

## **Supply Chain Analysis for the Development of Poultry Feed Industry in Bangladesh**

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**Abstract:** *The study aims to examine the supply chain analysis of poultry feed covering Dhaka, Gazipur, Narsingdi, Kishoreganj and Mymensingh district. In total 30 feed mills which categorized as high, medium and low quality on the basis of feed conversion ratio (FCR) along with 45 dealers; 15 sub-dealers and 120 farmers purposively. The primary data were collected during March 2013 to March 2014 by using survey schedule, KII and FGD. In addition, the secondary data were collected from different government documents. It is evident that the cost of feed was found Tk 39295, Tk 38643 and Tk 37218 per MT (metric ton) for high, medium and low quality feed mills, respectively. The gross returns were found to Tk 43160, Tk 42330 and Tk 40500 per MT and gross margin were Tk 6486, Tk 5957 and Tk 5285 per MT, respectively. The net returns were found Tk 3865, Tk 3687 and Tk 3279.2 per MT, respectively. It indicates that total gross return, gross margin and net return were higher than for high quality feed mill than medium and low quality feed mill. It is also evident that about 60% of raw materials were purchased from Dinajpur, Rangpur, Rajshahi, Jamalpur and Haor and coastal areas such as Bagergerhat, Chittagong and Khulna, where 100% of feed additives were imported. The unavailability of raw materials was the major problem for feed mills operation which influenced feed price and quality. If these problems could be solved within a reasonable time, stakeholders' would be able to get more benefits and run business smoothly.*

### **1. Introduction**

Livestock is playing an important role in the national economy by contributing significantly to agriculture and to the gross domestic product (GDP) of Bangladesh. The agricultural sector contributes 12.57% in the GDP whereas livestock sector contributes 2.15% in the GDP (BBS, 2014). Furthermore, it plays a pivotal

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role in the rural socioeconomic system as maximum households are directly involved in livestock. Total investment in poultry industry was Tk 150 billion with an annual turnover of Tk. 200 to 250 billion (Chowdhury, 2013). About 6 million people are employed in this industry and the number of commercial poultry farms in Bangladesh were 114,000 in 2010; 98000 in 2011 and 75000 in 2012 (Chowdhury, 2013). This has created job opportunity for more than 6 million people. Poultry industry is one of the major among livestock sub-sectors that committed to supply cheap sources of good quality nutritious animal protein to the nation. Poultry meat production was 30.21 lac tonnes and egg production 67542.80 lac in 2013/14 (BER, 2014). People in Bangladesh raise poultry mainly with a view to getting meat and egg to fulfill their day-to-day's consumption. Poultry plays a pivotal role in bridging the protein gap of animal origin in Bangladesh. Meat holds an important position in our daily diet. Chicken meat is also highly acceptable by all the people of almost all religions and cheap source of animal protein. Local as well as crossbred chicken production is still important system to support the fast growing human population with high quality protein. Table 1 shows that among animal population in Bangladesh, poultry population was 2329.9 lac in 2005-06 and in 2012-13 it reaches to 2932.35 lac (BER, 2013). Chowdhury (2013) pointed out that the per capita consumption of all meat is 14.67 kg and that of egg is 31 numbers as against the requirements of 56 kg meat and 365 eggs, respectively. The per capita poultry meat availability is approximately one-fifth of the consumed meat (3 kg) which needs to be increased more than double to satisfy the current demand of 7.67 kg while that of egg more than three times to meet the per capita minimum requirement of 102 eggs (Begum et al. 2011).

The poultry industry is crucial in the context of agricultural growth and improvement of diet for the people in Bangladesh. This industry is particularly important in the sense that it is a significant source of supply of protein and nutrition in a household's nutritional intake. Poultry is a common enterprise in rural Bangladesh. The poultry industry in Bangladesh is very important for the reduction of poverty and creation of employment opportunities. In the recent times, the demand for milk has increased by 6 percent and eggs by 5.2 percent. Fish and cattle production require a longer time. But poultry production is relatively faster and easier, if public and private sector initiatives go side by side.

