PCR-407

Competitive Research Grant

Sub-Project Completion Report

on

Supply Chain Analysis of Major Vegetables Produced in Hilly and Coastal Region of Bangladesh

Project Duration

July 2017 to September 2018

Submitted by
Agricultural Economics Division
Bangladesh Agricultural Research Institute
Gazipur-1701, Bangladesh

Submitted to

Implementation Unit-BARC, NATP-2

Bangladesh Agricultural Research Council

Farmgate, Dhaka-1215

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The Authors

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Acronyms

AERS	:	Agricultural Economics and Rural Sociology
BADC	:	Bangladesh Agricultural Development Corporation
BARC	:	Bangladesh Agricultural Research Council
BARI	:	Bangladesh Agricultural Research Institute
BBS	:	Bangladesh Bureau of Statistics
BCR	:	Benefit cost ratio
DAE	:	Department of Agricultural Extension
DAM	:	Directorate of Agricultural Marketing
FAO	:	Food and A
FAO	:	Food and Agricultural Organization
FGD	:	Focus Group Discussion
GDP	:	Gross Domestic Product
GM	:	Gross margin
Ha	:	Hectare
HYV	:	High Yielding Variety
MoA	:	Ministry of Agriculture
7FYP	:	Seventh Five Years Plan
MT	:	Metric Tons
CHT	:	Chittagong Hill Tracts
SCM	:	Supply Chain Management
TVC	:	Total Variable Cost
TFC	:	Total Fixed Cost
MC	:	Marketing Cost
NFDCC	:	National Fertilizer Distribution Coordination Committee
PSI	:	Private Sector Importers
BCIC	:	Bangladesh Chemical Industries Corporation
TSP	:	Triple Super Phosphate
MOP	:	Muriate of Potash

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Executive Summary

Bangladesh witnessed a revolution in vegetable production over the last decade. According to the recently releases FAO report, Bangladesh has ranked third in the list of vegetables producing countries of the world. The study was conducted in hilly and coastal region of Bangladesh for understanding the input distribution system, profitability of different production practices, supply chain and different drawbacks of production and marketing of selected vegetables. The study area covered three hill districts namely; Rangamati, Khagrachari and Bndarban and three coastal districts namely; Patuakhali, Satkhira and Cox's bazar where vegetables production is very limited due to different stress. Brinjal and yard long bean were selected from hilly areas and bitter gourd and cucumber were selected from coastal areas. The study was conducted during the period of 2017-2018. Primary data were collected through face to face interview and ssecondary data were collected from different published sources. Multistage simple random sampling technique was used and total sample size was 1140 for the study. The study revealed that vegetables production and marketing for both farmers and traders were profitable. Three production techniques were found in both regions such as; homestead, plain land and Jhum cultivation in the hilly areas and plain land, sorjon method and gher based cultivation in coastal area. The net return of brinjal and yard long bean in plain land cultivation was Tk. 1, 92,265/ ha and Tk.82362/ha respectively in hilly region and the BCR was found 1.88 and 1.53 respectively. The net return of Jhum cultivation was found Tk.70,113/ha and the BCR was found 2.02.On the other hand, the net return of bitter gourd and cucumber cultivation was Tk. 2,24,530/ ha and Tk. 1,57,893/ha and the BCR was found 2.08 and 1.82 respectively in plain land of coastal area. The profitability of sorjon cultivation and gher based agriculture system was Tk. 91023/ha and Tk. 1,29,115/ha respectively and the BCR was 1.37 and 1.76 respectively. Five supply chains of vegetables were identified in hilly area, of which four chains were dominant and 93.25% vegetables moved by those chains. On the other hand, four supply chains were identified in coastal areas of which three chains were dominant by which 94.43% vegetables moved from producer to consumer. Supply chain-II: Farmer-cum-retailer > Local Consumer is the most efficient chain for both in hilly and coastal region of Bangladesh. Because farmer himself done retailing to the consumer. About 28.30% products run though this chain and the producer's share of this chain was 95.59% for brinjal and 95.42% for yard long bean in hilly areas. However in coastal areas, about 25.50% products run though this chain and the producer's share of this chain was 96.29% for bitter gourd and 95.58 % for cucumber. Highest marketing margin was found in supply chain-V in hilly areas which was Tk. 647.60/qt. for brinjal and Tk. 645.81/qt. for yard long bean. In coastal areas, it was found highest in supply chain-IV which was Tk. 777.41/qt. for bitter gourd and Tk.554.65/qt. for cucumber. Farmers faced different production problem in the hilly areas such as; scarcity of irrigation water and quality seed, low yield, Insect & pest attack, poor technical knowledge and production practices, less use of farm machinery etc. and in coastal belt, farmers also faced unavailability of fresh irrigation water, incidence of salinity in the soil, intrusion of salinity due to heavy rainfall and drought, scarcity of quality seed, poor yield, poor technical knowledge etc. for vegetables cultivation. Trader's also faced some marketing problems such as; price fluctuation, high transportation cost, lack of market information, poor road & transport, unethical subscription, absence of permanent retail place and lack of storage facilities etc. Training program on modern technology and post-harvest handling, improvement of transportation and communication system, development of salt tolerant variety and wider expansion of existing modern technology in coastal region and linking farmers with the extension personnel and researcher were the major recommendation of this study.

CRG Sub-project Completion Report (PCR)

A. Sub-project Description

1. Title of the CRG Sub-Project: Supply Chain Analysis of Major Vegetables Produced in Hilly and Coastal Regions of Bangladesh

2. Implementing organization: Agricultural Economics Division, Bangladesh Agricultural Research Institute, Joydevpur, Gazipur-1701.

3. Name and address of with phone, cell and E-mail of PI/Co-PI (s):

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4. Sub-project budget (Tk.):

4.1 Total: 19,97,895/-

4.2 Revised (if any): Not applicable

5. Duration of the sub-project:

5.1 start date (based on of LoA sign): 13 July, 2017

5.2 End date: 30 September, 2018

6. Justification of undertaking the sub-project:

6.1 Background of the study

Bangladesh witnessed a revolution in vegetable production over the last decade. According to the recently releases FAO report, Bangladesh has ranked third in the list of vegetables producing countries in the world. The country produced a total of 14.23 million tons of vegetables in 2014-15 while the growth rate marked a steady six percent yield in each of the last three years (MoA, 2016).Vegetable cultivation has increased fivefold by arresting unfavorable land type like coastal, hill, char and hoar region of Bangladesh. Hills constitute about 12 per cent of the total area of Bangladesh in which chittagong hill tracts districts alone covers about 9%. Coastal region of

Bangladesh accounts for 30% of the net cultivable area (SRDI, 2012). But vegetable production in those areas is still in primitive stage due to different stresses.

