



Value Chain Analysis of Brinjal in the Chittagong Hill Tracts of Bangladesh

Shah Johir Rayhan¹, Md. Jahurul Islam^{2*}, Mohammad Mizanul Haque Kazal³ and M. Kamruzzaman⁴

¹Department of Management and Finance, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

²Department of Agricultural Economics, Khulna Agricultural University, Khulna-9100, Bangladesh.

³Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

⁴Department of Agricultural Economics, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur-1706, Bangladesh.

Authors' contributions

This work was carried out in collaboration among all authors. Author SJR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript.

Author MJI' managed the literature searches and helped in data and statistical analysis.

Authors MMHK and MK managed and supervised the analyses and overall study.

All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i330555

Editor(s):

(1) Dr. Rajesh Kumar, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), India.

Reviewers:

(1) Muhammad Tahir Akram, PMAS-Arid Agriculture University, Pakistan.

(2) Borgonovo Gigliola, University of Milan, Italy.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/67495>

Original Research Article

Received 20 February 2021

Accepted 24 April 2021

Published 29 April 2021

ABSTRACT

This study examined the value chain and marketing margin of brinjal in Bandarban, Khagrachari and Chittagong of Bangladesh. It looks at profitability, value addition at different levels and marketing efficiency for the various market. The simple random sampling technique was followed for collecting primary data from the vegetable growers in the study area. In this study, total 60 growers and 50 market intermediaries were selected. A primary survey was carried out in January to June 2016. The benefit-Cost Ratio was used for estimating profitability. Marketing cost and margin were used for calculating the value addition in every stage of the supply chain. For assessing marketing

*Corresponding author: E-mail: jahurul.bsmrau@gmail.com, jahurul@kau.edu.bd;

efficiency, price spread, producers share, and Acharya's methods were employed. The result revealed that brinjal cultivation was profitable since the Benefit-Cost Ratio (BCR) of brinjal cultivation was 1.59. The highest net marketing margin for brinjal was found in chain II. The most efficient marketing chain was found in chain III, which is Farmer → Retailer → Consumer (Local) in the study area. It appears that, based on the findings of the study, there is considerable scope exists for developing the value chain through keeping the marketing efficiency at the chain III level.

Keywords: Vegetable crops; marketing; value chain; Chittagong Hill Tracts (CHT); Bangladesh.

JEL: Q13, M31, O13

1. INTRODUCTION

Based on the projection of population statistics, Bangladesh has a population of approximately 164.62 million, making it one of the world's heavily populated nations [1]. While Bangladesh is on track for achieving middle-income country status by 2021, agriculture remains by far the state's largest employer, and 41% of the population is employed directly in agriculture. Almost 70% depend on agriculture [2]. Agriculture acts as the foundations of food supply for human beings through crops, livestock, fisheries, raw materials sources for industry, timber for construction and originator of foreign exchange for the country through the export of raw or processed agricultural commodities. It is the powerhouse of agro-industrial sector growth, including food processing, input production, marketing and related services. It plays a fundamental role in reducing poverty, which remains a predominantly rural phenomenon, as the primary source of economic linkages in rural areas. Agriculture also plays an essential role in boosting nutritious diets, especially in rural areas where production and consumption patterns are highly interlinked. In rural areas, 26.4% and 14.9% of the total populations live below upper and lower poverty line respectively [3]. However, as the country develops, and other sectors expand (such as readymade garments), the share of agriculture in Gross Domestic Product (GDP) has naturally deteriorated. The tentative figures indicate that the far-reaching agricultural sector's role in GDP in 2016-17 is 11.12% [4]. Contributions in GDP from the crop, fishery, livestock and forestry subsectors were 9.11%, 3.69%, 1.78% and 1.75% respectively. Success has been accomplished in the latest years owing to the ongoing reform and execution of agricultural policies.

