis is still that $\delta = 0$ or $\rho = 1$, that is, a unit root exists in Y (i.e., Y is non-stationary).

Spatial Price Relationship: To test the market integration, the following co-integration regression was run for each pair of price series:

$$Y_{it} = \alpha_0 + \alpha_1 Y_{jt} + \varepsilon_t \quad \ldots\ldots (5)$$

Where, Y_i and Y_j are price series of a specific commodity in two markets i and j, and ε_t is the residual term assumed to be distributed identically and independently. The test of market integration is straightforward if Y_i and Y_j are stationary variables but if the price series proved as non-stationary then we have to done another test (Engle-Granger test)

Testing whether the variables are co-integrated is merely another unit root test on the residual in equation (5). However, since the Y_i and Y_j are individually non-stationary, there is the possibility that the regression is spurious. The DF and ADF tests in the present context are known as Engle-Granger (EG) test whose critical values was provided by Engle-Granger (Ramakumar, 1998). The test involved regression the first-difference of the residual lagged level and lagged dependent variables (Engle-Granger test) is as follows:

For Engle-Granger (EG) test, $\Delta\varepsilon_t = \beta \varepsilon_{t-1}$ …………………. (6)

If the computed value of 't' of regression coefficient β is higher (in absolute term) than tabulated value, our conclusion is that the residuals from the regression are I (0), that is they are stationary and the regression is not spurious even though individually two variables are non-stationary.

RESULTS AND DISCUSSION

MARKETING PRACTICES

Buying and selling

In the study areas, the whole marketing of shrimp has been broken down into various functions such as buying and selling, transportation, grading, storaging, weighing, financing, market information and pricing. The activities involved in the transfer of goods are completed through buying and selling functions. *Aratdar*s do the

functions of negotiation between buyers and sellers of shrimp and help them at their own business premises on receipt of commission. They do not take the ownership of the products. Shrimp farmers sell 5% of their shrimpes to *farias;* 50% to *beparis*, 15% to *paikers* and 5% to retailers via *aratdar* and 25% to depot owners. *Farias* sell 60% to depot owners and 40% to retailers via *aratdar*. Depot owner and *bepari* each sell 100% of their shrimp to account holders. *Paikers* sell 100% of their shrimpes to retailers via *aratdar*. Account holders each sell 100% shrimp to processing plant owners and world market (export) respectively. Retailers sell the entire shrimp to ultimate consumers. Shrimp *farias* purchase 100% shrimp from farmers. Depot owners purchase 40% shrimp from farmers directly, 20% from *farias* and 40% from farmers via *aratdar*. *Paiker* and *bepari* purchase 100% shrimp from farmers through *aratdar*. Account holders purchase 30% shrimp from farmers, 50% from *beparis* and 20% from depot owners. Retailers purchase 80% from *beparis* and 20% from farmers via *aratdar*. Consumers purchase 100% of shrimp from the retailers in the study area (Table 1).

Table 1. Percent of shrimp/prawn transacted by value chain actors

Value chain actor	Purchase from (%)						
	Farmer	*Faria*	Farmer via *Aratdar*	*Bepari*	Depot owner	AC Holder	Retailer
Faria	100	-	-	-	-	-	-
Depot owner	40	20	40	-	-	-	-
Paiker	-	-	100	-	-	-	-
Bepari	-	-	100	-	-	-	-
A/C Holder	30	-	-	50	20	-	-
Processing plant	-	-	-	-	-	-	-
Retailer	-	-	20	80	-	-	-
Consuer	-	-	-	-	-	-	100

Value chain actor	Sold to (%)							
	Faria	Retailer via *Aratdar*	*Bepari* via *Aratdar*	*Paiker* via *Aratda*	Depot owner	AC holder	Processing plan	Consumer
Farmer	5	5	50	15	25	-	-	-
Faria	-	40	-	-	60	-	-	-
Depot owner	-	-	-	-	-	100	-	-
Paiker	-	100	-	-	-	-	-	-
Bepari	-	-	-	-	-	100	-	-
A/C Holder	-	-	-	-	-	-	100	-
Processing plant	-	World market	-	-	-	-	-	-
Retailer	-	-	-	-	-	-	-	100

Source: Field survey, 2012.