There are many types of production and marketing constraints that exist in those unfavorable ecosystems such as water log, tidal sore, salinity, rain-fed agriculture, poor market infrastructure, inefficient service provider etc. For these smallholders vegetables farming in those areas are subsistence and market is also disorganized. Indigenous people in Bangladesh are, in general, very poor, illiterate, and their livelihood depends on wage earnings and shifting cultivation (Uddin *et al.,* 2000). However, a large part of hilly areas are under state forest and some are under tea and rubber plantation. In the remaining part, Jhum (shifting cultivation following slash and burn method) is being practiced by the tribal people, especially in Chittagong hill tracts and locally in other areas. Jhum involves clearing of forest land after several years (4-5 years) of fallow. But now the fallow period has been reduced further to 2 years due to non-availability of land. This exposure of land has increased the chance of soil erosion and further degradation of land (M. A. Rahman, 2011).They receive the highest income from agriculture compared to other sources, but are constrained by limited cash and modern technology for higher agricultural production, which is a threat to the natural resources in the area (Farid and Mujibullah, 1990; Chowdhury, *et al*. 2004).

Livestock and poultry provide additional income. Their food basket contains mainly indigenous vegetables, fruits and the meat of animals. On the other hand smallholder farming in the coastal region was mostly subsistence-oriented, involving wet-season rice, livestock (mainly cattle), and some tree and vegetable crops in the house-yard. With the construction of coastal embankments in the 1960s, there was the possibility of planting dry-season crops, including rice, wheat, pulses, oilseeds, jute, melons, and various vegetables. In some areas, freshwater fish and prawn are cultivated along with rice in the wet season and brackish-water shrimp is cultivated in the dry season (Bala and Hossain 2010; Ahmed et al. 2010). The land-use pattern in the coastal region has been substantially influenced by the level of salinity and the availability of irrigation water for dry season crops. The proportion of fallowed areas has been increasing because of soil salinization and scarcity of freshwater irrigation (SRDI 2012). Nearly one million hectares remain fallow in the dry season, principally due to soil and water salinity (Bala and Hossain 2010)

The main effort of our 7FYP is also to improve the efficiency of agricultural marketing to reduce market distortions and the cost of marketing, and to ensure that farmers get proper price for their produce and consumer gets quality products.In the existing supply chain, there are a number of middlemen which causes a huge gap between vegetable growers and end consumers. Again the vegetable marketing information system rarely exists in those areas for which the vegetable growers unable to get vegetables' price and demand information. So they cannot sell it at the right price to the middlemen. Moreover poor road and market infrastructure, inappropriate transport and handling make the vegetable supply chain hardening both in the hill and coastal region.

A supply chain is effective at that time when it meets the demand of end consumers at the right place, at the right time and at right price. It creates benefits for all the parties involved in the chain. In case of vegetable supply chain, it needs to meet the vegetable demand of consumers

effectively so that consumers, vegetable growers and middlemen get equal benefit from it. If it is not effective then the interest of any party may decreases which also impact on the overall supply chain negatively (Hossain M. A. and M. N.Hossain, 2013). Therefore the study is undertaken for creating employment opportunities for poor farmers, getting information on production technique, improving supply chain efficiency, lower post-harvest losses and improving market infrastructure in with the above objectives.

6.2 Land utilization pattern in the hilly region

The total land area of Bandarban, Khagrachari and Rangamati district was 4,47,903 ha, 2,70,000 ha and 6,11,600 respectively. In Bandarban upazila, the major share forest area occupied 63.45% of total land area in Bandarban district whereas it was 52.34% in Khagrachari district and 67.61% in Rangamati district. On the other hand, the amount of cultivable area was only 9.45% in Bandarban district, 16.31% in Khagrachari district and 8.95% in Rangamati district. The vegetables crops covered 1.35% land in Bandarban district and 3.46% land in Khagrachari district and 0.98% land in Rangamati district. Highest cropping intensity was found in Rangamati district (159%) followed by Kharachari (154%) and Bandarban district (150%).

Table 6.1 Land utilization patterns of the three districts in hilly region

Particulars	Bandarban		Khagrachri		Rangamati	
	Area (ha)	Percent	Area (ha)	Percent	Area (ha)	Percent
1 Total area	447903	100	270000	100	611600	100
2. Homestead and others	3880	0.87	81744	30.28	4876	0.80
3. Forest area	284194	63.45	141330	52.34	413492	67.61
4. Cultivable land	42335	9.45	44030	16.31	54753	8.95
5. Single cropped	20119	4.49	22820	8.45	23872	3.90
6. Double cropped	12931	2.89	18780	6.96	23070	3.77
7. Triple cropped	2470	0.55	2430	0.90	3430	0.56
8. Fallow land	6815	1.52	--	0.00	4381	0.72
9.Total cropped area	53391	11.92	67670	25.06	80302	13.13
10. Net cropped area	35520	7.93	44030	16.31	50372	8.24
11. Vegetables crops	6038	1.35	9351	3.46	6020	0.98
12. Cropping intensity (%)	150%	--	154%	--	159%	--

(Source: DAE, 2017)

6.3 Land utilization pattern in the coastal region

The total land area of Cox's bazar, Patuakhali and Satkhirai district was 2,49,186 ha, 3,22,015 ha and 3,81,729 respectively. The major share of forest area occupied 36.88% of total land area in Cox'sbazar district whereas it was 6.69% in Patuakhali district 34.65% in Satkhira district. On the other hand, highest cultivable land was found in Patuakhali district which was 63.23% and lowest cultivable land was found in Cox's bazar district which was 35.88% in total land area.

Table 6.2 Land utilization patterns of the three districts in coastal region

Particulars	Cox'sbazar		Patuakhali		Satkhira	
	Area (ha)	Percent	Area (ha)	Percent	Area (ha)	Percent
1 Total area	249186	100	322015	100	381729	100
2. Homestead and others	--	--	--	--	9270	2.43
3.Water body	33420	13.41	--	--	3134	0.82
4. Forest area	91902	36.88	21550	6.69	132265	34.65
5. Cultivable land	89398	35.88	203601	63.23	229607	60.15
6. Single cropped	6100	2.45	50900	15.81	39523	10.35
7. Double cropped	58050	23.30	91620	28.45	103063	27.00
8.Triple cropped	20232	8.12	61081	18.97	45025	11.80
9.Four/more than three cropped	1500	0.60		0.00	1015	0.27
10. Fallow land	3516	1.41	11805	3.67	40981	10.74
11.Total cropped area	188896	75.81	417383	129.62	383784	100.54
12. Net cropped area	85882	34.47	203601	63.23	188626	49.41
13. Vegetables crops	12120	4.86	13605	4.22	16335	4.28
14. Cropping intensity (%)	220%		212%		204%	

(Source: DAE, 2017)

Double cropped area was found highest in all the study area of coastal region rather than single and triple cropped are.The vegetables crops covered 4.86% land in Cox's bazar district, 4.22% land in Patuakhali district and 4.22% land in Satkhira district. Highest cropping intensity was found in Cox's bazar district (220%) followed by Patuakhali (212%) and Satkhira district (202%).