A value chain describes the full range of activities required to produce a product or service from

conception through the intermediate stages of development (including a mixture of physical transformation and the input from different supplier services), distribute to final customers and post-use final disposal [5,6]. The concept of the value chain also refers to adding value to preliminary products by combining them with other resources (i.e. tools, human resources, knowledge and skills, other raw materials or preliminary products). The product's value gets increased as it moves through the various stages of the supply chain [7]. In the typical selling scheme, farmers produce commodities that are "pushed" directly into the marketplace. Producers are segregated from the end-user and have minimal power over production-related costs or of the resources earned for their products. In a marketing system for the value chain, farmers are closely linked to customers' requirements and work closely with processors and dealers to generate particular products as consumers demand. Similarly, consumers are connected to the requirements of farmers through flows of information and products. Under this approach, the returns can be increased for farmers, and livelihoods can be improved by constant innovation. Actors at all stages of the value chain can have an advantage rather than concentrating profits on one or two links. The agricultural supply chain is an integral part of the value chain and the terms value and supply chain may sometimes be used interchangeably in the literature or are at least closely related.

Value Chain Development is a tool against poverty. Globalization fills market gaps and brings producers and consumers closer together. The sustainable development of a country stresses the need for international cooperation through catalyzing foreign investment which ultimately brings regional and global competition into local markets [8]. Policymakers are continuously exploring the potential of agro-industries with a strong focus on nurturing

efficient sustainable agricultural value chains as a form of further expanding the dominant position of agriculture in poverty alleviation and economic growth. Value chain analysis is a tool for policymakers to specify necessary actions, prioritize investments and development and growth prospects. By identifying the level of intensity, flaws, and weak points, value chain analysis may assist participants build a common vision of how the chain will work and recognize mutual partnerships that can contribute to chain performance improvements.

The vegetable growers in the Chittagong Hill Tracts (CHT's) region will get fair prices of their produces if the agro-processing industry and proper marketing channel can be developed. Vegetable growers count losses every year in CHT's as they often are compelled to trade their produces at reduced prices compared with production costs because of the poor infrastructure, absence of traders, middlemen as well as a dearth of variation in consumption patterns. The farmers are losing their interest to cultivate vegetables as they are denied fair prices and turned into tobacco cultivation. If this tradition goes on, it will be very alarming for the environment, soil fertility and human health especially in the hilly area. There is a good scope to enhance the poor farmers' income across the value chain and entrepreneurship development through the appropriate use of product diversification and set of a proper marketing channel for vegetables. Since this sector is closely aligned with the country's food safety [9], promotion of appropriate marketing knowledge, availability of processing materials and setting up of small processing plant may enhance farmers' and entrepreneur's income in the long run.

An effective marketing mechanism ensures higher income for farmers and expands the markets for the produce by transporting them to isolated parts of the world [10]. Policymakers need to find ways of reducing the needless role of intermediaries in creating an effective marketing system that benefits farmers and consumers more [11].

The outcome of this research study will help to analyze the existing supply chain/value chain and upgrading the existing chain of selected products, assessing hill farmer's access to market and identifying market opportunity of hill agricultural product for developing value chain in

the Hill Tract. The study can be supportive for new entrepreneurs by establishing a new entrepreneurship model by developing value chain of vegetable crops. Thus, the study is a pioneer study in CHT through which both growers and entrepreneurs will be benefited. The study can also be supportive research for national policy as well as for further research.

Considering the above issues in mind, the current study has been articulated in light of the specific objectives as follows:

1. To assess the profitability and value addition of brinjal at a various stages of supply chain;
2. To examine the marketing efficiency at the study areas.

2. MATERIALS AND METHODS

2.1 Study Area Selection

The study area selection was done purposively based on the brinjal production and marketing in the CHT area. The Upazilas selected for the study were Khagrachari Sadar, Dighinala, Panchari, Bandarban Sadar, and Chittagong Sadar. The markets selected for the study were, one wholesale market namely: Riazuddin Bazar in Chittagong Sadar. The retail markets of Khagrachari District are Khagrachari sadar bazar, Panchari bazaar, Dighinala bazar. The retail markets of Bandarban District are Bandarban sadar, Balaghata bazar.