**Table 1: Numbers of livestock and poultry population in Bangladesh (in lac)**

Particular	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Total livestock	464.70	475.10	485.00	495.58	506.52	512.66	528.36	530.20	535.90	539.72	543.57
Total Poultry	2329.90	2459.70	2523.10	2626.28	2707.12	2788.06	2885.66	2932.35	3041.72	3122.93	3206.33

Source: BER, 2014 and DLS, 2016

Poultry feed mill industry as an agribusiness enterprise is comparatively new in

Bangladesh. Total feed business, especially the business of concentrates was controlled by some feed traders. Bangladesh is a feed deficit country. At present there are about 250 registered feed mills in this country (Uddin, 2014). These feed mills are not produced sufficient amounts of feed. Shortage of feed is major constraints to the development of poultry sector in Bangladesh There is a general agreement that low poultry production in Bangladesh is mainly due to lack of feed staff (Table 2). The major feed additives are: toxin binder, mold inhibitor, enzymes, synthetic amino acids and vitamins, feed premixes, vitamin-mineral premixes, trace minerals, organic acids, probiotics, salmonella killer, antibiotic for therapeutic use through feeds (antibiotic as growth promoter is strictly prohibited to use in the feed according to Feed Act 2010). Most of the feed additives have been imported by the Health companies and feed millers. Major Feed ingredients that have been imported by the commercial feed millers are: Meat and Bone meal, fish meal, protein concentrates, fish meal, soybean meal where around 50% is locally produced (Uddin, 2014). Though, due to the government's initiatives, supply situation of feed has improved slightly, but still supply is very much inadequate in relation to high increasing demand. The expansion of commercial feed industry in Bangladesh can possible to fulfill more than 80% of the total compound feed requirements. Considering the existing growth rate of poultry, cattle and aquaculture, the estimated annual compound feed requirement would be 10.60 million MT in 2020-21.

**Table 2: Annual feed requirements (MT) & commercial feed supply**

Particulars	Year	
	2001-2002	2010-2011
Broiler PS	54,268	255,500
DOC (broiler)	301,077	858,000
Layer PS	10,336	19,710
DOC (layer)	810,146	1,357,070
Cattle	5,066	10,106
Fish	-	800,000
Total feed required (MT)	1, 180,893	3,300,386
Industrial compound feed supply (MT)	281,550	2,767,440
Availability (%)	23.84	83.85

Source: FAO, 2013.

By ensuring the supply of quality feed for livestock sub-sector, the feed mill industry is enhancing the whole economy significantly through its forward linkage effect. The feed mill industry improves the efficiency and digestibility of feed through scientific formulation and processing and helps efficient use of scarce feed

resources. This industry also generates a number of employments in the processing plants and involves a number of people in feed distribution channels. This increases the importance of the industry day by day. Realizing the importance of this industry, the GOB is trying to make involved more private entrepreneurs here. This study is an modest effort undertaken to examine the cost effective supply chain of raw materials and supply of poultry feed. The specific objectives are to investigate the backward and forward linkages of feed mills; to examine the cost effective supply chain of poultry sector by estimating the marketing cost, margin and efficiency of feed miller and market intermediaries; and to find out the farmers' perception about the quality of feeds of different feed millers. The information may be helpful to the existing and potential entrepreneurs and market participants to improve their supply chain and decisions.