6.4 Present status of vegetables production in hill areas of Bangladesh

The total area of vegetables cultivation in all three hill district was 21,409 ha in which 28.20% in Bandarban district, 42.68% in Khagrachari district and 28.12% in Rangamati district. In all three district area of winter vegetables was higher than the summer vegetables. Total vegetables production in all area was 3,54,954 MT in which 29.71% in Bandarban district, 42.62% in Khagrachari district and 27.67% in Rangamati district.

Table 6.3 Present status of vegetables production in hill areas

Study araes	Winter vegetables		Summer vegetables		All vegetables	
	Area (ha.)	Production (MT)	Area (ha.)	Production (MT)	Area (ha.)	Production (MT)
1.Bandarban district	3492 (29.01)	77243 (34.58)	2546 (27.17)	28203 (21.43)	6038 (28.20)	105446 (29.71)
Bandarban sadar	706	16591	369	3486	1075	20077
Lama	581	6883	779	8139	1360	15022
2.Khagrachari district	4975 (41.33)	83310 (37.30)	4376 (46.69)	67987 (51.67)	9351 (43.68)	151297 (42.62)
Matiranga	800	12600	643	9992.22	1443	22592.22
Manikchari	635	10033	540	8391.6	1175	18424.6
3.Rangamati district	3570 (29.66)	62818 (28.12)	2450 (26.14)	35393 (26.90)	6020 (28.12)	98211 (27.67)
Rangamati sadar	358	6919	255	3449	613	10368

KawKhali	371	5990	475	7116	846	13106
Total (1+2+3)	12037	223371	9372	131583	21409	354954

(Source: DAE, 2017)

Fig 6.1 shows the areas of summer and winter vegetables produced in three study areas of hilly region. It is observed from the fig 6.1 that highest area of winter and summer vegetables was found in khagrachari district. Simultaneously highest production was also found in Khagrachari district (fig 6.2)

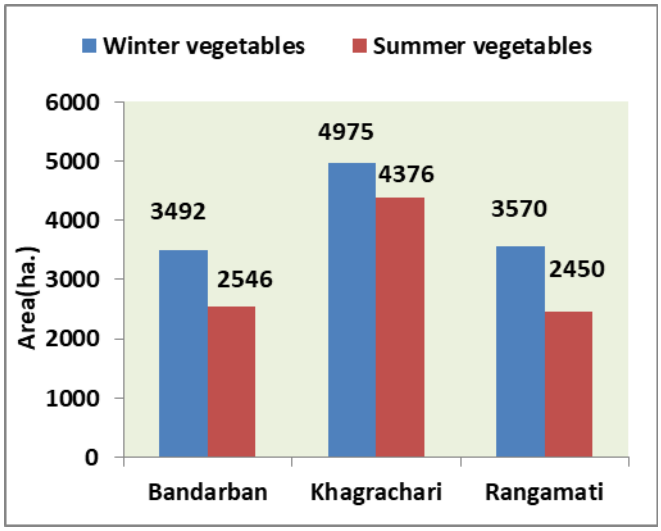

Fig. 6.1 Area of winter and summer vegetables in Hilly areas

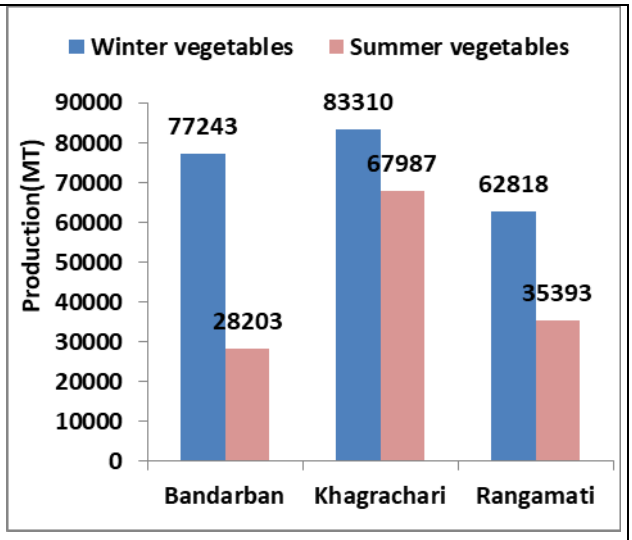

Fig. 6.2 Production of winter and summer vegetables in Hilly areas

6.5 Present status of vegetables production in Coastal areas of Bangladesh

The total area of vegetables cultivation in all three hill district was 42069 ha in which 28.82% in Cox's bazar district, 32.35% in Patuakhal district and 38.84% in Satkhira district. The area and production of winter vegetables were higher than the summer vegetables in all three districts. Total vegetables production in all area was 8,94,839 MT in which 39.75% in Cox's bazar district, 27.53% in Patuakhal district and 32.72% in Satkhira district.

Table 6.4 Present status of vegetables production in coastal areas

Study area	Winter vegetables		Summer vegetables		All vegetables	
	Area (ha.)	Production (MT)	Area (ha.)	Production (MT)	Area (ha.)	Production (MT)
Cox's bazar district	9620 (34.04)	320670 (46.16)	2500 (18.12)	35000 (17.49)	12120 (28.82)	355670 (39.75)
Cox's bazar sadar	2150	60200	150	1800	2300	62000
Chokoria	4500	148500	1200	20400	5700	168900
Patuakhal district	9500 (33.61)	199861 (28.77)	4105 (29.76)	46496 (23.23)	13605 (32.35)	246357 (27.53)
Galachipa	1450	29087	400	4930	1850	34017
Kolapara	2777	60055	840	8613	3617	68668
Satkhira district	9145 (32.35)	174177 (25.07)	7190 (52.12)	118635 (59.28)	16335 (38.84)	292812 (32.72)

Ashashuni	620	11620	515	7922	1135	19542
Shamnagar	680	11044	520	8530	1200	19574
Total (1+2+3)	28265	694708	13795	200131	42060	894839

(Source: DAE, 2017)

It is observed from the fig 6.4 highest area of winter vegetables was found in cox's bazar district and highest area of summer vegetables were found in satkhira district. On the other hand highest production of winter vegetables and lowest production of summer vegetables were found in cox's bazar district and highest production of summer vegetables were found in Satkhira district.