2.2 Selection of Sample and Sampling Technique

The target population is characterized as those engaged in the brinjal production and marketing operation process. It was not possible to interview all the farmers and traders of the study area due to time and resource constraints. Sampling is an important part of survey work. A sample of farms was chosen which could represent a reasonably true picture of the entire population. The sample included the growers of brinjal and various market players, such as Faria, Bepari, Wholesaler, Aratdar and Retailer. A random sampling method was adopted to accumulate the data from the farmers and different market participants.

Table 1. Distribution of samples

Particulars	Bandarban	Khagrachari	Chittagong	Total
Farmer	30	30	0	60
Faria	4	4	0	8
Bepari	4	4	0	8
Aratdar	0	0	10	10
Wholeseller	0	0	10	10
Retailer	5	5	4	14
Total				110

Source: Authors calculation from the Field Survey

Primary data were collected to meet the stated aims of the present study for the brinjal from Khagrachari and Bandarban in January- March 2016. Focus Group Discussion was conducted during May-June 2016.

As the population size was not readily available, the brinjal growers and market intermediaries were selected considering availability at the first sight and from the Farmers Grower Group (FGG) as well as Farmers Marketing Group (FMG). The market actors or intermediaries imply to those individuals who function between the farmers and consumers. The key market actors were faria, bepari, aratdar, wholesaler and retailer. Information was gathered on the amount of trade, marketing costs (depreciation of investment capital, interest on operating capital, transport costs, office costs, tax, market toll, wastage, etc.), distribution modes, purchase and sales price, product and price formation, gross and net margins and marketing constraints. Similar and comparable methods were followed for bepari, faria, aratdar, wholesaler and retailers.

2.3 Data Analysis

Data collected from questionnaire interviews were coded where relevant, loaded into a database system through Microsoft EXCEL and was analyzed using SPSS-19 Statistical Software. Descriptive statistics (percentage, mean, range, standard deviation, coefficient of correlation, variance coefficient, etc.) were used to define the variables and broad marketing costs were calculated by following approached defined by [12].

In the current research, the costs and margins of the growers of brinjal, and yard-long beans were calculated. Production costs include both variable and fixed costs. The variable costs include costs for seed, cost of human labor, 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. The following profit equation was employed to assess the profitability of production.

Net return of producer (Eq. 1)

$$\Pi = P_F \cdot Q_F - (TVC + TFC) \tag{1}$$

Where,

- Π is Profit of producer per hectare
- P_F is Per unit price of Vegetable (Tk/kg)
- Q_F is Quantity of brinjal (Qt/ha)
- TVC is Total variable cost of brinjal cultivation
- TFC is Total fixed cost of brinjal cultivation

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) (Eq. 2).

$$GR = \sum P_b \cdot Q_b \tag{2}$$

Where

- GR is Gross return from brinjal
- P_b is Per unit price of brinjal
- Q_b is Quantity of brinjal

The argument for using gross margin analysis is that the brinjal growers were more interested to know their return over variable cost.

The following equation was used to assess the gross margin (Eq. 3).

$$GM = TR - VC \tag{3}$$

Where,

- GM is Gross margin; TR is Total return; VC is Variable cost

Interest on operating capital= Amount of operating capital× Interest rate (%) × Time required (in years) /2

Variable cost of production will be considered as operating capital.

2.4 Value Chain Analysis

Analysis of the value chain includes identifying all the functions performed in a specific commodity sector, organizing them into the sequence, and analyzing each function about both the preceding steps and subsequent ones.

2.4.1 Marketing cost, marketing margin and value addition by traders

The marketing costs mainly include costs for various market operations like transportation, loading and unloading, market toll, rents, staff salary, electricity, generator cost, commission, wastage, depreciation, and other miscellaneous costs. The items of the marketing costs vary with the type of intermediaries.