Grading

Grading is the basic function of sales transactions and is defined as the classification of products according to some standards or measures (Kohls and Uhl, 2005; p. 314). Grading is the sorting of produce into different market quality which facilitates exchange by simplifying buying and selling as it makes the sale by showing sample and description possible. It also simplifies the concentration process and makes easier and less costly the movement of goods through the marketing channel. Grading facilitates sale since different sizes of Shrimp have different prices. In Bangladesh, all intermediaries' grade shrimp on the basis of weight However, Grading system of shrimp is different from other species. Here grading is based on number of pieces to make one kg. In case of golda, it starts from U-5 (under 5) meaning ≤ 5 pieces of golda to make one kg, and bagda starts from 8/12 meaning that 8 to 12 pieces comprise one kg.

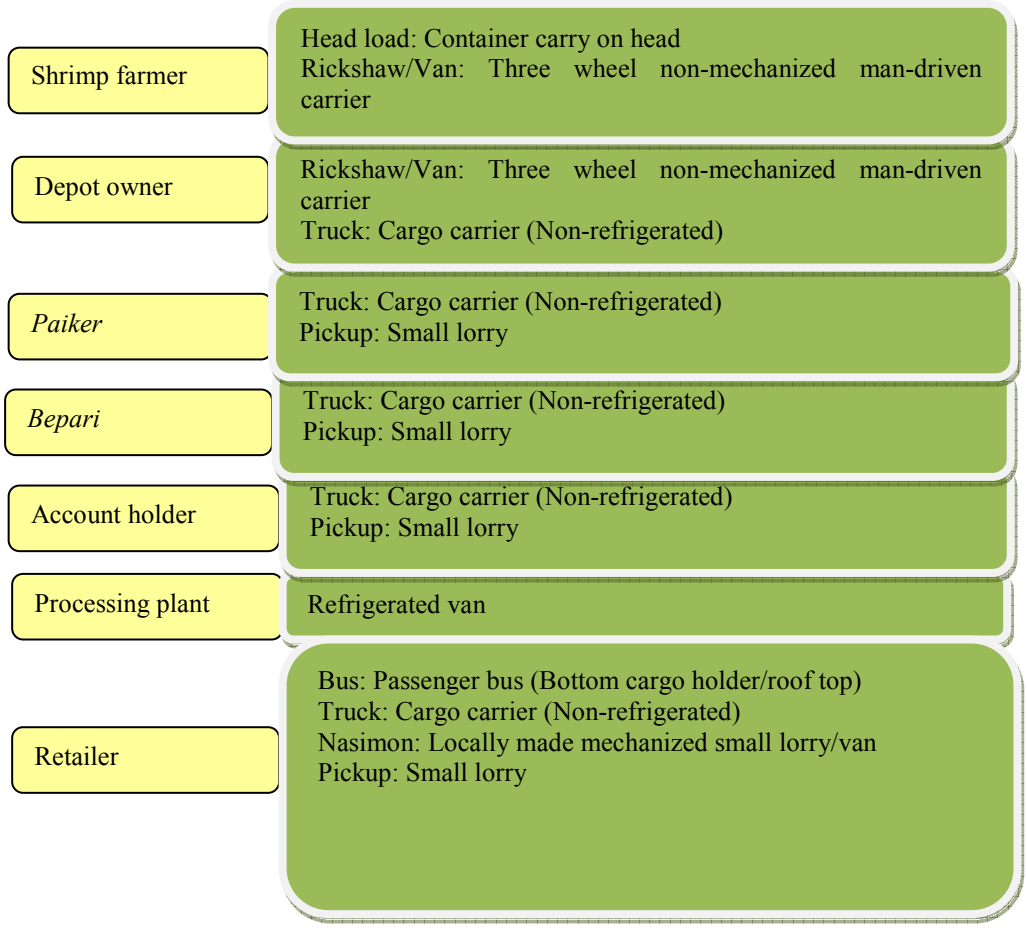
Storage

The storage facilities help buyers and sellers to reduce the wide fluctuation of prices between peak and lean seasons. The storage function is primarily concerned with making goods available at the desired time and enables traders to receive better prices for their products. Because of high perishability, shrimp requires extremely specialized storage facilities matching the seasonal demand. Only the processing plants in the shrimp industry use proper storage systems for export to the world market. Other intermediaries use only ice to transport shrimpes from one place to another. Though all intermediaries use ice during marketing, their use of ice in shrimp is not scientific for which quality of shrimp gets affected. While retail selling, some use ice and some do not

Transportation

In the study areas, the shrimp farmers and intermediaries use various modes of transports such as van, rickshaw, truck, passenger bus, pickup, *Nasimon* (locally made pick-up type van for transporting passengers and goods), head load etc, to transfer product from the producing areas to the consumption centre. Figures 1show different modes of transport used by the intermediaries to transport shrimp from one place to another.