## 2. Methodology

The study was mainly based on field survey in addition of some secondary information. Purposive sampling technique was used in selected 30 feed mills. It was categorized by high, medium and low quality feed mill on the basis of feed conversion ratio (FCR). One more important part of research work is sample selection. In a complete enumeration, the essential information is collected from different stakeholders'. The field work conducted with feed miller, dealer, different sizes of poultry farm owners and farmers. 30 feed mills, 45 dealer, 15 sub-dealer and 120 farms were selected on the basis of quality (FCR) from Dhaka, Gazipur, Narsingdi, Kishoreganj and Mymensingh districts. FCR categorized on the basis of collected from firms level data from feed performance. Table 3 shows that a multi-stages stratified sampling was adopted in this study. The selected 30 feed mills categorized on the basis of feed conversion ratio (FCR) that is high quality feed mills (FCR; below 1.5 to 1.6), medium quality feed mills (FCR: 1.6 up to 1.7) and low quality feed mills (FCR: 1.7 up). The selected commercial farms were categorized by flock size small scale: < 1000 birds, medium scale: 1001-2000 birds and large scale: above 2000 birds.

**Table 3: Distribution of sampled feed mills and poultry farms**

Quality of feed mills (FCR basis)	Number of feed mills	Poultry farms			Total farm
		Small scale (< 1000 birds)	Medium scale (1001-2000 birds)	Large scale (Above 2000 birds)	
High	10	20	10	10	40
Medium	10	20	10	10	40
Low	10	20	10	10	40
Total	30	60	30	30	120

In conformity with the objectives of the study, a structured questionnaire developed for collecting relevant primary data from the poultry feed miller, dealer and

sub-dealer and farmers. The present study covered approximately from March –December 2013 to July-December 2014 study period and data analyzed with a combination of tabular and statistical techniques. For analyzing the data, descriptive statistics such as sum, average, ratio, percentages, etc. was derived and calculated to present the results. In this study, profit was calculated by deducting total costs from total returns. The following equation was used to assess the profitability of poultry feed production and broiler production. The profitability of feed production and individual farmers was derived in terms of gross return, gross margin, net return and benefit cost ratio (undiscounted) of different enterprise. When analyzing profitability of broiler farming, and poultry feed producing it is important to economic value. The formulas need for the calculation of profitability is discussed below:

### Gross return

Gross return calculated by multiplying the total volume of output of an enterprise by the average price in the harvesting period (Dillon and Hardaker, 1993). The following equation was used to estimate GR:

$$GR_i = \sum_{i=1}^n Q_i P_i$$

Where,

GR<sub>i</sub> = Gross return from i-th product;

Q<sub>i</sub> = Quantity of the i-th product;

P<sub>i</sub> = Average price of the i-th product; and i = 1,2,3.....n.

### Gross margin

Gross margin calculated by the difference between gross return and total variable costs. That is,

$$GM = GR - TVC$$

Where,

GM= Gross margin;

GR= Gross return; and

TVC = Total variable cost.

### Net return

Net return analysis considered fixed costs i.e., cost of land rent, interest on operating capital, etc. Net return calculated by deducting all costs (variable and fixed) from the gross return. To estimate the relative profitability of different agricultural enterprises, profit equation of the following algebraic form was used:

$$\Pi = \sum_{i=1}^n (P_{Y_i} \cdot Y_i) - \sum_{i=1}^n (P_{X_i} \cdot X_i) - \text{TFC}$$

Where,

$\Pi$  = Net return;

$P_{Y_i}$  = Price per unit of the i-th produce;

$Y_i$  = Quantity of the i-th produce;

$P_{X_i}$  = Price per unit of the i-th inputs;

$X_i$  = Quantity of the i-th inputs;

TFC = Total fixed costs; and  $i = 1, 2, 3, \dots n$  (number of items).

### Marketing System

An attempt was made to characterise the existing marketing systems of poultry and their products. The following steps were followed in characterising marketing systems of the poultry products.