The Total marketing cost incurred by the farmers and intermediaries in a channel is estimated by the Eq. 4.

$$C = C_f + C_{m1} + C_{m2} + C_{m3} + \dots + C_{mi} \quad (4)$$

C is Total cost of vegetable marketing in a channel

C_f is Cost paid by the producer when commodity moves

C_{mi} is Cost incurred by the ith middlemen in the process of buying and selling of vegetable in a channel. (i = 1, 2,3, ...n)

The marketing margin and net marketing margin of different value chain actors were estimated by the Eq. 5-6.

$$\text{Marketing Margin} \left(\frac{\text{Tk}}{\text{kg}} \right) = \text{Sales price} \left(\frac{\text{Tk}}{\text{kg}} \right) - \text{Purchase price} \left(\frac{\text{Tk}}{\text{kg}} \right) \quad (5)$$

$$\text{Net Marketing margin} \left(\frac{\text{Tk}}{\text{kg}} \right) = \text{Marketing margin} \left(\frac{\text{Tk}}{\text{kg}} \right) - \text{Marketing cost} \left(\frac{\text{Tk}}{\text{kg}} \right) \quad (6)$$

$$\text{Value Addition (\%)} = \frac{(\text{Sales Price} - \text{Purchase Price})}{\text{Purchase Price}} \times 100 \quad (7)$$

Marketing margin of a channel is measured by using the Eq. 8.

$$M = M_f + M_{m1} + M_{m2} + M_{m3} + \dots + M_{mi} \quad (8)$$

M is Total margin in a channel

M_f is Return received by the farmer

M_{mi} is Margin received by the ith middlemen

Value Addition by Traders and Gross Margins are expressed by Eq. 9-10.

$$\text{Value Addition} = \text{Gross margin} - \text{Marketing cost} \quad (9)$$

$$\text{Gross Margin} = \text{Sale price} - \text{Purchase price} \quad (10)$$

2.5 Marketing Efficiency

Marketing performance was assessed using various marketing efficiency measures, as defined by [13-15]. In this research, marketing efficiency was studied by analyzing price spread, the share of growers, Acharya's methods for estimating marketing efficiency and return on investment.

2.5.1 Acharya marketing efficiency

Acharya's [15] method of marketing efficiency is an optimum measure of marketing efficiency, especially for judging the efficiency of alternate market/channels. Marketing efficiency was estimated by applying Acharya's index, which is defined by Eq. 11.

$$ME = \frac{FP}{MC + MM} \quad (11)$$

ME is Marketing efficiency.

FP is Net price received by farmers

MC is Total marketing cost

MM is Total net marketing margin of intermediaries.

A higher value of ME denotes higher level of efficiency and vice versa.

2.6 Price Spread

Price-spread, and producers' shares in consumers' price and Net price received by growers were calculated by Eq. 12-14. (7)

$$\text{Price spread} = \text{Price paid by consumer (Tk/kg)} - \text{Price received by the grower} \left(\frac{\text{Tk}}{\text{kg}} \right) \quad (12)$$

$$\text{Producer's share (\%)} = \frac{\text{Price Received by the Producer} \left(\frac{\text{Tk}}{\text{kg}} \right)}{\text{Consumer's Price} \left(\frac{\text{Tk}}{\text{kg}} \right)} \times 100 \quad (13)$$

$$\text{Net Price Received by Grower} = \frac{\text{Gross Price Received (Tk/kg)} - \text{Average cost incurred in marketing} \left(\frac{\text{Tk}}{\text{kg}} \right)}{\quad} \quad (14)$$

As a measure of marketing efficiency, Shepherd's formula [13] was used as the ratio of total value of goods marketed to the total marketing cost. The higher the ratio, higher is the efficiency and vice-versa.

Four performance indicators were used for measuring efficiency of different marketing chains. These indicators were (i) Producers' share (11), (ii) Marketing cost (12), (iii) Intermediaries' margin (13), (iv) Acharya Marketing Efficiency (14) [16]. The cost of marketing was calculated and the lowest cost marketing chain was ranked 1 and that which has highest cost as the last. The same approach was followed in ranking the margin of middlemen in each chain.

The final ranking of all the four indicators of all chains were computed by using the composite index (Eq. 15.)

$$R = \frac{R_i}{N_i} \quad (15)$$

Where:

R_i = Total value of ranks of all indicators (I_1 - I_6) all chains

N_i = Number of indicators.

The lowest mean represents relatively the most efficient channel and vice versa [17].