Figure 1. Mode of transport used by farmers and intermediaries for movement of shrimp



Financing

The financing function is the advancing of money by someone to carry on the business. For effective operation, financing is of crucial importance in the whole marketing system of shrimp. The source of finance for the value chain actors in the study areas are shown in Table 2 shows that in the case of shrimp, most of the farmers, *aratdar*, *bepari* and retailers are self-financed. Depot owners use a combination of own funds, bank loans, NGO and *aratdars* for shrimp marketing. Only 20% of depot owners procure loans from banks while 5% and 3% received from NGOs and *dadon* giving *aratdars* respectively. However, a majority of depot owners use their own fund for the business. 34% of the *paikers* take *dadon*

Table 2. Sources of finance of shrimp farmers and intermediaries

Sources of finance	***Market participants (%)***							
	Farmer	Depot	*Aratdar*	*Paiker*	*Bepari*	A/C holder	Processing plant	retailer
Own fund	78	72	100	64	91	70	43	100
Bank	0	20		0	0	30	57	
NGO	7	5		2	0			
Friend and relatives	1	0		0	0			
Dadon from *Aratdar*	14	3		34	9			

Source: Field survey, 2012.

Market Information

Market information is a facilitative function required for efficiently operating marketing system. In the study area, visiting the markets and use of telephone/mobile phones are the most common sources of collecting market information for all value chain actors. Table 11 shows that fellow traders are also a common source of market information for all types of value chain actors except processing plants. These and LC *paikers* mainly depend on email/internet to gather market information from *aratdar* besides their own funds to run their businesses. Account holders partly and processing plant owners mostly depend on bank loans to accelerate the business operations.

Table 3. Sources of market information for farmers and intermediaries

Sources of market information	Market participants (%)								
	Farmer	Depot owner	*Aratdar*	*Paiker*	Retailer	LC *paiker*	*Bepari*	A/C holder	Process-ing plant
From market	80		58	73	92	40	71	80	50
Fellow traders	51		45	43	25	20	29	20	0
Email/Internet	0		0	0	0	80	0	0	100
Telephone/ mobile	60	100	90	87	55	100	100	100	100

Source: Field survey, 2012.

Packaging

Packaging may be defined as the general group of activities in product planning which involves designing and producing the container or wrapper for a product (Stanton, 1991). Packaging is essential for proper transportation of shrimp. 'Box' made of cork sheet is widely used by A/C holders and processing plant owners in shrimp. Different sizes of packaging materials along with their capacities are shown in table 4.

Table 4. Packaging practices of shrimp marketing in Bangladesh

Packaging practices	Using materials	Capacity	Used by
Basket	Bamboo, Rope and Polythene	40 kg 20 kg	Farmer, *Paiker* and Retailer Retailer
Drum	Plastic	40 kg 20 kg	Farmer, *Paiker* Retailer
Crate	Plastic, Polythene	40 kg	Depot owner (shrimp), *Paiker*, *Bepari*, Account holder (Shrimp), Retailer
Steel box	Steel sheet	250 kg	*Paiker*, *Bepari* (hilsha)
Wooden box	Wood, Polythene	160 kg	*Bepari*, *Paiker*,
Box	Cork sheet	40 and 20 kg	Account holder, Processing plant (shrimp)

Source: Field survey, 2012.

Pricing

In the study areas, all intermediaries are involved in buying and selling of shrimp. Depot owners, *bepari* and AC holders of shrimp marketing chain follow prefixed prices set by the processing plant. Farmer, *aratdar*, *paiker*, LC *paiker,* and processing plants practice open bargaining, auction and going market prices method for fixing price of their products in varying degree. Cent percent of the retailers follow open bargain for selling their shrimp to consumers (Table 5).

Table 5. Pricing methods followed in selling shrimpes in Bangladesh

Pricing methods	Market participants (%)								
	Farmer	Depot owner	*Arat-dar*	*Paiker*	Retailer	LC *paiker*	*Bepari*	A/C holder	Process-ing plant
Open bargaining	29	0	10	53	100	20	30	0	99
Auction	60	0	99	37	0	40	0	0	0
Based on going market prices	29	0	0	30	0	80	70	0	15
Prefixed prices	0	100	0	0	0	0	100	100	0
Cost-plus method	0	0	0	0	0	0	0	0	0

Source: Field survey, 2012.

