

**PROFITABILITY ANALYSIS OF SUPPLY CHAIN ACTORS IN
TROPICAL FRUIT MARKETING IN KHAGRACHARI HILL DISTRICT,
BANGLADESH**

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ABSTRACT

The paper presents how developing countries like Bangladesh's rural supply chain actors act in fruit supply chain. Their profitability analysis by identifying gross return and net margin as an indicator of their efficiency also found in this study. Some factors which are directly affect in entire supply chain also identified by multiple linear regression. This paper finding is applied in a case example of rural supply chain development as an important indicator in empowerment generation in developing country.

Keywords: Fruit, Supply Chain, Market Actors, Profitability.

I. INTRODUCTION

In Bangladesh, importance of horticulture remains and its contribution not only in human diet mainly for vitamins and minerals but also in income generation is extremely high. However, the present consumption of fruits in Bangladesh is 14 g/day/capita, which is far below the minimum average requirement of 400 g/day/capita (both fruits and vegetables) (FAO/WHO 2003). The production of horticultural products has a comparative advantage particularly under condition where arable land is scarce, labor is abundant and market is accessible. This is the prevailing situation in many countries of South and South East Asia where the size of land holding is the lowest in the world and transportation infrastructure has shown dramatic

improvements (FAOSTAT, 2004; Hailegiorgis, 2011). Feeding the growing global population and the changing demand in domestic and international markets for horticultural products creates both challenges and opportunities. Therefore, efficient marketing is crucial to increase the supply chain system of agricultural products as well as the risk and uncertainty in timely delivery of quality and safe produce at reasonable prices to the consumers.

Marketing of agricultural products consists primarily of moving products from production sites to points of final consumption (Branson and Norvell, 1983). Lundy et al. (2004) also clearly stated that a market chain is used to describe the numerous links that connect all the actors and transactions involved in the movement of agricultural goods from the farm to the consumer, it means agricultural goods and products flow up the chain and money flows down the chain. The term supply chain analysis is used to refer to the overall group of economic agents (a physical person such as a farmer, a trader or a consumer, as well as legal entities such as a business, an authority or a development organization) that contribute directly to the determination of a final product (FAO, 2005). The literature on supply chain analysis (SCA) suggests vertical interdependencies require a systemic understanding of resource allocation and information flow between firms engaged in sequential stages of production (Christopher, 1998; Simchi-Levi et al., 2000; Lazzarini et al., 2001). It is becoming increasingly important to evaluate not only how suppliers transact with a given buyer, but also how they interact between themselves to promote knowledge exchange (Stuart et al., 1998; Dyer and Nobeoka, 2000; Lazzarini et al.,2001). Thus the chain encompasses the complete sequence of operations which, starting from the raw material, or an intermediate product, finishes downstream, after several stages of transformation or increases in value, at one or several final products at the level of the consumer (FAO, 2005).

In Bangladesh, generally 9 major and 48 minor fruits are produced in this country. Area devoted to these fruits accounts for 1,39,535 hectares. Major fruits, such as mango, banana, jackfruit, pineapple, papaya, litchi and jujube are produced on 79 percent of the area. All these fruits account a good marketing system to reach its consumer. An efficient supply chain system increases income generation. For economic growth and poverty reduction smallholder market participation is so important (Christopher 2007; Takele 2010). Considering this factors small country like Bangladesh can give emphasis on efficient marketing system. Branson and Norvel (1983) defined the marketing system in terms of what is otherwise known as supply chain.

Different marketing channels of agricultural products have been identified by several authors in Bangladesh. One of the most common channels is Growers-‘Bepari’- ‘Aratdar’-Retailers-Consumers. The commodity price is apparently higher at the retailers’ level (Hassan *et al.*, 2013). But calculating the costs and margins for identifying profitability level of the different

market intermediaries are sometimes seems difficult because of meager in the scientific literature and insufficient data provided by market intermediaries.

After identifying market actors calculating their profitability is necessary to measure their business situation. Profitability can be measured on yearly basis or over or the lifespan of an investment while the lifespan profitability measure is employed to enable in resource allocation decision (Ross et al. 2001; Asante et al., 2014). Return on assets, profit margin and return on equity are also well known profitability measures (Ross et al. 2001). Once cost and benefits has been identified, if they are to be compared, they must be valued. Underlying all financial analysis is the assumption that prices reflect value, or can be adjusted to do so (Gittinger, 1996; Asante et al., 2014).