3. RESULTS AND DISCUSSION

Marketing chain is the alternative root of products flow from producers to consumers [18]. Market chain analysis aims to provide information on profitability for the various agents along the market chain. The market chain starts from the farmer or producer and finishes at consumers. From farmer to consumer, various market actors are being involved in this supply chain to reach the product to the end consumer. These market actors are faria, bepari, aratdar, wholesaler and the retailer. The following major marketing chain was found in the study areas:

- i. Farmer → Faria → Retailer → Consumer (Local)
- ii. Farmer → Faria → Bepari → Aratdar (Chittagong) → Retailer → Consumer (Chittagong)
- iii. Farmer → Retailer → Consumer (Local)
- iv. Farmer → Bepari → Aratdar (Chittagong) → Retailer → Consumer (Chittagong)
- v. Farmer → Bepari → Aratdar (Chittagong) → Wholesaler → Retailer → Consumer (Chittagong)

3.1 Cost of Production and Profitability of Selected Vegetables

On average, the total cost of brinjal production was Tk. 220,010.38/ha in which total variable cost was Tk. 179,963.97/ha and fixed cost was Tk. 40,048.92/ha. The Highest cost was found in Khagrachari district (Tk. 224,369.06/ha) because farmers of Khagrachari district applied fertilizer, irrigation water and pesticide adequately (Table 2).

3.1.1 Profitability of brinjal in the study areas

Average yield of brinjal was found to be 26096.06 kg/ha. The higher yield was found in Bandarban district (26166.67 kg/ha). The average gross return, gross margin and net return were Tk. 350,072.65., Tk. 170,108.68 and Tk. 130,062.27 per hectare respectively. The BCR of brinjal production was 1.59 in all areas (Table 3). This result corroborated by the Hoq et al. [19] where it was found that Benefit-cost ratio (BCR) of the vegetable (bitter gourd) as more profitable.

3.2 Marketing Margin of Brinjal for Different Chains

The net marketing margin for each intermediary as well as chain were presented in Table 4. The net marketing margin was highest at chain II and lowest at chain I. This result has been supported by Janifa et al. [20] where it was found that the retailers earned the highest net marketing margins. On the contrary, for aiming to assess the efficiency of marketing of tomato in the central markets of Khartoum State at winter 2010, Emam [21] conducted a study where it was revealed that wholesalers generally got higher marketing margins than retailers with exception of Khartoum market, where retailers got higher marketing margins than wholesalers.

Table 2. Cost of brinjal production in the study areas

Sl. No.	Cost Items	Bandarban (Tk)	Khagrachari (Tk)	Average (Tk)
1	Human Labour			
	Land Cleaning and Preparation	9548.33	10235.21	9891.77
	Seed Sowing/Planting	15763.33	16120.56	15941.95
	Weeding	7410.00	7541.23	7475.62
	Fertilizer Application	5715.00	7520.20	6617.60
	Insecticide Application	12116.67	13256.01	12686.34
	Harvesting and Carrying	11586.67	12346.94	11966.81
2	Land Preparation (Power Tiller)	15526.67	16450.21	15988.44
3	Seedling/Seed	9253.33	10059.56	9656.45
4	Fertilizer Cost			
	Urea	6224.40	7162.84	6693.62
	TSP	22318.00	22743.56	22530.78
	MP	3556.33	4125.75	3841.04
	Cowdung	4000.00	5000.00	4500.00
5	Insecticide	42973.33	45012.55	43992.94
6	Irrigation	7606.67	8754.56	8180.62
	Total Variable Cost	173598.73	186329.20	179963.97
7	Land Use Cost	36850.00	32450.00	34650.00
8	Interest on Operating Capital	5207.96	5589.88	5398.92
	Total Fixed Cost	42057.96	38039.88	40048.92
Total		215651.69	224369.06	220010.38