Shrimp Marketing Channels

Shrimp is sold in both domestic and overseas market. Major supply chains of shrimp in the study areas are shown below:

Overseas Value chain

Value chain – I	Shrimp Farmer – *Aratdar* – *Bepari* – Account Holder – Processing plant – Consumer
Value chain - II	Shrimp Farmer – Depot owner – Account Holder – Processing plant – Consumer
Value chain - III	Shrimp Farmer – Account Holder – Processing plant – Consumer

Domestic value chain

Value chain - IV	Shrimpermen – *Aratdar* – Retailer – Consumer (Local market)
Value chain – V	Shrimp Farmer – *Aratdar* – *Paiker* – Retailer – Consumer (Distant market)

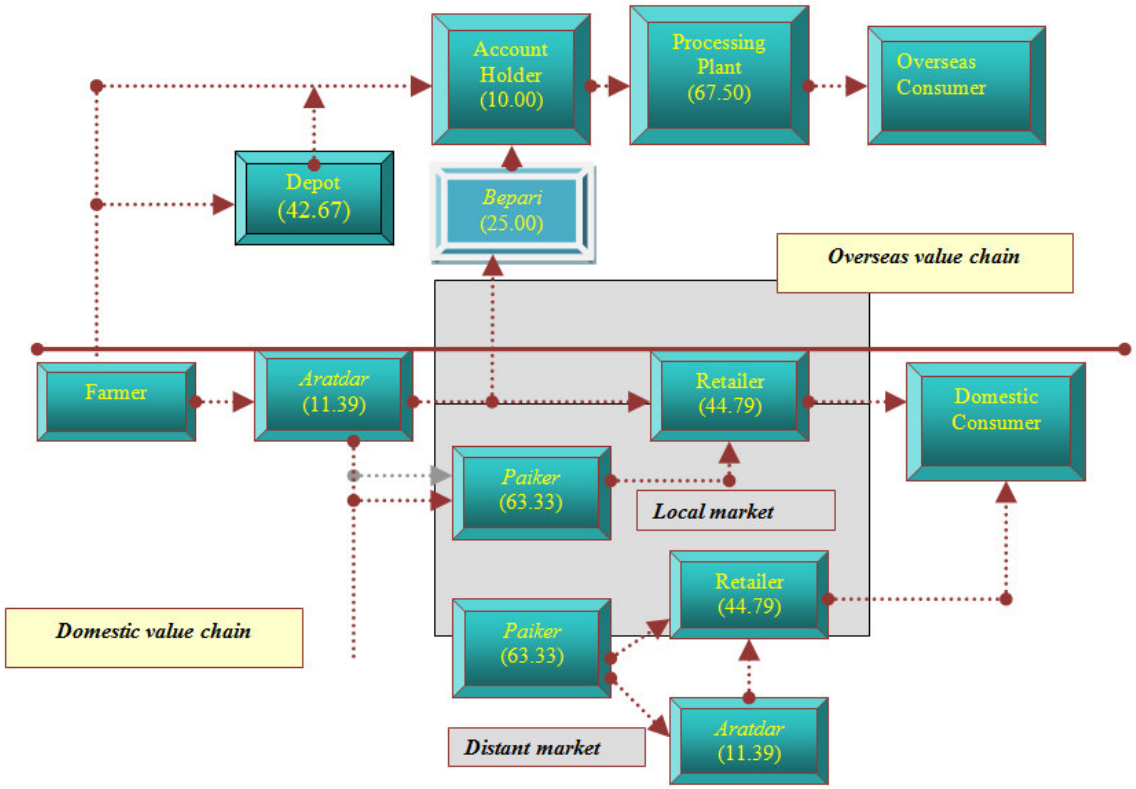


Figure 2. Value chain of shrimp in Bangladesh

Value Addition Costs by Different Actors

The cost incurred to transport the product from producers to consumers is ordinarily known as marketing cost. In other words, the cost of marketing represents the cost of performing various marketing functions (Kohls and Uhl, 2005; p.96). Marketing costs are incurred when commodities are shipped from the farm to the final market. Intermediary-wise marketing costs are discussed below:

In case of shrimp marketing system, the highest value added cost is incurred by farmers (Taka 1193.35) per maund. The second and third highest costs are incurred by *paikers* (Taka 1116.47) and the processing plants (Taka 1050.26) respectively. The *paiker* in shrimp marketing system operates at the local producing markets as well as in the inter district consuming markets. Here, *beparis* have no *aratdari* commission because *beparis* sell all of their shrimp to account holders. Shrimp marketing system is clustered around the commission agent 'account holder'. The major cost item is *aratdar's* commission for farmers' and *paikers*. Transportation cost is the highest cost item for depot owners, *beparis* and retailers. Wages and salaries are the major cost item for *aratdars* and processing plants respectively. Icing is the major cost for A/C holder for shrimp marketing system in the study area. *Aratdar's* commission (35.25%) constituted the highest cost in shrimp/prawn marketing. (Table 6).