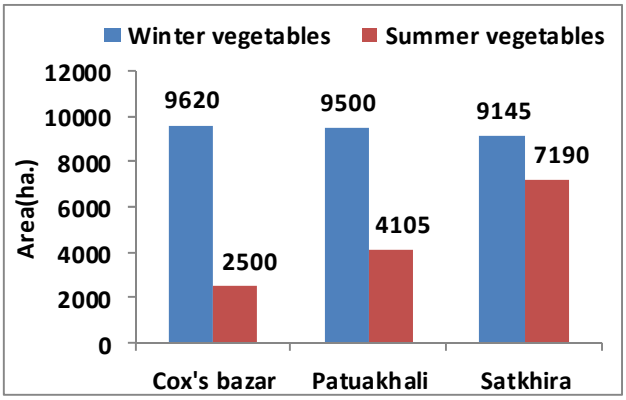

Fig 6.3 Area of winter and summer vegetables in coastal areas

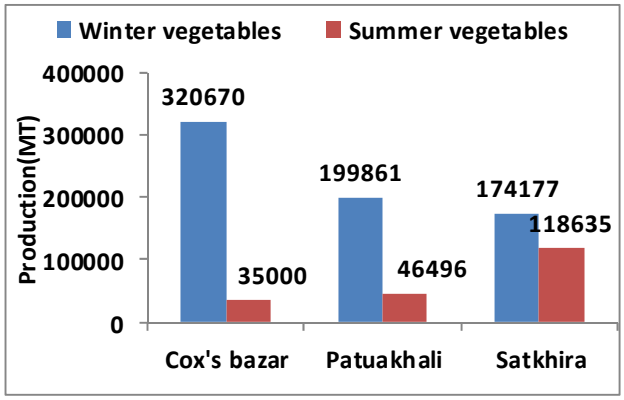

Fig 6.4 Production of winter and summer vegetables in coastal areas

7. Sub-project goal: Improve production and marketing system of vegetables by removing constraints of supply chain in hilly and coastal region.

8. Sub-project objective (s):

I. To analyze input supply, production system and profitability of major vegetables in hilly and coastal region;
II. To examine the existing market, marketing system and supply chain of selected vegetables in those areas;
III. To identify the constraints to production, marketing and urban market linkage of vegetables and suggest some policy recommendations for improving the vegetables supply chain.

9. Sub-project implementation location (s)

The study was implemented in Rangamati, Khagrachari and Bandarban district of hilly region and Patuakhali, Satkhira and Coxs Bazar district of coastal region.

10. Methodology

Research methodology is an arrangement of the essential conditions for collection and analysis of data in a form that aims to combine relevance to research purpose. The reliability of research depends on the proper methodology used in the study. The adopted methodology for the study is stated in this section.

10.1 Selection of the study area

The study was implemented at different unfavorable ecosystem in Bangladesh. Two unfavorable situations were considered viz; hilly and costal region of Bangladesh. Three districts were selected from hilly areas such as; Bandarban, Khagrachari and Rangamati and three districts were selected from coastal areas such as; Cox's bazar, Patuakhali and Satkhira. Project locations were selected based on intensive growing areas of the selected vegetables on the basis of BBS data and expert's opinion. Table 10.1 showed the detailed study location in two ecosystems.

Table 10.1 Detail study location of the project

Region	Districts	Upazilas
Hilly Region	Rangamati	Rangamati Sadar
		Kawkhali
	Khagrachari	Matiranga
		Manikchari
	Bandarban	Bandarban Sadar
		Lama
Coastal Region	Patuakhali	Golachipa
		Kolapara
	Satkhira	Ashasuni
		Shamnagar
	Coxsbazar	Coxsbazar sadar
		Chakoria

The following fig.10.1 showed the different study location in the map of Bangladesh that we have conducted survey for data collection.

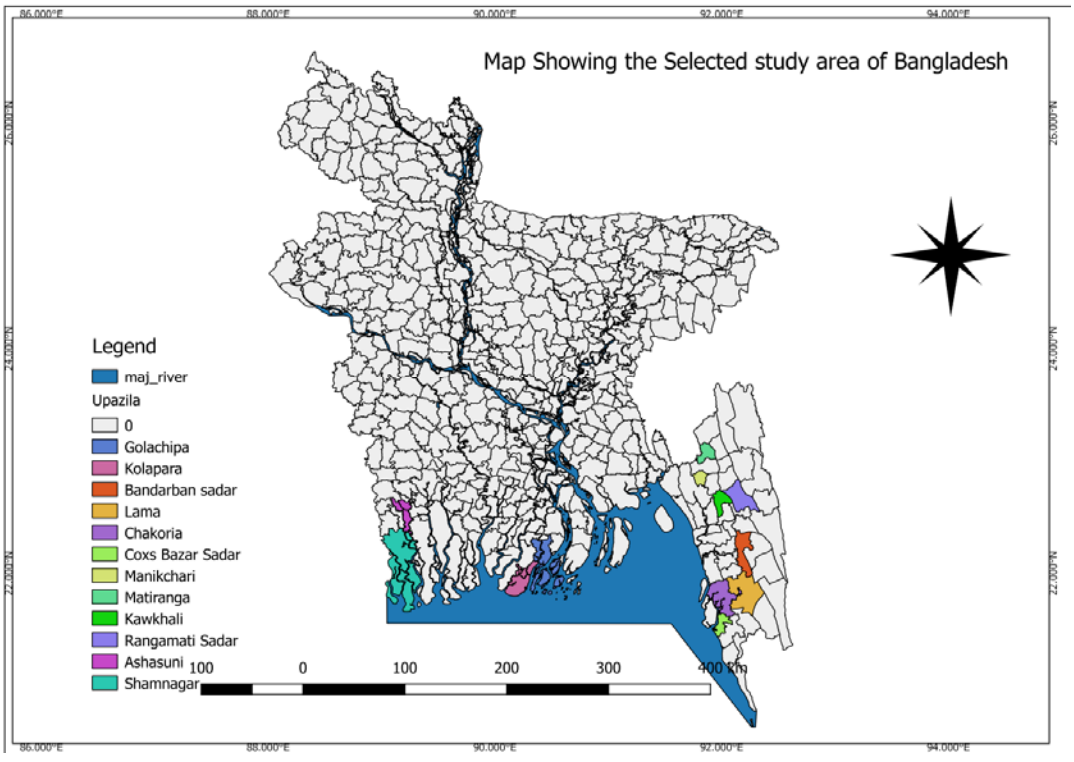

Fig 10.1 Map showing the selected areas of hilly and coastal region

10.2 Selection of Vegetables

Four important vegetables, taking two from hilly area and another two from coastal area were selected for the study. The selected vegetables were brinjal and yard long bean from hilly region and bittergourd and cucumber from coastal region of Bangladesh. The vegetables were selected on the basis of intensively and stressfully growing in that unfavorable ecosystem. The vegetables were selected which are mostly fitted for those location and its production technology and supply chain were taken into consideration. The selections of vegetable were finalized after pre-test.

10.3 Sampling Technique

The intended stakeholders were vegetable growers and vegetable traders (i.e. *Bepari, Arathdar*, Retailers). Multistage simple random sampling techniques were adopted for selecting the reasonable numbers of stakeholders involved in vegetable supply chain. Multi-stage sampling technique was followed for location selection and simple random sampling was used for sample respondent selection.