Source: Authors calculation from the Field Survey

Table 3. Yield, gross return, net return of brinjal in the study areas

Particulars	Bandarban	Khagrachari	Average
Yield (Kg)	26166.67	26025.45	26096.06
Price (Tk/Kg)	13.33	13.50	13.42
Gross Return (Tk/hectare)	348801.71	351343.58	350072.65
Total Variable Cost (Tk /hectare)	173598.73	186329.20	179963.97
Total Cost (Tk/hectare)	215651.69	224369.06	220010.38
Gross Margin (Tk/hectare)	175202.98	165014.38	170108.68
Net Return (/hectare)	133150.02	126974.52	130062.27
BCR	1.62	1.56	1.59

Source: Authors calculation from the Field Survey

3.3 Marketing Efficiency of Different Channel of Brinjal

3.3.1 Price spread

Price spreads of different chains of brinjal were presented in Table 5. The price spread was highest when brinjal was transferred by channel V, i.e., Farmer → Bepari → Aratdar (CHT) → Wholesaler → Retailer → Consumer (Chittagong) and the amount is Tk11.20 per Kg. The lowest price spread was found for channel III i.e., Farmer → Retailer → Consumer (Local) and the amount is Tk5.77 per Kg.

The study of Murthy et al. [22] revealed that the price spread of vegetables over different marketing channels indicates that the producer's

share has an inverse relationship with the number of intermediaries. The net price the producers receive is relatively higher on the channels in which the product is sold directly to consumers or retailers which is supported by our study also.

3.3.2 Producers' share to consumers' price

The producers' share of different marketing chains like I, II, III, IV and V were 58.37, 41.58, 59.51, 50.96 and 45.37 percent respectively which were paid by the consumers as retail prices (Table 6). Farmers' share in different marketing chains was the highest in chain III followed by chain I and chain IV and the lowest in chain II. It indicates if the farmer would sell their brinjal through Farmer → Retailer → Consumer (Local),

Table 4. Marketing margin and cost of brinjal in different chains (Tk /Kg)

Chain	Intermediaries	Purchase Price	Sales Price	Gross Marketing Margin	Marketing Cost	Net Marketing Margin	Return on Business capital (%)
Chain I	Faria	7.88	10.13	2.25	1.14	1.11	12.31
	Retailer	10.13	13.50	3.37	1.83	1.54	12.88
	Total			5.62	2.97	2.65	
Chain II	Faria	7.88	9.88	2.00	1.14	0.86	9.53
	Bepari	9.88	14.25	4.37	3.30	1.07	8.12
	Retailer	14.25	18.95	4.70	1.83	2.87	17.85
	Total			11.07	6.27	4.80	
Chain III	Retailer	8.48	14.25	5.77	1.83	3.94	38.22
	Total			5.77	1.83	3.94	
Chain IV	Bepari	9.30	13.88	4.58	3.30	1.28	10.16
	Retailer	13.88	18.25	4.37	1.83	2.54	16.17
	Total			8.95	5.13	3.82	
Chain V	Bepari	9.30	13.88	4.58	3.30	1.28	10.16
	Wholesaler	13.88	16.94	3.06	1.70	1.36	8.73
	Retailer	16.94	20.50	3.56	1.83	1.73	9.22
	Total			11.20	6.83	4.37	

Source: Authors calculation from the Field Survey

Table 5. Price spread in different chains of brinjal

Particulars	Chain I		Chain II		Chain III		Chain IV		Chain V	
	Tk/kg	Percent	Tk/kg	Percent	Tk /kg	Percent	Tk/kg	Percent	Tk/kg	Percent
A. Gross Price Received by Farmer	7.88	58.37	7.88	41.58	8.48	59.51	9.30	50.96	9.30	45.37
i. Marketing Cost incurred by farmer	2.22	16.44	2.22	11.72	2.22	15.58	2.22	12.16	2.22	10.83
ii. Net price received by Farmer	5.66	41.93	5.66	29.87	6.26	43.93	7.08	38.79	7.08	34.54
B. Gross Margin of Faria	2.25	16.67	2	10.55	0.00	0.00	0.00	0.00	0.00	0.00
ii. Marketing Cost incurred by Faria	1.14	8.44	1.14	6.02	0.00	0.00	0.00	0.00	0.00	0.00
ii. Net price received by Faria	1.11	8.22	0.86	4.54	0.00	0.00	0.00	0.00	0.00	0.00
C. Gross Margin of Bepari	0.00	0.00	4.37	23.06	0.00	0.00	4.58	25.10	4.58	22.34
ii. Marketing Cost incurred by Bepari	0.00	0.00	3.3	17.41	0.00	0.00	3.3	18.08	3.3	16.10
ii. Net price received by Bepari	0.00	0.00	1.07	5.65	0.00	0.00	1.28	7.01	1.28	6.24