Besides profitability analysis measuring marketing margin also an indicator of profitability level. According to Tomek and Robinson (1990), marketing margin is defined as a difference between price paid by consumers and that obtained by producers or the price of collection of marketing services. (Menduoza, 1995; Hailegiorgis, 2011) also explained that marketing margin measures the share of the final selling price that is capturing by particular agent in the marketing chain. Moreover, marketing margins are often estimated for different levels (wholesale, retail etc.) in the marketing system It includes costs and typically, though not necessarily, some additional income. It also consists of marketing functions such as transportation, storage and processing (Adeyokunnu, 1973; Hailegiorgis, 2011). In addition, handling cost (packing and unpacking), costs of searching for a partner with whom to exchange, screening potential trading partners to ascertain their trustworthiness, bargaining with potential trading partners (officials) to reach an agreement, transferring the product, monitoring the agreement to see that its conditions are fulfilled, and enforcing the exchange agreement (Holloway and Ehui, 2002).

Considering profitability level of market intermediaries in agricultural products some variables or factors are affect or correlated with the entire marketing system. Chinna (2009) also found that the cost of marketing of a particular commodity is influenced by different factors such as quantity of the product, perishability, bulkiness, risk involved, facilities in the market, grading, storage, transportation, regular or irregular supply, advertisement, processing, packaging, retail or wholesale, degree of market information and competition in the market.

However, inefficient marketing chain reduce demand from consumers and participation by farmers, who face significant challenges in seizing opportunities to participate in growing markets for high-value nutritious crops like fruits (Hassan et al., 2013). Marketing constraints include both high costs and risk. (Bezabih and Hadera 2007) stated that production is seasonal and price is inversely related to supply. However, expanding the scale of horticulture production is often hindered by lack of market access, market information, and many biological factors

(Weinberger and Lumpkin, 2005). There may be ample raw materials available for short seasons, which mostly go waste due to lack of processing facilities (Brown, 2000; Asante et al., 2014). A large body of literature on agricultural markets argues that the presence of high transaction costs affect the performance of the market (Smith et al., 2005; Barrett 2008; Kirsten et al., 2002).

Therefore important questions are arisen:

- How can developing and low income country’s middlemen get enough profit and collaborate with others in supply chain to improve their rural life?
- How developing countries middlemen tackle factors that are correlated with their business which are directly influence the entire supply chain?

Considering these questions the objectives of this present study are: profitability analysis of supply chain actors on some selected fruits (mango, jackfruit and litchi) in Khagrachari hill district one of most vulnerable and ethnic community prone hill district in Bangladesh. In addition, present study also identifies some factors that are directly correlated with supply chain of selected fruits in the study area.

Dewan *et al.*, 2016 found raw material supplier, fruit grower, *Bepari*, wholesaler, *Faria* and Retailer were the supply chain actors in Khagrachari hill district. There were also Aratdars from Chittagong market who were involved in fruits supply chain when fruits were sold in Chittagong market. However, there were 9, 6 and 6 supply chain were found for mango, jackfruit and litchi in the study area. All these entire supply chain service providers played a great role in study area. Specially, Hill agricultural Research Station and different NGO’s as well as international organization like FAO, UNDP etc. organized different training and seminars regarding fruits production techniques, harvesting and post-harvest technique etc. which really helpful for indigenous fruit growers. From raw material supplier to consumer information, product and monetary flow was existed. Existing supply chain and total fruit supplied (%) by each chain was given in Table 1:

Table1: Existing fruit supply chain and total fruit supply (%)

Supply Chain		% of total fruit supplied
Mango per ton		
Chain I	RMS- G-C (L)	35.88
Chain II	RMS- G – F (L) – R – C	3.30%
Chain III	RMS- G – B (L) – C (L)	13.95%
Chain IV	RMS- G –F (L) -C (L)	3.15%
Chain V	RMS- G –B (L)–A (CM)–B (CM) – R (CM) – C (Ch)	10.25%
Chain VI	RMS- G – B (L)– B (Od)–C (Ch)	6.25%
Chain VII	RMS- G –A (CM) -B (CM)- C (Ch)	5.81%