10.4 Sample size

A total of 600 vegetable growers (6 district x 2 vegetables x 2 upazila x 25 farmers) and 480 intermediaries (6 districts x 2 vegetables x 40 traders) taking 10 Famrmer-cum retailer, 8 beparis, 8 paiker-cum-retailer, 10 retailers and 04 arathdar (commission agent) from both primary and secondary markets were randomly selected for each vegetables. Sixty (60) traders of selected vegetables from Chattagram terminal market were interviewed. Thus the total sample size for the study was 1140 (600 farmers + 540 traders).

Table 10.2 Sample distribution of the study

Region	Study area	Vegetables name	Producer	Intermediaries	Total sample
A. Hilly Area	Rangamati	Brinjal, Yard long bean	100	80	180
	Khagrachari	Brinjal, Yard long bean	100	80	180
	Bandarban	Brinjal, Yard long bean	100	80	180
B. Coastal Area	Patuakhali	Bittergourd, Cucumber	100	80	180
	Coxs Bazar	Bittergourd, Cucumber	100	80	180
	Satkhira	Bittergourd, Cucumber	100	80	180
C. Terminal Market	Riazuddin Bazar, Chattagram	All selected Vegetables	--	60	60
Total sample			600	540	1140

10.5 Data and Information

Both primary and secondary data and information were required for the project. Primary data related to producer and traders were gathered from field level through questionnaire survey from the aforesaid locations. The data were collected on production cost, profits, supply chain, marketing cost, marketing margins, marketing constraints, etc from the farmers and traders. Secondary data and information relating to different statistics of area, yield, production, market

price, and other relevant data were gathered from various published sources (e.g. BBS, FAOStat, journal, research reports, thesis, etc.) through an in-depth literature review.

10.6 Method of data collection

Primary data were collected from the selected respondents through face to face interview method. Scientific officers/ Scientific Assistants were responsible for data collection. They collected data from selected farmers and traders with the supervision of principal investigator.

10.7 Preparation of interview schedule

Two sets of interview schedules were prepared for collecting desired data from the growers and traders. The interview schedules were pre-tested for judging their suitability. After pre-testing, the schedules were finalized and printed.

10.8 Analytical Techniques

10.8.1 Profitability at producers' level: The Following profit equation (1) was used to assess the profitability of vegetables cultivation. Net return from vegetables cultivation;

$$\pi_{ijk} = P_{ijk.}Q_{ijk} - (TVC_{ijk} + TFC_{ijk}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, π= Net return from ith vegetables per hectare

P_{ijk}= Per unit price of ith vegetables (Tk/kg)

Q_{ijk}= Quantity of ith vegetables (kg/ha)

TVC_{ijk} = Total variable cost of ith vegetables (Tk/ha)

TFC_{ijk}= Total fixed cost of ith vegetables (Tk/ha)

i (1..4)= number of crops,

j (1..6)= number of location,

k (1…..600) = number of farmers.

10.8.2 Net marketing margin at traders' level: The following profit equation (2) was used for calculating net margin at traders' level.

$$\Pi = GM - MC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, Π = Traders' profit (Tk/)

GM = Gross margin (Tk/quintql)

MC = Marketing cost (Tk/quintal)

10.8.3 Measurement of marketing efficiency: Rajagopal (1986) and Chauhan*et al*., (1994) also used six performance indicators for measuring marketing efficiency of a specific product. The indicators are (i) producer's share to the consumer's price, (ii) relative marketing cost, (iii) level of middlemen margin, (iv) deviation between the minimum and maximum prices, (v) peak period seasonal price variability, and (vi) lean period seasonal price variability. Out of six performance indicators four indicators were used in this study on the basis of available data and information. The producers' share was derived by the ratio of net average price received by the producer to the weighted average price of vegetables. It was calculated with the following formula and the channel which had highest producer's share was ranked 1 as first and vice -versa. It was calculated with the following formula (3):

Percentage of producer's share = $\frac{P_{pi}}{P_{ri}} \times 100$ ..... (3)

Where,

$P_{p\,i}$ = Producers' share

P_{ri} = Average price of vegetables at the retail level in each channel.

i = Number of channels (i = 1, 2, ------, n)

The cost of marketing was calculated and the lowest cost marketing channel 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 channel. The deviation (d) between the highest and lowest prices in each month in the respective channels was computed. The price equalization among all the categories of farmers denote d = 0. That is, there is no price deviation among the farmers' prices .If the differences are high it implies highest price deviation and vice-versa. The seasonal movements of prices will be studied by adopting the simple standard deviation (δ). The following equation (4) will be used in the study.

$$\delta = \sqrt{\left(\frac{1}{T}\right)} \sum W_t \left(P_t - P\right)^2 \quad \text{..... (4)}$$

Where,

Where, δ = Standard deviation

P = Average price of vegetables of the season in each channel,

P_t = Average farm price for the agricultural year,

T = Total month in the year.

W_t = Sales during the month in each channel (St) / Sum of the sales during the month in all channels

S_t = i^{th} month

S_{it} = i^{th} channel of t^{th} month

The entire season has been divided in two periods. The peak period and lean period in each agricultural year.

The final ranking of all the four indicators of all channels were computed by using the composite index formula (8). The lowest value of indicator mean represents relatively the most efficient channel and vice versa (Rajagopal, 1986).

$$R = \frac{R_i}{N_i} \quad \text{..... (5)}$$

Where,

Ri = Total value of ranks of all indicators (I_1------ I_6) all channels

Ni = Number of indicators.

11. Results and discussion

The results and discussion of the study were presented sequentially in the chapter 11.1 to chapter 11.7 according to fulfil and better understanding of the objectives of the project.

CHAPTER 11.1

AVAILABILITY AND DISTRIBUTION SYSTEM OF AGRICULTURAL INPUT

Agricultural inputs uses pattern and its availability is very important for the production process of vegetables. Generally agricultural inputs refer to seed, fertilizer, pesticides and others production factors of production. Efficient production mostly depends on availability and judicious uses of inputs and its proper distribution system. Vegetables cultivation required those types of inputs 2-3 times higher than cereals crops. This chapter discussed the different types of input, its sources, and distribution system in the study areas of Bangladesh.

11.1.1 Seed supply system

Vegetables productivity largely depends on the use of quality seeds. High yield depends to a great extent on quality seed accompanied by other inputs like fertilizers, pesticides and improved machinery. Large yield depends to a large extent on suitable varieties of seeds which are capable of producing higher yields, provided other associated factors are available in proper combination. Improved varieties of seed are one of the most important parts of strategic inputs. All dealers get their vegetables seed supply from BADC and Seed Company. Dealer supply their vegetables seed to different sub-dealer and retailer sometimes farmers. Farmers also get some seed from research institutions. They also used their own seed for production purposes.