Particulars	Chain I		Chain II		Chain III		Chain IV		Chain V	
	Tk/kg	Percent	Tk/kg	Percent	Tk /kg	Percent	Tk/kg	Percent	Tk/kg	Percent
<i>D. Gross Margin of Wholesaler</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.06	14.93
ii. Marketing Cost incurred by Wholesaler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.7	8.29
ii. Net price received by Wholesaler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36	6.63
<i>E. Gross Margin of Retailer</i>	3.37	24.96	4.7	24.80	5.77	40.49	4.37	23.95	3.56	17.37
ii. Marketing Cost incurred by Retailer	1.83	13.56	1.83	9.66	1.83	12.84	1.83	10.03	1.83	8.93
ii. Net price received by Retailer	1.54	11.41	2.87	15.15	3.94	27.65	2.54	13.92	1.73	8.44
Price Paid by Consumer (A+B+C+D+E)	13.50	100.	18.95	100.	14.25	100.	18.25	100.	20.50	100.
Price Spread	6.52		11.08		5.77		8.95		11.20	

Source: Authors calculation from the Field Survey

Table 6. Producers' share in the final product price in different chains (Tk/Kg)

Particulars	Chain I	Chain II	Chain III	Chain IV	Chain V
Producer Price (A)	7.88	7.88	8.48	9.30	9.30
Weighted Average price at retail level (B)	13.50	18.95	14.25	18.25	20.50
Percentage of producers' Share(A/B)*100	58.37	41.58	59.51	50.96	45.37
Rank (I ₁)	2	5	1	3	4

Source: Authors calculation from the Field Survey

they would be most benefited. It has been revealed by the study of Xaba and Masuku [23] where it is showed that the biggest share of the producer was acquired by direct sale to customers. The study also recommended that producers ought to develop co-operatives to help negotiate prices within the vegetable supply chain.

3.3.3 Marketing cost and margin

The size and composition of marketing margin can be used as a useful measure of efficiency. Marketing cost was the lowest for chain III for involving fewer numbers of intermediaries followed by chain I, IV and II, respectively. It was the highest in chain V for the presence of large number of buyers. Marketing margin was lowest for chain I followed by chain III, IV, II and V, respectively. The marketing costs and margins and net margins for different chains are presented in Table 7. The Table reveals that the marketing margins to the middlemen of the brinjal marketing system amount to be the highest in chain V and the lowest in chain I. The highest marketing margin appeared as opposed to other chains given the large number of intermediaries engaged in chain V.

3.3.4 Acharya's method for estimating marketing efficiency

The performance of marketing was assessed based on the Acharya's formula of marketing efficiency. Results showed that the most efficient marketing channel was chain III: Farmer → Retailer → Consumer (Local) (1.47) (Table 8).

There was a noticeable result for all channels that when brinjal was supplied through Faria, the chain was more efficient than other chain. This is possibly due to lower marketing cost, lower marketing cost corresponding higher marketing efficiency.

3.3.5 Overall marketing efficiency measurement

Different marketing chains were carried out based on different performance indicators in different chain using composite index formula. The result exposed that the marketing chain II, IV and V were not comparatively efficient in the brinjal producing region. This was due to the low prices received by farmers in chain I and III compared with other chain. The farmers reply to marketing chain III, selling directly to the retailer-consumer, showed to be most desirable (Table 9). It may, thus be decided from the forgoing analysis that farmers' shares had been very low in chain (II, IV and V) while marketing cost and intermediary margins in these chains were high. In order to increase the share of farmers, the development of the situation in Chain III should be prioritised by the government to help with more marketing activities in these regions.