Table 6. Total marketing cost of different intermediaries involved in shrimp marketing (per maund)

Cost items	Farmer	*Aratdar*	Depot owner	*Paiker*
Aratdar's commission	1017.24	-	-	758.96
Transportation	36.40	-	190.40	138.93
Baskets	73.03	-	40.00	40.00
Icing	-	-	52.10	76.34
Wage	-	90.95	164.64	70.51
Salaries	-	34.67	145.61	-
House rent	-	17.50	18.81	-
Electricity	-	5.87	6.36	-
Telephone bill	15.03	46.38	19.63	11.81
Personal expenses	51.65	40.52	58.33	19.90
Packaging for export	-	-	-	-
Storage	-	-	-	-
Tips and donation	-	11.89	5.20	-
Wastage	-		-	-
Others	-	6.70	-	-
Total	1193.35	254.48	701.08	1116.47

Source: Field survey, 2012

Table 6. Total marketing cost of different intermediaries involved in shrimp marketing (per maund)..... Contd.

Cost items	*Bepari*	A/C holder	Processing plant	Retailer	Total
Aratdar's commission	-	-	-	-	1776.20 (35.27)
Transportation	162.67	53.28	237.50	102.35	921.53 (18.30)
Baskets	50.00	11.34	7.32	10.00	231.69 (4.60)
Icing	44.00	73.70	20.80	62.45	329.39 (6.54)
Wage	14.00	10.31	172.62	-	523.03 (10.39)
Salaries	-	15.17	545.63	-	741.08 (14.72)
House rent	-	1.35	-	2..21	37.66 (0.75)
Electricity	-	0.89	281.75	3.26	298.13 (5.92)
Telephone bill	4.67	2.42	8.63	21.15	129.72 (2.58)
Personal expenses	4.33	4.35	2.46	10.91	192.45 (3.82)
Packaging for export	-	-	4.92	-	4.92 (0.10)
Storage	-	-	3.81	-	3.81 (0.08)
Tips	-	0.33	-	-	17.42 (0.35)
Wastage	-	-	2.32	34.23	36.55 (0.73)
Others	-	-	-	7.60	14.30 (0.28)
Total	279.67	173.16	1050.26	267.72	5036.19 (100.00)

**Figures in the parentheses indicate percentages of total cost. 1 maund = 40kg*
Source: Field survey, 2012.

Marketing Margin

Average net marketing margins of all intermediaries for Shrimp are given in Table 7. Farmer average marketing cost is Taka 1193.35 per maund. Among all intermediaries, profit of the processing plant is the highest of Taka 1649.74 per maund followed by retailers (Taka 1523.95), *paiker* (Taka 1416.86), depot owner (Taka 1005.72) and *bepari* (Taka 720.33). *aratdars* and A/C holders earn apparently less profit than other intermediaries in

shrimp marketing system because they only charge the fixed amount of commission against their volume of business. However, *aratdars* and A/C holders perform a large volume of business everyday so their total profit is not less than that of other intermediaries except for processing plant owners. Processing plant owners create very high value addition for export buyers so definitely they gain more profit than other intermediaries in shrimp marketing system in Bangladesh.

Table 7. Average net marketing margin of different intermediaries for shrimp marketing (Tk/maund)

Intermediaries	Purchase price	Sale price	Gross marketing margin	Marketing cost in	Net marketing margin
Farmer	-	21560.00	21560.00	1193.35	20366.65
Aratdar	-	-	455.65	254.48	201.17
Depot owner	21760.00	23466.80	1706.80	701.08	1005.72
Paiker	17866.67	20400.00	2533.33	1116.47	1416.86
Bepari	23800.00	24800.00	1000.00	279.67	720.33
Account Holder	-	-	400.00	173.16	226.84
Processing plant	24766.67	27466.67	2700.00	1050.26	1649.74
Retailer	24844.44	26636.11	1791.67	267.72	1523.95

Source: Field survey, 2012.

Note: Aratdar Gross margin = Average received Aratdar's commission. Gross margin = Sale price – purchase price. Net margin = gross margin – marketing costs

Distribution of Value Addition Cost and Net Profit

Table 8 shows the percentages of total value addition cost and total net profit by different intermediaries for different shrimp marketing system in Bangladesh. Farmers, in shrimp marketing, bear the major marketing cost (23.70% of total cost) because they have to pay *aratdar's* commission which ultimately increases their marketing cost.