#### Marketing margin (MM):

Gross margin = sales price – purchase price

#### Net marketing margin (NMM):

Net margin = gross margin – marketing costs

#### Return on Working Capital (ROWC):

$$\text{Return on working capital} = \frac{\text{Net margin}}{\text{Working capital}} \times 100$$

Working capital = purchase price + marketing costs

Farmers' perception determinate by using Likert Scale Methods

### 3. Results and Discussion

#### 3.1 Backward and Forward Linkages

Poultry feed mills provide an important linkage between feed grain producers and feed using farms. The collection of raw materials related to poultry feed production is backward linkage and feed distribution is forward linkage. Raw materials were collected from two sources—firstly from domestic source and secondly import

from others countries. Rice bran and rice polish was mainly collected from the rice processing mills spread all over the country. But the major portion of domestic rice bran and polish were supplied from the Rajshahi and Rangpur divisions. Table 4 shows that 60% maize were collected from domestic sources like; Dinajpur, Rangpur, Rajshahi and Northan area and 40% maize were imported from India, USA, Bhutan and Brazil. 80% of rice polish and rice bran collected from Dinajpur, Rangpur, Rajshahi and Jamalpur area a small portion of rice polish and rice bran was also imported from India and Thailand. 40% of full fat soybean and soybean meals were collected from Noakhali, Northern area and 60% of full fat soybean and soybean meals were imported from India, USA, Brazil. 80% of fish meal, fish fat, dried fish and poultry meat, poultry fat, dried poultry were mainly collected from costal and haor areas such as- Bagerhat, Chittagong and Sundarban area of Bangladesh and 20% from China, Brazil Vietnam and Indonesia. A small portion of coconut cake came from Bagerhat and Khulna districts of Bangladesh, but 80% of coconut cake and copra meal imported from Sri Lanka and India (Field survey, 2014). The raw material collection channels, which were used commonly by the feed mills of Bangladesh, are illustrated in following Figure 1.