ChainVIII	RMS- G - R (L)- C (L)	6.45%
ChainVIX	RMS- G -W (L)-C (L)	20%
Jackfruit per 100 pieces		
Chain I	RMS- G-C(L)	35.88%
Chain II	RMS- G – B(L)- C (L)	15%
Chain III	RMS- G – F(L) – R – C (L)	8.78%
ChainIV	RMS- G –W (L) –A (CM)–B (CM) – R(CM) – C (Ch)	6.50%
ChainV	RMS- G – B (L)–B (CM)–R (CM) – C (Ch)	15.45%
Chain VI	RMS- G -B (L) - B (F) - C	18.48%
Litchi per 1000 pieces		
ChainI	RMS- G – C	34.23%
Chain II	RMS- G – B(L)- C	20%
Chain III	RMS- G – F(L)- C	7.21%
Chain IV	RMS- G –W (L) – C	12.7%
ChainV	RMS- G –B (L)–A (CM)– R (CM) – C (Ch)	8.42%
Chain VI	RMS- G -W (L) -R (L) - C	11.11%

RMS= Raw material supplier, G = Grower, B= Bepari, F = Faria, R= Retailer, A= Aratder, W = Wholesaler, C= Local Consumer, L= Local Market, CM= Chittagong Market, Ch= Chittagong District, Od= Other district, F= Fenny

II. METHODOLOGY

The research work carried out in some selected area at Khagrachari Sadar upozila, Panchari and Dighinala upozila under Khagrachari District, considering the most potential geological area of fruit production and marketing in the year of 2014. Both primary and secondary data were used in this study where primary data was collected from 214 respondents, where 56 respondents were mango growers, 34 were jackfruits growers, 40 were litchi growers, 20,16,16 and 32 were Faria, wholeseller, Retailer and Bepari respectively, among these intermediaries, Bepari and Wholesaler, they transport fruits to other districts in the country. A pre-test was done from the fruit growers and market intermediaries before the final survey. Data obtained from questionnaire interviews were coded where appropriate entered into a database system using Microsoft EXCEL, and analyses using SPSS Statistical Software. Descriptive statistics (percentage, mean, range, standard deviation, correlation co-efficient, co-efficient of variation, etc.) was used to describe the variables. For the estimation of comprehensive marketing costs, the method described by Dawe et al. (2008) was followed.

Production cost Production costs include both variable and fixed costs. The variable costs include costs for seed/seedling, cost of human labour, cost of cultivation, cost of fertilizer, cost of irrigation, cost of insecticide and pesticide, etc. The fixed costs include mainly land use cost, interest on running capital and depreciation.

Profitability of fruit growers The following profit equation was used to estimate the profitability of production of the selected fruits. $\Pi = PF \cdot QF - (TVC + TFC)$, Where, Π = Profit of producer per unit per year, PF = Per unit price of fruits, QF = Quantity of fruits, TVC = Total variable cost, TFC = Total fixed cost

Gross returns of fruit growers Gross return was calculated by multiplying the total volume of output by the per unit price of the commodity at the time of harvest. The following equation was used to estimate gross return (GR): $GR = \sum P_b \cdot Q_b$, Where, GR = Gross return from fruits, P_b = Per unit price of fruits, Q_b = Quantity of fruits

Gross margin of fruit growers The argument for using gross margin analysis is that the fruit growers were more interested to know their return over variable cost. The following equation was used to assess the gross margin.

$GM = TR - VC$, Where GM = Gross margin, TR = Total return, VC = Variable cost

Marketing margins of market intermediaries

The net marketing margins of the intermediaries (after physical losses) were calculated by the following formula: Net marketing margin = Sales price - (Purchase price + Marketing cost)

Factors correlated with supply chain

For estimating factors that were directly correlated with middlemen's profit and affect entire supply chain multiple linear regression analysis with following variables was done

$$Y = F(X_1, \dots, X_n)$$

Where,

Y = Profit of middlemen (dependent variable)