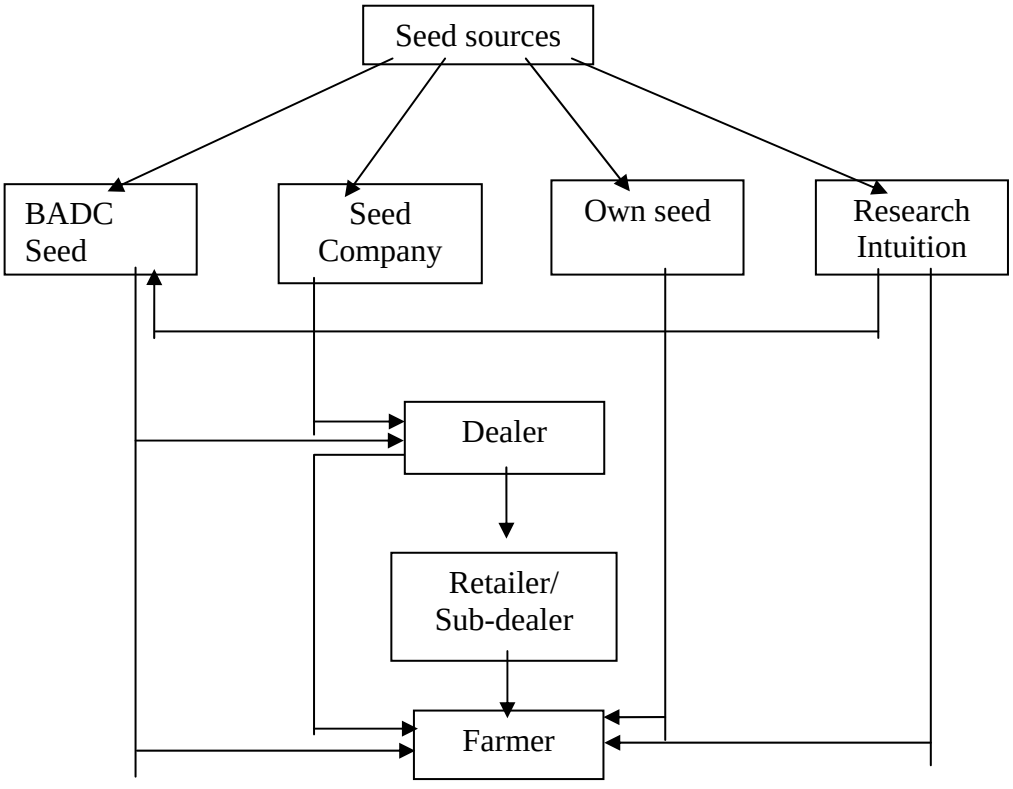

Fig.11.1.1 vegetables seed supply system in the study areas

11.1.2 Sources of seed in hilly areas

Major sources of vegetables seeds in the hilly areas were own seed, retailer, sub-dealer and dealer. Dealers are the company appointed traders whereas sub-dealers works under dealer and retailers collect seeds from dealers or sub-dealers for selling seed to the farmers. Sometimes sub-dealers works as a retailer. Majority of the brinjal farmers purchased seed/seedling from retailer or sub-dealers (55%) followed by own source (30%), dealer (15%) in all area. Whereas in case of yard long bean about 53% farmers purchase seed from retailer or sub-dealers, 23% farmers used own seed and 25% farmers purchase seed from different dealer. All three district of Chattagram hill tracts majority of farmers purchased selected vegetables seed from retailer or sub-dealer (Table 11.1.1).

Table 11.1.1 Sources of seed in hilly areas

Particulars	% of responses			
	Brinjal			
Seed sources	Bandarban	Khagrachari	Rangamati	All area
Own	26	36	28	30
Retailer or Sub-dealer	60	50	54	55
Dealer	14	14	18	15
Seed sources	Yard long bean			
	Bandarban	Khagrachari	Rangamati	All area
Own	20	22	26	23
Retailer or Sub-dealer	56	50	52	53
Dealer	24	28	22	25

11.1.3 Sources of seed in Coastal areas

In coastal belt of Bangladesh major sources of vegetables seeds were also own seed, retailer, sub-dealer and dealer. Majority of the bittergourd farmers purchased seed/seedling from retailer or sub-dealers (44%) followed by dealer (37%), own sources (19%), in all selected coastal areas of Bangladesh. Whereas in case of cucumber about 45% farmers purchase seed from retailer or sub-dealers, 39% farmers purchase from

88different dealer and 25% farmers used own seed. All three districts in coastal belt majority of the farmers purchased selected vegetables seed from retailer or sub-dealer followed by different dealer (Table 11.1.2).

Table 11.1.2 Sources of seed in Coastal areas

Particulars	% of responses			
	Bittergourd			
Seed sources	Cox's bazar	Patuakhali	Satkhira	All area
Own	20	18	20	19
Retailer/sub-dealer	48	40	44	44
Dealer	32	42	36	37
Seed sources	Cucumber			
	Cox's bazar	Patuakhali	Satkhira	All area
Own	18	14	16	16
Retailer/sub-dealer	48	40	48	45
Dealer	34	46	36	39

11.1.4 Fertilizer supply system

Fertilizers supply was not enough when actually needed. As a result farmers have to buy fertilizers with higher prices from black market than the government's fixed prices. Sometimes there was no fertilizer crisis but farmers still considered fertilizer prices were high. Evaluation and identification of the lapses of the existing fertilizer distribution system may help the government for improving the present fertilizer distribution and marketing system.