Table 8 Percentage distribution of value addition cost and profit by intermediaries and marketing system

	Shrimp	
Intermediaries	% of total cost	% of total profit
Farmer	23.70	-
Aratdar	5.05	2.98
Depot owner	13.92	14.91
Inter district *bepari*	-	-
Bepari	5.55	10.68
Inter district *paiker*	-	-
LC *paiker*	-	-
Paikar	22.17	21.01
Account Holder	3.44	3.36
Processing plant	20.85	24.46
Retailer	5.32	22.60

Source: Field survey, 2012.

Note: Percentages of total value addition cost/net profit calculated =

$$\frac{\text{Marketing cost/ Net marketing margin}}{\text{Tota marekting cost/ net marekting margin}} \times 100$$

Intermediaries Share to Consumers' Taka

Farmers'/shrimpermen's share of different species of shrimpes is reasonable in the study areas except for shrimp shrimp. The major share (46%) of consumer Taka goes to *mahajon* in shrimp marketing system of Bangladesh. For other species farmers' share is 67%, 72% and 76% for major carp-pangas-tilapia, shrimp (overseas value chain) and shrimp (domestic value chain) respectively. The price spread is the highest in shrimp (overseas value chain) for its world market demand and the lowest in major carp-pangas and tilapia for the shortest supply chain and lower unit price than shrimp.

Table 9. Share (%) of intermediaries to consumer's Taka by distribution channel

Intermediaries	Shrimp	
	Overseas value chain	Domestic value chain
Farmer	72	76
Mahajon	-	-
Aratdar	4	4
Paiker	-	10
Bepari	4	-
Account Holder	10	-
Processing plant	10	-
Retailer	-	7
Price spread (Tk/kg)*	177.50	156.74

Source: Field survey, 2012. *Equals Farmer's net price/margin received minus retailer's sale price in per kg terms*

Spatial Price Relationship

Market Integration

The degree of interrelationships between price movements in two markets is called market integration. In other words, in an integrated market, price of a homogeneous commodity at different spatially separated locations should tend to move together indicating efficient spread of price information and inter-linkages of markets. In interlinked commodity market price movement in one location should be highly correlated with price movement in other locations.

Integration by Co-integration Method

To avoid the problem of spurious correlation between time series variables especially price variable, co-integration method was used which was developed by Engle and Granger (1987) for making firm decisions on market integration. The valuable contribution of the concepts of unit root, co-integration, is to force to find out if the regression residual are stationary (Gujarati, 2004, p. 822). As Granger (1987), notes, "A test for co-integration can be thought of as a pre-test to avoid spurious regression situations." An intuitive explanation of the main concepts of co-integration analysis is that prices move from time to time, and their margins are subject to various shocks that drive them apart or not. If in the long run they exhibit a linear constant relation, it can be said that they are co-integrated. Granger representation theorem (Engle and Granger, 1987) tests that if a set of variables are co-integrated or integrated of order 1, denoted by I (1), there exists a valid error correction representation of the data. For instance, price changes in one period may depend upon surplus demand of the previous period. Hence it is possible to recognize the short-run and long-run behavior through an error correction mechanism. The detail method is as follows:

Co-integration Test for Shrimp

To test the stationary of the prices of Shrimp, the DF and ADF tests for wholesale price of Shrimp were conducted. ADF test was applied in case where serial correlation exists and that could be found from the Durbin Watson statistic (d-value). The estimated tau (τ) statistic of the regression coefficient of one period lagged price, DW statistic and decision that was undertaken are presented in Table 10.

The tau (τ) statistic compared with absolute values (e.g., estimated t values 1.256, -1.971 and -1.828for Dhaka district prices which are less than the critical τ values without a constant, with a constant and with a constant and trend (-2.60,-3.51 and -4.04 at 1% level). That means the null hypothesis is accepted and concluded that the Shrimp prices of Dhaka district contained unit root that is the price series is non-stationary. Similarly, it is found that prices of Shrimp of all the selected districts are non-stationary.

The next step is to examine whether bivariate co-integration exists among different districts Shrimp prices. The researcher's aim was to find that which market's price influences others. It is normally assume that Dhaka is the reference market and it influences other markets prices. As data on prices of Shrimp for Dhaka, Chittagong, Rajshahi, Khulna, Sylhet, Khulna and Gazipur was available from DAM's weekly price report from the year of2000 to 2012, so the available data were used for the analysis. In Table 11. the results of estimated co-integration regression and the final result were presented. The Engle-Granger (EG) tests of residual or error term confirmed the stationary of the residual series for all groups of two markets.