X₁ = Educational level of middlemen

X₂ = Capital invested by middlemen

X₃ = Fruit selling place

X₄ = Source of market information

X₅ = marketing cost of middlemen

X₆ = Fruit purchase price

X₇ = Labour charges

III. RESULT AND DISCUSSION

Total Cost of Fruit Growers

The total cost of fruit growers included all kinds of variable costs such as equipment cost, fertilizer cost, pesticide cost, labour cost, transportation cost etc. According to result, in the study area total average cost of mango was BDT. 6722 per ton, jackfruit was BDT. 1064 per 100 pieces and litchi was BDT. 779 per 1000 pieces in a year (Table 2). Here all fixed cost e.g. land rent was ignored because majority of fruit grower's land was own land and rest was leased in from Government and the leased rent was so less that it was ignorable here. Here, the main cost was fertilizer cost. All growers need to purchase their own fertilizer to increase their production. The second most important cost was transportation cost. Because of the hilly region, here required more labour to carry fruits from garden to road or to market this required more labour cost and loding/unloding cost. For jackfruit production, the cost required at initial stage of garden. At fruiting stage there required only equipment cost, labour cost, transport cost etc. For litchi production equipment cost and fertilizer cost was higher than other cost.

Profitability of Fruit Grower

By calculating profitability of fruit grower the result showed that, mango grower got highest profit when they sold their fruits to town market and it was BDT. 67388 per ton, but when grower sold his fruit on the garden it required no transport cost. Jackfruit grower got maximum profit by selling big jackfruit to market. Same case happens, when litchi grower sold his fruit (China 3) to town market and it was BDT. 6201 per thousand pieces (Table 2).

Table 2: Profitability of fruit growers

Sl. No	Selling place	Profitability of fruit growers					
		Mango (BDT./Ton)	Jackfruits BDT. /100 piece			Litchi BDT. /1'000 piece	
			Small <4 kg	Medium 4-8 kg	Big >8 kg	China 3	China 2
	Total average cost	6722		1064			779
1	Garden	48098	676	2362	2892	2181	1211
2	Local market	56218	847	2933	4966	2331	1361
3	Town market	67388	1082	3539	6201	2511	1571

Source: Field survey, 2014. (1 BDT = 0.0129 USD was in 2014 at survey time)

Gross Return and Gross Margin of Fruit Growers

Gross return was calculated by multiplying price of product per unit by the total and quantity of product. According to research result, here gross return of mango was BDT. 1337310, BDT. 29920 for jackfruit and BDT. 51393.5 for litchi during the survey period. But the actual situation was different from the calculated value. Because, here all calculated data was average data and the actual big grower get maximum return against his cost but small scale grower get lower and sometimes does not bear all cost which ultimately lower his production as well as lower his return. Gross margin was calculated by, deducting variable cost from total cost. Here, gross margin of mango grower was BDT. 12,49312 , for jackfruit grower the amount was BDT. 25631 and for litchi BDT. 44,684 during the survey period.

Marketing costs and margins of market intermediaries

Table 4, 5, and 6 indicates different types of marketing cost and margin related to the transaction of mango, jackfruit and litchi by Faria, wholesaler, retailer, and Bepari. In this study, gross marketing margin of each trader was estimated by deducting the purchase price of fruits (mango, jackfruit and litchi) from the sale price, while the net margin/profit component was estimated by deducting the marketing cost from the gross marketing margin. The arrangement of marketing cost (mango marketing per ton) of all intermediaries, rent cost was higher than other cost for Faria, wholesaler and Bepari, for retailer charges cost was higher than other cost (Table 4). Mango marketing margin of intermediaries per ton of mango were BDT. 30000, BDT. 30000, BDT. 30000 and BDT. 25000 for Faria, wholesaler, retailer and Bepari respectively. The highest net margin of BDT. 21398 per ton mango was received by retailers as well as their profits were better than others.

Table 4: Total cost and marketing margin of different mango market intermediaries (BDT./ton)

Sl. No.	Cost item	Market intermediaries			
		Faria	Wholesaler	Retailer	Bepari
	Marketing Cost	20405.24	22553.75	18601.75	19052.41
a.	Purchase price	50000	45000	50000	55000
b.	Sale price	80000	75000	80000	80000
c.	Gross margin(b-a)	30000	30000	30000	25000
d.	Marketing cost	20405.24	22553.75	18601.75	19052.41
e.	Net margin (c-d)	9594.76	7446.25	11398..25	5947.59

Source: Field survey, 2014. (1 BDT = 0.0129 USD was in 2014 at survey time)

It may be mentioned here that total volume handled by the *Faria*, wholesaler and *Bepari* will be much higher marketing cost than retailers, it was the reason for comparatively lower net margin for these three traders (Table 4).