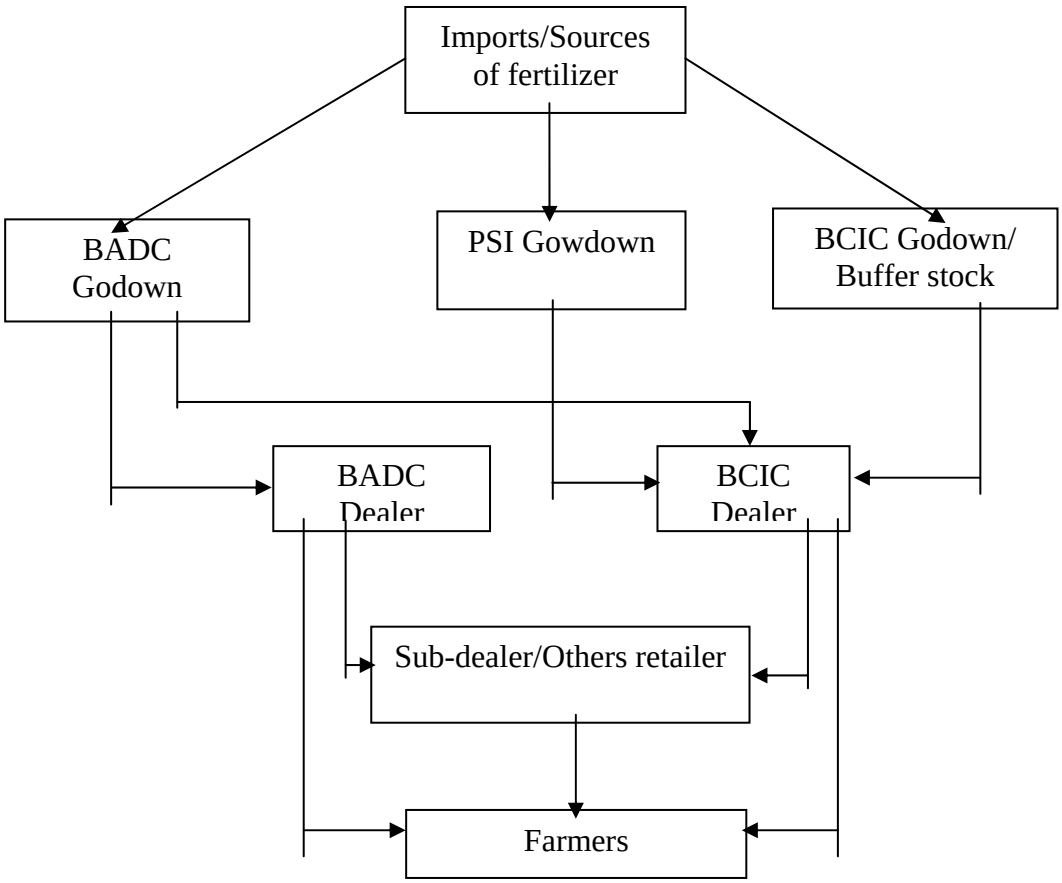

Fig 11.1.2: Fertilizer distribution system in the study areas

All dealers get their fertilizer supply from BCIC, BADC and PSI on the basis of allotment given by the NFDCC. Dealers collect their allotted fertilizers from different places, e.g., fertilizer factories, buffer godowns, PSI godowns (in Noapara) and different import points (M.M Hossain and M.F. Haq, 2010). Dealer supply their fertilizer stock to different sub-dealer and retailer sometimes direct to farmers. Sub-dealer and retailer sell their allocated fertilizer to the farmers as per their requirement.

11.1.5 Sources of fertilizer in hilly region

Farmers in the hilly areas bought fertilizer from dealer and retailer only. Two types of dealer found in the study areas such as BCIC dealer and BADC dealer. Most of the brinjal farmers (54%) bought fertilizer from BADC/BCIC dealer. The rest of the farmers (46%) bought fertilizer from retailer. On the other hand, in case of yard long bean, majority of the farmer (51%) bought fertilizer from retailer and 49% farmer bought fertilizer from BADC/BCIC dealer which was inverse

situation of brinjal farmers (Table 11.1.3).But the percentage of buying fertilizer from retailer and BADC/BCIC Dealer for both vegetables farmer are almost the same. It may be due to the likelihood of the farmers.

Table 11.1.3 Sources of fertilizer in hilly region

Particulars	% of Responses			
	Brinjal			
Fertilizer sources	Bandarban	Khagrachari	Rangamati	Grand Total
Retailer	38	52	48	46
BADC/BCIC Dealer	62	48	52	54
Fertilizer sources	Yard long bean			
	Bandarban	Khagrachari	Rangamati	Grand Total
Retailer	60	44	48	51
BADC/BCIC Dealer	40	56	52	49

11.1.6 Farmer's opinion regarding fertilizer price in hilly region

Farmers were asked about fertilizer price usually they purchased and they opined three relevant answers such as; fair price, slightly higher price and higher price. Brinjal and yard long bean farmers were provided more or less similar opinion regarding fertilizer price. Majority of the brinjal farmers (49%) paid slightly high price to buy fertilizer, followed by fair price (35%) and higher price (17%). Whereas in case of yard long bean, it was 50% for slightly higher price, 35% for fair price and 16% for higher price (Table 11.1.4).

Table 11.1.4 Farmers opinion regarding fertilizer price in hilly region

Particulars	% of responses			
	Brinjal			
Price related information	Bandarban	Khagrachari	Rangamati	All area
Fair price	34	32	38	35
Slightly higher price	46	52	48	49
Higher price	20	16	14	16
Price related information	Yard long bean			
	Bandarban	Khagrachari	Rangamati	All area
Fair price	36	38	32	35
Slightly higher price	48	48	54	50
Higher price	16	14	14	15

11.1.7 Farmers opinion regarding quality of fertilizer in hilly region

There was a mixed opinion among the farmers of three hilly districts about the quality of fertilizer. A large part of the brinjal farmers (41%) complained about the quality of fertilizer was moderate. Approximately 39% farmers mentioned the quality as good. Only 20% brinjal farmers mentioned the quality of fertilizer is adultered in all hilly areas. On the other hand, 43% yard long bean farmers pointed out that the fertilizer quality was moderate. About 30% farmers mentioned the fertilizer was good and only18% farmers said the quality was adultered (Table 11.1.5).

Table 11.1.5 Farmers opinion regarding quality of fertilizer in hilly region

Particular	% of responses			
	Brinjal			
Fertilizer quality	Bandarban	Khagrachari	Rangamati	All area
Good	38	44	34	39
Moderate	42	32	50	41
Adultered	20	24	16	20
Fertilizer quality	Yard long bean			
	Bandarban	Khagrachari	Rangamati	All area
Good	44	34	40	39
Moderate	32	52	44	43
Adultered	24	14	16	18

11.1.8 Sources of fertilizer in coastal area

Farmers in the coastal areas bought fertilizer from dealer (BCIC and BADC) and retailer only. Two types of dealer found in the coastal areas such as BCIC dealer and BADC dealer. Majority of the bittergourd farmers (69%) bought fertilizer from BADC/BCIC dealer. The rest of the farmers (31%) bought fertilizer from retailer. On the other hand, in case of cucumber, majority of the farmer (67%) bought fertilizer from BADC/BCIC dealer and 33% farmer bought fertilizer from retailer which was slightly diverge situation from hilly farmers (Table 11.1.6).

Table 11.1.6 Sources of fertilizer in coastal area

Particulars	% of respondents			
	Bittergourd			
Fertilizer sources	Cox's bazar	Patuakhali	Satkhira	All area
Retailer	38	24	32	31
BADC/BCIC dealer	62	76	68	69
Fertilizer sources	Cucumber			
	Cox's bazar	Patuakhali	Satkhira	All area
Retailer	40	28	30	33
BADC/BCIC dealer	60	72	70	67

11.1.9 Farmer's opinion regarding fertilizer price in coastal region

Farmers were asked about their opinion regarding fertilizer price in coastal areas. They opined three relevant answers such as; fair price, slightly higher price and higher price. Majority of the bittergourd farmers (53%) paid slightly high price to buy fertilizer, followed by fair price (35%) and higher price (12%). Whereas in case of cucumber farmers, it was 20% for slightly higher price, 46% for fair price and 34% for higher price which was much different from bittergourd farmers (Table 11.1.7).