Thus the results indicated that the residual series (which are linear combination of Shrimp price series) are stationary at level I (0). That means yet the original price series being non-stationary but their linear combination being I (0), the seriesareco-integra

Table 10: Unit Root Test (Test of Stationarity/Non-stationarity) for the Prices of Shrimp

Market	Method	Condition	Intercept	Coefficient of Pt-1	Coefficient of Δ Pt-1	Coefficient of Δ Pt-2	Coefficient of trend	d-value	Decision
Dhaka	used	used		Pt-1	Δ Pt-1	Δ Pt-2	(t)		Non-stationary
	DF	Without		0.007				2.12	
		constant		-1.256					
		With constant	27.24	-0.127 (-1.971)				2.2	
		With constant & trend	55.4	-0.248 (-1.828)			3.295	1.96	
Chittagong	DF	Without constant		0.003 (-1.251)				1.39	Non-stationary
		With constant	17.65	-0.125 (-1.628)				1.34	
		With constant & trend	39.4	-0.321 (-2.397)			2.298	2.06	
Khulna	DF	Without constant		0.004 (-0.868)				2.1	Non-stationary
		With constant	13.78	-0.176 (-1.958)				1.95	
		With constant & trend	28.008	-0.374 (-2.214)			4.981	1.81	
	ADF	1 lagged difference with trend	67.05	-0.58 (-2.417)	0.239		6.597	1.98	
Sylhet	DF	Without constant		0.006 (-1.267)				2.02	Non-stationary
		With constant	38.24	-0.137 (-1.89)				2.1	
		With constant & trend	74.36	-0.248 (-1.825)			3.239	1.98	
Gazipur	DF	Without constant		0.004 (-0.75)				2.09	Non-stationary
		With constant	25.61	-0.117 (-1.524)				1.79	
		With constant & trend	93.5	-0.28 (-1.789)			4.205	1.98	
Khulna	DF	Without constant		0.004					Non-stationary
		With constant		-1.345				1.59	
		With constant & trend	35.01	-0.128 (-1.537)				1.98	

Note: Figure within ( ) shows t-values of the regression coefficient.
Dickey-Fuller Critical values for 1% and 5% are: Without a constant: -2.60 and -1.95 respectively, with a constant: -3.51 and
-2.89 respectively, with a constant and trend: -4.04 and -3.45, respectively, for sample size 100 (Gujarati 2004, p.975).
Source: Department of Agricultural Marketing (DAM 1995-2012)

Table 11. Spatial Price Relationships between different Markets for Shrimp from May 1995 to December 2012

Markets	Co-integrating Regression	Co-integration Test Engel-Granger	Decision
Dhaka-Chittagong	P_D= 17.316+ 0.869P_C R^2= 0.891 (32.57)	ΔU_t= -0.743 U_{t-1}*** (-8.893)	Co-integrated
Dhaka-Rajshahi	P_D=3.53+ 0.985P_R R^2= 0.892 (32.664)	ΔU_t= -0.628 U_{t-1}*** (-7.632)	Co-integrated
Dhaka-Khulna	P_D= 16.202+ 0.96P_K R^2= 0.895 (33.248)	ΔU_t= -0.716 U_{t-1}*** (-8.581)	Co-integrated
Dhaka- Sylhet	P_D= 18.93+ 0.87P_S R^2= 0.886 (21.75)	ΔU_t= -0.567 U_{t-1}*** (-7.30)	Co-integrated
Dhaka-Mymensingh	P_D= 2.234+ 0.979P_M R^2= 0.884 (31.413)	ΔU_t= -0.832 U_{t-1}*** (-9.701)	Co-integrated
Dhaka-Gazipur	P_D= 12.702+ 0.978P_G R^2= 0.801 (22.90)	ΔU_t= -0.582 U_{t-1}*** (-7.27)	Co-integrated

Note: Figure within ( ) shows t-values of the regression coefficient.
Tau (τ) values (without constant) at 1% and 5% level of significance are -2.55 and -1.95 respectively in the equation.
*** indicates 1% level of significance.
** indicates 5% level of significance.
Source: Department of Agricultural Marketing (DAM 1995-2012)

As mentioned earlier, Khulna is surplus area in Shrimp production and the rest districts considered in the study are deficit area, so when price changes in this surplus area then automatically prices will changes for the other districts.

Finally, the result implies that if any divergence from long-run equilibrium occurs in period t-1, it will be adjusted towards equilibrium level in period t. Thus, the selected Shrimp markets in Bangladesh are shown to be integrated. This is mainly attributed to close proxy, good communication facilities especially development of cell phone technology and good infrastructure availabilities among the market centers in Bangladesh.