Total cost of jackfruit marketing per 100 pieces was not same as mango marketing because most of the time intermediaries were only collected jackfruits and supply directly to market or other region. That's the reason why other costs like electricity cost, packaging cost, current bill, generator, commission cost, etc were not happened. For estimating marketing margin of jackfruit market intermediaries, same method was followed as like mango intermediaries. Here marketing margin of *Faria* was higher than other intermediaries when they supply big jackfruit and the amount was BDT 3053 per 100 pieces (Table 5). As like jackfruit marketing, some other cost like current bill, generator cost, commission etc were not found in litchi marketing. Here, for total cost of litchi marketing was calculated in taka per 1000 pieces. There was few difference of marketing margin between litchi intermediaries. According to the result, highest margin was received by retailer (Table 6).

Table 5: Marketing margin of different jackfruit intermediaries

Market intermediaries	Marketing cost (BDT./100 piece)	Size of jackfruit	a.Purchase price(100 piece)	b. Sales price (100 piece)	c.Gross margin(b-a)	d.Marketing cost	e.Net margin (c-d)
Faria	1946.3	Small <4 kg	2000	5000	2500	1546.3	953.7
		Medium 4-8 kg	4000	7000	3000	1846.3	1153.7
		Big >8 kg	5000	10000	5000	1946.3	3053.7
Wholesaler	1150	Small <4 kg	-	-	-	-	-
		Medium 4-8 kg	3000	6000	3000	1150	1850
		Big >8 kg	5000	8000	3000	1050	1950
Retailer	1010.3	Small <4 kg	1800	4000	2200	1010.3	1189.7
		Medium 4-8 kg	4000	7000	3000	1210.3	1789.7
		Big >8 kg	5500	8500	3000	1010.3	1989.7
Bepari	1779.25	Small <4 kg	2000	5000	3000	1579.25	1420.75
		Medium 4-8 kg	4000	7000	3000	1979.25	1220.75
		Big >8 kg	6000	10000	4000	1779.25	2220.75

Source: Field survey, 2014. (1 BDT = 0.0129 USD was in 2014 at survey time)

Table 6: Marketing margin of different litchi intermediaries

Sl. No.	Market intermediaries	Marketing cost (BDT./1000 piece)	Litchi variety	a.Purchase price('000piece)	b.Sales price('000 piece)	c. Gross margin (b-a)	d. Marketing cost	e.Net margin (c-d)
1	Faria	653	China 3	2000	3500	1500	653	847
			China 2	1500	2500	1000	653	347
2	Wholesaler	935	China 3	2000	3500	1500	935	565
			China 2	1200	2500	1300	935	365
3	Retailer	837.5	China 3	2000	3800	1800	837.5	962.5
			China 2	1500	2500	1000	837.5	162.5
4	Bepari	877.62	China 3	2500	4200	1700	877.62	822.38
			China 2	1500	3000	1500	877.62	622.38

Source: Field survey, 2014. (1 BDT = 0.0129 USD was in 2014 at survey time)

Correlation between different factors

The profitability of middlemen of selected three fruits was found significantly correlated with different factors shown in Table 8. For Bepari educational level, amount of capital invested, fruit selling place, sources of information and fruits purchase price was positively correlated with Bepari's profit. In case of wholesaler, educational level, capital, fruit selling place, source of information positively and marketing cost and labour charges was negatively related with wholesalers profit. In both cases of Faria and retailer, two factors marketing cost and fruits purchase price was negatively and other four factors educational level, capital invested, fruit selling place, source of information was positively related with their profit. Abaye (2007), examined the factors determining rainfed rice production in Adamawa state (Nigeria), two of the variables used (farm size and seed) were significantly affect the production. Also resource productivity analysis revealed that seed was over utilized, while land and herbicide were underutilized. Decreasing the quantity of seed use and increasing the size of land and quantity of herbicide respectively could increase efficiency.