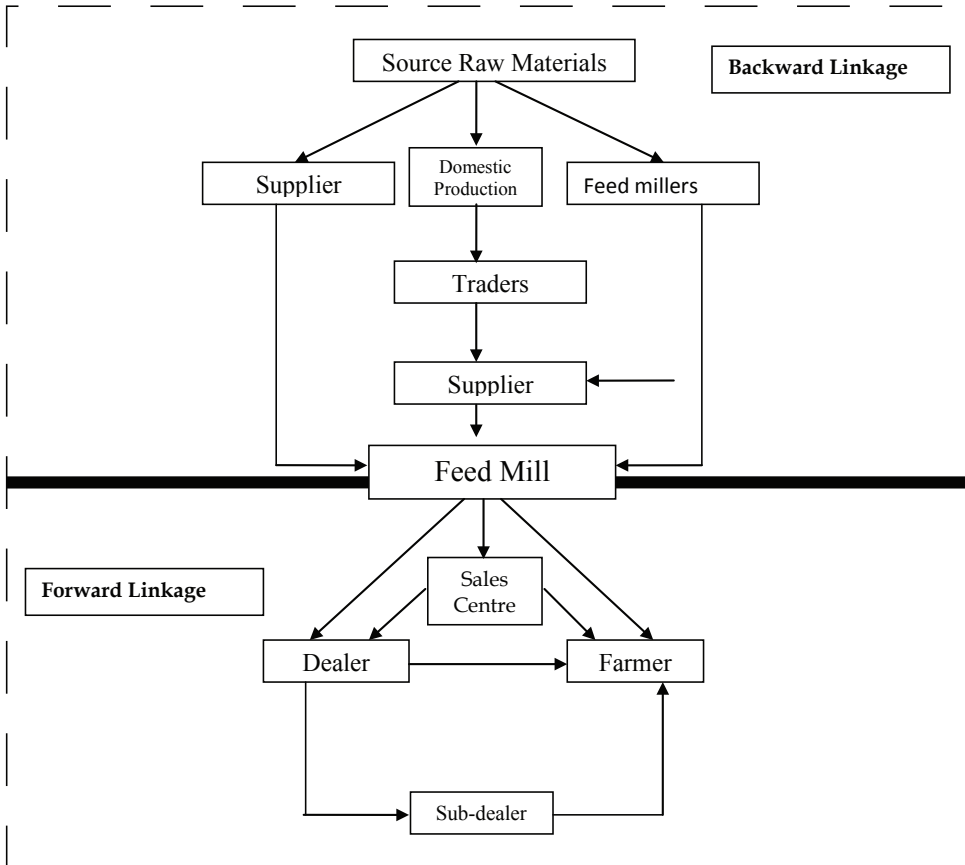


Table 4: Sources of raw material of poultry feed

Items	Domestic sources		Imported	
	Main districts	Percent	Main country	Percent
Maize	Dinajpur, Rangpur, Rajshahi and Northan Area	60.0	India, USA, Bhutan and Brazil	40.0
Rice bran and rice polish	Dinajpur, Rangpur, Rajshahi and Jamalpur Area	80.0	India, Thailand	20.0
Full fat soybean and soybean meals	Noakhali, Luckpur, Northern area	40.0	India, USA, Brazil	60.0
Fish meal, fish fat, dried fish	Haor areas, coastal areas such as Bagerhat, Chittagong and Sundarban	80.0	China, Brazil Vietnam, Indonesia	20.0
Coconut cake	Bagerhat and Khulna	20.0	Sri Lanka and India	80.0
Protein concentrates			Netherlands and some other countries of Europe.	100.0
Vitamins and mineral premixes, other chemicals and medicines			America, Germany, China, Vietnam and India	100.0
Feed binders			America, India, China and Malaysia	100.0

Source: Field survey, 2014

### 3.2 Production Cost of Poultry Feed

The term cost generally refers to outlay funds for poultry feed mill. Cost items are classified into two major groups e.g., fixed cost and variable cost and these together equaled total cost. In the study average high quality poultry feed production cost was higher than average medium and average low quality of poultry feed. High quality poultry feed production cost was Tk 39295 per tonne (Tk 39.29/kg) where medium and low quality of poultry feed production cost per metric ton was Tk 38643 (38.63 per kg) and Tk 37218 (37.49 per kg), respectively (Table 5 and Figure 2). All variable and fixed cost is decreasing with feed quality because of quality feed depends on different feed production items cost.



**Table 5: Production cost of different quality poultry feeds mills**

Item	High quality (Tk/MT)	Medium quality (Tk/MT)	Low quality (Tk/MT)
<b>A. Variable Cost</b>			
Raw Material Cost	32203.9	32082	31389
Electricity cost	450.41	440	400.7
Marketing cost	3000	2888.3	2552.8
Maintenance cost	120.33	100.88	110
Interest on working capital	900.04	862.6	763
Total variable cost	36674	36373	35215
<b>B. Fixed Cost</b>			
Land use cost	320.73	290	250
Machinery, tools & equipment cost	820.24	739.33	687.8
Building ,warehouse & others cost	400.53	350.7	300
Salary &wages cost	1030.1	850	730
Electrification gas/generator cost	20	10	10
Permanent labor cost	30	30	28
Total Fixed Cost	2621	2270.03	2005.8
Total Cost (A+B)	39295	38643	37218

Source: Author’s estimation based on field survey, 2014.