CONCLUSION

The findings of this study indicated that the marketing of Shrimp is a profitable business. Thus, the selected Shrimp markets in Bangladesh are shown to be integrated. This is mainly attributed to close proxy, good communication facilities especially development of cell phone technology and good infrastructure availabilities among the market centers in Bangladesh. It also suggests that there is wide scope for the development of Shrimp farming and trading in this country. In this study the profit of retailer was higher than that of other intermediaries. To make the business more profitable, efficient marketing system should be developed by reducing marketing cost and increasing marketing service. The government in Bangladesh needs to ensure that the proper infrastructure and necessary social capital are available for effective participation of all the market intermediaries of the seafood value chain. For better shrimp marketing, side by side with the private sector, government should also play active role in providing physical facilities like refrigerated storage, refrigerated vans, good market places with related facilities like water, ice, electricity, drainage facilities and sitting arrangements etc. Development of road networks is greatly needed, which is a responsibility of the government. Market regulations needs to be strictly followed. Monitoring to ensure shrimp quality needs to be strengthened. Similarly, it is also the responsibility of the government to see that consignment can reach the destination without requiring paying unnecessary tolls and subscriptions. The development of good road and transport networks can reduce superfluous involvement of intermediaries, which could be beneficial for both the shrimpers/farmers and consumers. Assembling centers with refrigerated storage facilities may be developed so that the perishability of shrimp is checked, which would enable the assembling centers to make bulk sell/transfer to the next destination. This could reduce post harvest loss and provide better price for the shrimpers/farmers.

REFERENCES

1. ADB 2005. An evaluation of small-scale freshwater rural aquaculture development for poverty reduction. Operations Evaluation Department, Asian Development Bank, Manila, Philippines.
2. Ahmed, M., Rab, M.A. and Bimbao, M.A.P. 1993. Household socio-economic resource use and marketing in two thanas of Bangladesh. ICLARM Technical Report 04, p. 34.
3. Bangladesh Bank, 2011. Annual Report of Central Bank of Bangladesh 2009-2010, http://www.bangladesh-bank.org/, Accessed date: 22.03.2011.

4. Crawford, I.M. 997. *Agricultural and food marketing management*. Food and Agricultural Organization of the United Nations, Rome, pp.261-262.
5. Dey, M. M., M.F. Alam, and M. L.Bose. 2010. Demand for aquaculture development: perspectives from Bangladesh for improved planning. *Reviews in Aquaculture* 2: 1-17.
6. DOF 2011. Shrimpery statistical yearbook of Bangladesh 2008-2009. Shrimperies Resources Survey System, Department of Shrimperies, Dhaka, Bangladesh.
7. Engle, R. F. and Granger, C. W. J. (1987), "Co-integration and Error Correction: Representation, Estimation and Testing". *Econometrica*, Vol. 55 (2): 251-276
8. Faruque G. 2007. An Exploration of Impacts of Aquaculture Production and Marketing of Rural Livelihoods in Three Regions in Bangladesh (PhD thesis). University of Stirling, UK.
9. Ferris R.S.B., Collinson C., Wanda K., Jagwe J. and Wright P. 2001. Evaluating the marketing opportunities for shea nut and shea nut processed products in Uganda. A report prepared for USAID. P.77.
10. Hasan, M.R. 2001. Demand-led research and management of wild freshwater shrimp in Bangladesh. Support of University Shrimperies Education and Research (SUFER), Dhaka, p.76.
11. Investopedia. 2011. http://www.investopedia.com/terms/v/valuechain.asp, Access date: May 16, 2011.
12. Jacinto E.R. 2004. A research framework on value chain analysis in small scale shrimperies. Paper presented to the 10th Biennial Conference of the International Association for Study of Common Property, Oaxaca, México, 9–13 August 2004, p.27.
13. Kaplinsky, R., and Morris, M. 2000. A Handbook for Value Chain Research, International Development research Center (IDRC), Canada.
14. Kohls, R.L and Uhl, J.N 2005. *Marketing of agricultural products*. *9th edition*. Macmillan publishing co., Inc., New York.
15. Porter, M.E. (1980). Value Chain Analysis.Oxford Press Ltd. London.
16. Sapkota-Bastola, P, M.M. Dey, M.F. Alam, K. Singh. 2012. Price transmission relationships along the seafood value chains in Bangladesh: An analysis of both aquaculture and capture shrimperies species.. A report submitted to Food and Agriculture Organization for the project entitled A Value-chain Analysis of International Shrimp Trade and Food Security with an Impact Assessment of the Small-scale Sector.
17. United States Department of Agriculture. Agriculture Fact Book 1998. Chapter 1. Online. Retrieved June 7, 1999. http://www.usda.gov/news/pubs/fbook98/chart1.htm.