IV. CONCLUSION

The study has come out with some important conclusion. The total average cost of mango was BDT. 6722 per ton, jackfruit was BDT. 1064 per 100 pieces and litchi was BDT. 779 per 1000 pieces in a 2014. Mango grower got highest profit when they sold their fruits to town market, jackfruit grower got maximum profit by selling big jackfruit to market and in case of litchi when litchi grower produce and sold China 3 variety litchi they got highest profit. The highest net margin of BDT. 21398 per ton mango was received by retailers as well as their profits were better than others. In case of jackfruit, marketing margin of *Faria* was higher than other intermediaries when they supply big jackfruit and the amount was BDT 3053 per 100 pieces and litchi retailer got highest margin.

From multiple linear regression three factors labour charges, marketing cost and fruit purchase price was negatively correlated and other four factors educational level, capital invested, fruit selling price and source of information were positively correlated with market intermediary's profit.

Strategies to enhance effective supply chain of selected fruits can be increased significantly with particular interventions such as:

- Increasing of the volume of produce handled through modern technology invention and proper institutional support.
- Giving more priority in logistic support as well as cold chain storage facilities to prevent post-harvest losses.
- Providing market intelligent support to supply chain actors.
- Adequate financial support for entrepreneurship development in this sector.
- Enforcing government regulation to support fruit processing plant to encourage better production as well as empowerment generation in this hill district.

An important implication has been found from these findings to be considering in designing agribusiness development to improve fruit growers to market linkages both in locally and globally. At present, supply chain actors only concentrate on local business but there is a huge scope of exporting as this area's supply chain actors can get geographical advantages than others district, it takes only 4 hour to reach Chittagong port from Khagrachari hill district (distance 114 kms or 70.8 miles). So there there is an opportunity to linking ethnic fruit growers and market actors with rest of the world. Giving the opportunity to rural supply chain actors and reforming the market policies can result a much larger integration of Bangladesh economy with rest of the world.

Table 8: Correlation between different factors

Factors	Coefficient	significance	Coefficient	significance	Coefficient	significance
	't' value		't' value		't' value	
	Mango		Jackfruit		Litchi	
Beperi						
Education	0.0465*	0.002	0.007**	1.063	0.372*	.00713
Capital	0.0607*	0.009	0.325	0.748	1.481	0.151
Selling place	0.381*	0.008	0.269*	0.079	1.012**	1.322
Source of information	0.209	0.836	0.371	0.713	0.731	0.472
Marketing cost	-0.414	0.680	-0.781	0.442	-0.660	0.550
Purchase price	1.000*	0.002	1.501*	0.0146	0.077	0.939
Wholesaler						
Education	0.182*	0.003	0.156	0.441	1.936*	0.008
Capital	0.829	0.438	1.014	0.871	0.067**	1.120
Selling place	0.750	0.478	0.533*	0.033	0.792	0.449
Source of information	0.597	0.569	0.251	0.600	1.788	0.107
Marketing cost	-.187	0.671	-1.031*	0.032	-1.221	0.253
Labour charges	-0.061*	0.011	-0.15*	0.001	-0.000**	1.00
Faria						
Education	1.040*	0.015	0.945**	1.905	0.673	0.515
Capital	1.661	0.175	0.686	0.507	0.130	0.899
Selling place	2.931	0.451	3.014*	0.012	0.881	0.398
Source of information	1.461	0.521	1.169	0.267	0.196	0.848
Marketing cost	-0.772	0.261	-1.775	0.104	-0.312	0.761
Purchase price	-2.33*	0.055	-0.033	0.975	-1.001	0.338
Retailer						
Education	0.365	0.723	3.860*	0.004	1.701	0.119
Capital	0.922	0.380	0.703	0.500	0.573	0.112
Selling place	0.571	0.955	3.785*	0.004	1.89	0.581
Source of information	0.256	0.804	3.779*	0.004	0.764	0.090
Marketing cost	-0.055	0.957	-0.861*	0.001	-0.771	0.460
Purchase price	-2.738*	0.023	-5.234*	0.001	-1.701	0.118

R² obtained varies from 0.68 to 0.91 for all three middlemen in different states¹. *=1% level of significance, **= 5% level of significance.

¹ R² is coefficient of multiple determination

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