It has also been corroborated by the study of Dastagiri et al. and Gunwant et al. [24,25] where they showed that Producer-Wholesaler-Retailer-Consumer is the most common marketing channel for majority of the crops. The highest marketing efficiency are found to be in the producer to consumer channel.

Table 7. Marketing cost, margin and net margin of the intermediaries under different chains (Tk /Kg)

Particulars	Chain I	Chain II	Chain III	Chain IV	Chain V
Purchase price	7.88	7.88	8.48	9.30	9.30
Sale Price	13.50	18.95	14.25	18.25	20.50
Marketing margin	5.62	11.07	5.77	8.95	11.20
Rank (I ₂)	1	4	2	3	5
Marketing Cost	2.97	6.27	1.83	5.13	6.83
Rank (I ₃)	2	4	1	3	5
Net marketing Margin	2.65	4.8	3.94	3.82	4.37

Source: Authors calculation from the Field Survey

Table 8. Acharya's marketing efficiency of various channels (Tk/Kg)

Particulars	Chain I	Chain II	Chain III	Chain IV	Chain V
Price Received by the Farmer (FP)	7.88	7.88	8.48	9.30	9.30
Total Marketing Cost (MC)	2.97	6.27	1.83	5.13	6.83
Total Net Marketing Margin (MM)	2.65	4.80	3.94	3.82	4.37
Marketing efficiency {FP/(MC+MM)}	1.40	0.71	1.47	1.04	0.83
Rank (I ₄)	2	4	1	3	5

Source: Authors calculation from the Field Survey

Table 9. Efficiency of different marketing chains

Performance Indicator	Chains				
	Chain I	Chain II	Chain III	Chain IV	Chain V
I_1	2	5	1	3	4
I_2	1	4	2	3	5
I_3	2	4	1	3	5
I_4	2	4	1	3	5
Composite Index (R_i/N_i)	1.75	4.25	1.25	3.00	4.75
Final Ranking	2	4	1	3	5

Source: Authors calculation from the Field Survey; Notes: R_i = Total value of the ranks of performance indicators; N_i = Total number of performance indicators

4. CONCLUSION

The study explores the value chain analysis at Bandarban, Khagrachari and Chittagong districts of Bangladesh. The findings of the study reveal that the production of brinjal cultivation is profitable. The highest price spread for brinjal was found in chain V having Tk. 11.20 per Kg. The highest Producers' Share to Consumers' Price for brinjal was 59.51 percent in chain III. The highest Acharya's marketing efficiency of brinjal was 1.47 in chain III. The most desirable and efficient marketing channel was chain III, Farmer → Retailer → Consumer (Local) for brinjal in the study area. Based on the findings of the study it can be concluded apparently that considerable scope exists to increase the productivity of brinjal and to develop the value chain. A large number of people are involved in the production and marketing of vegetables. So, the farmers and actors could certainly be benefited financially if the production and marketing system of vegetables are well developed.

5. RECOMMENDATION

Since the production of brinjal cultivation is profitable; Government may take the necessary action for the expansion of the high value vegetables in the Chittagong hill districts through awareness raising programmes and training by Department of Agricultural Extension (DAE). To enhance the share of the farmers, development of chain III situation (Farmer → Retailer → Consumer (Local) should be given priority by Government to help in performing more marketing activities in these areas. For developing a more dynamic marketing channel in favour of the producer and intermediaries, another study program should be taken in the hilly areas to generate information and suggestion in those areas.

ACKNOWLEDGEMENTS

This work is the part of the project activities of "Entrepreneurship and Value Chain Development for Linking Hill Farmers with Market" (Component-IV), Commissioned Research Project (CRP) of Hill Agriculture funded by Bangladesh Krishi Gobeshona Endowment Trust (BKGET) under Krishi Gobeshona Foundation (KGF), Dhaka. A six months' fellowship was awarded to the first and second author from this project for completing

their MS research and the implementation of this project was carried out by Bangladesh Agricultural Research Institute (BARI). The research work had been undertaken in the project areas of Chittagong Hill Tracts of Bangladesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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