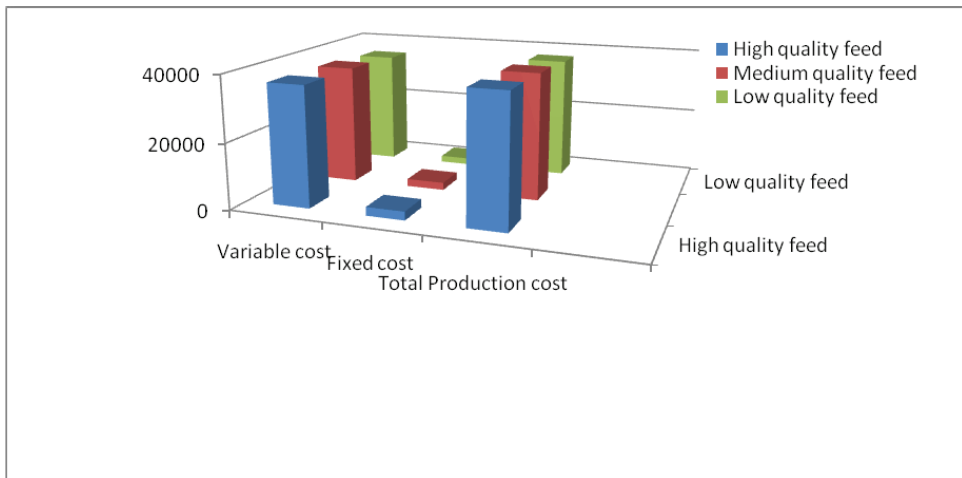


Figure 2: Different quality feed production cost

In this study average gross return from high quality poultry feed production was higher than average medium and low quality of poultry feed. High quality poultry feed gross returns was Tk 43160 per tonne where Tk 42330 and Tk40500 per tonne, respectively a average medium and low quality of poultry feed which has been shown in Table 6.

**Table 6: Return from different poultry feed mills**

Item	Total Quantity (MT/Month)	Sales Price Tk/kg	Gross Return (Taka)	Gross Return (Tk/MT)
High quality feed	11321	43.16	488614360	43160
Medium quality feed	6778	42.33	286912740	42330
Low quality feed	1743	40.5	70591500	40500
All average	6614	42	282039533	41997

Source: Author's estimation based on field survey, 2014.

In this study gross margins were calculated by deducting variable cost from gross return. Average gross margin, net return and BCR (undiscounted) was Tk 6058, Tk 3438 and 1.1 per tonne, respectively for high quality poultry feed mill, Tk 5957, Tk 3687, 1.12 for average medium quality poultry feed mill and Tk 5285, Tk3282 and 1.10 for average low quality poultry feed (Table 7). In this study area high quality feed production per month was more than medium and low quality feed production because of high quality feed demand higher than medium and low quality feed.

**Table 7: Total return, gross margin, net return, BCR (undiscounted) for different poultry feed production**

Item	High quality feed Tk/MT	Medium quality feed Tk/MT	Low quality feed Tk/MT
A. Gross Return (GR)	43160	42330	40500
B. Variable Cost (VC)	37102	36373	35215
C. Fixed Cost (FC)	2620	2270	2003
D. Total Cost (TC)=(B+C)	39722	38643	37218
E. Gross Margin (GM) = (A-B)	6058	5957	5285
F. Net Return (NR)=( E-C)	3438	3687	3282
G. Benefit Cost Ratio(BCR= A/D)	1.1	1.12	1.10
H. Net Return per Taka Investment (F/D)	0.10	0.11	0.1

Source: Author's estimation based on field survey, 2014.

### 3.3 Poultry Feed Production Steps

In order to get prepared feed, the feed ingredients have to go through a long mechanical process. The whole process can be divided into seven stages which are as follows:

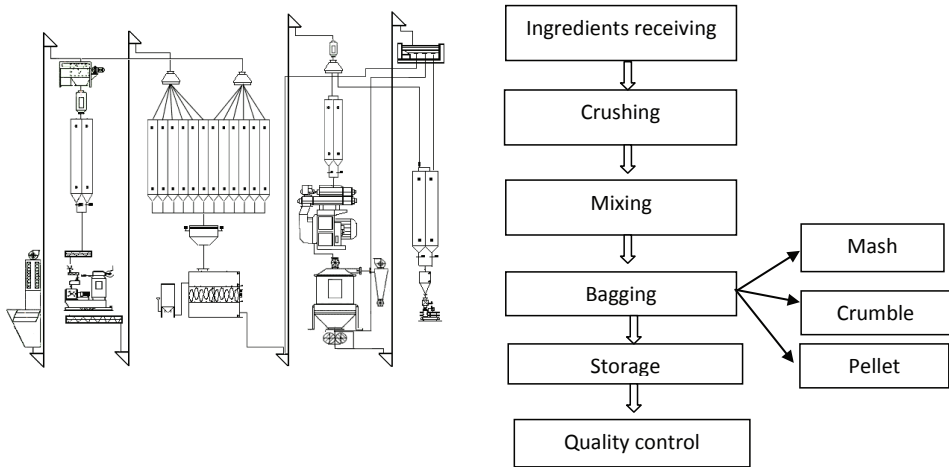


Figure 3: Steps involved in poultry feeds production

Bagging is an important step in feed processing. For bagging the feed, bags made of polypropylene (PP) are used. Brand name, trademark of the producer, specification of feed, net weight, date of production and other necessary information are printed on the bags. Each bag generally contains 50kg feed-which gives it an easy handling and well stacking characteristics. After preparing feed, different types of feeds are stored separately. Distribution channel plays a very important role in achieving marketing objectives of a company. By performing the work of transferring products from producers to consumers, a distribution channel overcomes the time, place and possession gaps that separate goods and services from those who need or want them. The feed mills under this category used slightly more complex channels to distribute their products. An outline of the distribution channels used by the privately owned feed mills is illustrated in Figure 3.

On the basis of Figure 3, the following channels of distribution can be identified-

Channel I: Feed mill →Sales Centre→Dealer→Poultry farm

Channel II: Feed mill →Dealer→ Poultry farm

Channel III: Feed mill→Poultry farm

Channel IV: Feed mill→Dealer→Sub-dealer→Poultry farm

Channel V: Feed mill →Sales Centre →Dealerr→Sub-dealer→Poultry farm

Among the above mentioned channels, channel-I and II were the most important

channels and also used widely as the main channels. Their marketing margins were shown in Table 8 and Figure 4.

**Table 8: Marketing margin of poultry feed miller, dealer and sub-dealer**

Level of quality	intermediaries	Purchase price/ (Tk/MT)	Sales price/ MT(Tk.)	Gross marketing margin/ (Tk/MT)	Marketing cost/ MT(Tk.)	Net marketing margin/ (Tk/MT)	Return on working capital (%)
High quality	Miller	39295	43160	3865	3000	865	8.07
	Dealer	43160	44643	1483	566.85	916.15	2.10
	Sub-Dealer	43360	44643	1283	348.94	934.06	2.13
Medium quality	Miller	38643	42600	3957	2880	1077	9.66
	Dealer	42600	43756	1156	563.03	592.97	1.37
	Sub-Dealer	42806	43756	950	331.95	618.05	1.43
Low quality	Miller	37218	41010	3792	2550	1242	9.91
	Dealer	41010	42050	1040	472.46	567.54	1.36
	Sub-Dealer	40900	42050	1150	313.79	836.21	2.03

Source: Author's estimation based on field survey, 2014

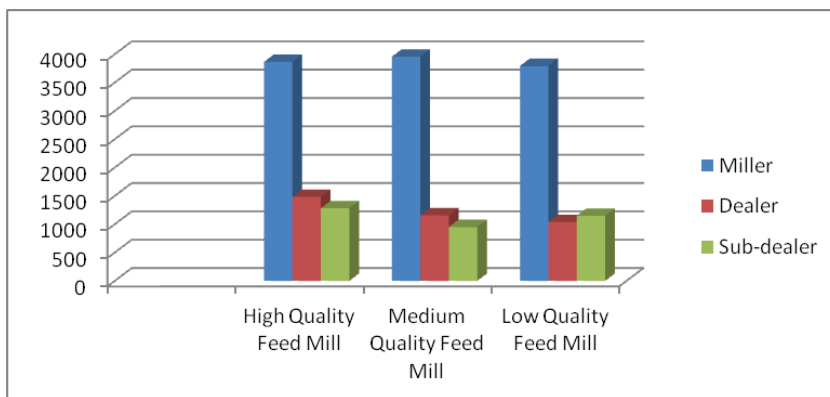


Figure 4: Marketing margin of poultry feed miller, dealer and sub-dealer

### 3.4 Farmers Perception on Performance of different Quality Feeds on Broiler Production

The word performance refers to the degree of success in achieving stated objectives. It's could make to achieve its goals. Performance means execution of an action or the fulfillment of a promise (<http://en.wikipedia.org/wiki/performance>). The performance of poultry feeds quality refers its effects on broiler production. High, medium and low quality of poultry feeds qualities depend on use of quality of ingredients, nutritional contents and storage life etc. and their qualitative

features of feeds. Another it refers management of feed mills, sales personnel, technical assistance and supports provided by the feed mills aimed to influence its performance on FCR.

High, medium and low quality poultry feed mills performance and their farmer perception on broiler production is discussed below. A subset of poultry feeds quality is a practice which strives to build performance standards into the implementation of feeds on broiler production. It is concluded that the high quality feed intake farms profit were more than medium and low quality poultry feeds intake farms.

### **3.4.1 Perception on different quality feed mills**

Perception means senses or mind of cognition or understanding and interpretation of sensory information (<http://en.wikipedia.org/wiki/perception>). The poultry farmer's perception about high, medium and low quality feeds means their opinions or interpretation after farming on feeds FCR.

#### **Determinates of perception**

After feeds performance on broiler production farmers easily share their opinion which quality feeds has more influence on FCR. In this section, farmers' perception investigates about high, medium and low quality feed with the help of Likert Scale method.

#### **Perception of farmers on different quality poultry feeds; Likert Scale Methods**

Farmer's perception of broiler production by using different quality feeds investigated in this study. Five point of Likert Scale used for measuring perception of the different stakeholders'. There were 3 statements of high, medium and low quality feeds including for both favour and disfavour against 5 point scale. All the statement arranged randomly under their opinions. Each stakeholder was asked to indicate his extent of agreement or disagreement against each statement along a 5-point scale, i.e., strongly agree, agree, undecided, disagree and strongly disagree. Weights assigned to these responses were 5, 4, 3, 2 and 1 in favour and 1, 2, 3, 4 and 5 in disfavor. The total score of stakeholder was determined by summing up the weights for responses against all the statements. Table 9 shows that the weighted scores (ws) of high, medium and low quality feed were 570, 430 and 360 and their ranked 1st, 2nd and 3rd of the statements based on farmers perception, respectively. The rank of high quality feed was in 1st rank that means high quality feeds performance was better than medium and low.

**Table 9: Perception of farmers on different quality feeds**

Different quality feed mills (On the basis of FCR)	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Weighted score	Rank
High	95	20	1	3	1	570	1
Medium	60	10	10	20	20	430	2
Low	30	20	15	30	25	360	3

Source: Author's estimated based on field survey, 2014

Note: FCR= Feed Conversion Ratio

#### 4. Conclusion

The findings of the study indicate that the high quality feed performance are better than those of medium and low quality feed. The poultry feed production cost and gross margin, gross return and net return of high quality feed mills are higher than the medium and lower quality feed mills. The study concluded that the benefit from broiler production is dependent on supplying the birds with the highest achievable quality of feed. The study also identified the unavailability of raw materials which were the major problems for feed mills operation which influenced feed price of poultry feed and quality. The findings of the study also indicate that the profitability of poultry feed production is quite satisfactory and have capability to attract interest of the entrepreneurs of Bangladesh. The study further reveals that the trading of poultry feed is a profitable venture to the dealers and sub-dealers. The poultry feed industry is performing a vital role in the development of poultry industry in Bangladesh.

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