Table 11.1.7 Farmers opinion regarding fertilizer price in coastal region

Particulars	% of responses			
	Bittergourd			
Fertilizer prices	Cox's bazar	Patuakhali	Satkhira	All area
Fair price	44	34	26	35
Slightly higher price	38	58	64	53
Higher price	18	8	10	12
Fertilizer prices	Cucumber			

	Cox's bazar	Potuakhali	Satkhira	All area
Fair price	36	48	54	46
Slightly higher price	18	20	22	20
Higher price	46	32	24	34

11.1.10 Farmer's opinion regarding fertilizer quality in coastal region

There was a varied opinion among the farmers of three coastal districts about the quality of fertilizer they used. Majority of the bittergourd (43%) and cucumber (48%) farmers opined the quality of the fertilizer they used was good. About 39% bittergourd and 33% cucumber farmers complained about the quality of fertilizer was moderate. Only 20% bittergourd and 19% cucumber farmers mentioned the quality of fertilizer is adulterer in all coastal areas (Table 11.1.8).

Table 11.1.8 Farmer's opinion regarding fertilizer quality in coastal region

Particulars	% of respondents			
	Bittergourd			
Fertilizer quality	Cox's bazar	Patuakhali	Satkhera	All area
Good	52	36	42	43
Moderate	30	48	38	39
Adultered	18	16	20	18
Fertilizer quality	Cucumber			
	Cox's bazar	Patuakhali	Satkhira	All area
Good	56	42	46	48
Moderate	24	40	36	33
Adultered	20	18	18	19

11.1.11 Pesticides supply system

Fig.11.1.3 showed the pesticide supply system to the vegetables farmers. Farmers used different kinds of pesticide for better production. All types of pesticides distributed by the company's salesman/distributor to the company dealer or BADC dealer. Dealer supplied pesticide to the retailer and sometimes directly to the farmers. Retailer got pesticide from the company dealer or BADC dealer supplied to the vegetables farmers in the study areas.

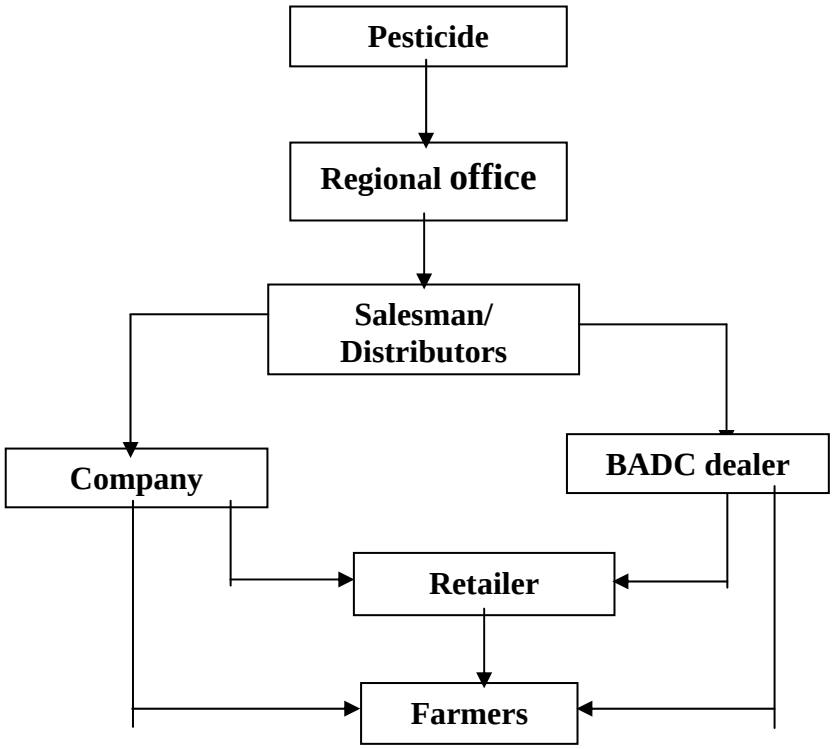

Fig.11.1.3 Pesticide distribution system in the study areas

11.1.12 Sources of pesticide in hilly region

The main sources of this pesticide in the hilly areas were retailer, company dealer and BADC dealer. Two types of dealer found in the study areas such as company dealer and BADC dealer. Most of the brinjal farmers (47%) bought pesticide from BADC dealer followed by retailer (37%) and company dealer (17%). In case of yard long bean farmers, similar trends were found. Majority of the farmer (51%) bought pesticide from BADC dealer followed by retailer (35%) and company dealer (13%).

Table 11.1.9 Sources of pesticide in hilly region

Pesticide sources	% of responses			
	Brinjal			
	Bandarban	Khagrachari	Rangamati	All area
Retailer	32	38	40	37
Company dealer	18	14	18	17
BADC dealer	50	48	42	47
Pesticide sources	Yard long bean			
	Bandarban	Khagrachari	Rangamati	All area
Retailer	36	36	34	35
Company dealer	14	10	16	13
BADC dealer	50	54	50	51

11.1.13 Farmer's opinion regarding pesticide quality in hilly region

Farmers respond a location wise varied opinion among three hilly districts about the quality of pesticide. However, on an average majority of the brinjal farmers (40%) complained about the

quality of pesticide was moderate. Approximately 37% farmers mentioned the quality was good. Only 23% brinjal farmers mentioned the quality of pesticide is adultered in the hilly areas. On the other hand, 48% yard long bean farmers mentioned that the pesticide quality was moderate. About 33% farmers stated the pesticide quality was good and only19% farmers said the quality was adultered (Table 11.1.10).

Table 11.1.10 Farmer's opinion regarding pesticide quality in hilly region

Particulars	% of responses			
	Brinjal			
Pesticide quality	Bandarban	Khagrachari	Rangamati	All area
Good	38	38	36	37
Moderate	38	36	46	40
Adultered	24	26	18	23
Pesticide quality	Yard long bean			
	Bandarban	Khagrachari	Rangamati	All area
Good	36	30	34	33
Moderate	44	54	46	48
Adultered	20	16	20	19

11.1.14 Sources of pesticide in coastal region

Similar sources of pesticide were also found in coastal area but pesticide buying frequency was found different from the hilly areas. Here most of the farmers bought pesticide from retailer rather than dealer. About 59% bittergourd farmers bought pesticide from retailer followed by BADC dealer (26%) and company dealer (15%). In case of cucumber farmers, similar trends were found. Majority of the farmer (56%) bought pesticide from retailer followed by BADC dealer (29%) and company dealer (15%) (Table 11.1.11).

Table 11.1.11 Sources of pesticide in coastal region

Particulars	% of responses			
	Bittergourd			
Pesticide sources	cox's bazar	Patuakhali	Satkhira	Grand Total
Retailer	58	62	56	59
Company dealer	16	10	20	15
BADC dealer	26	28	24	26
Pesticide sources	Cucumber			
	cox's bazar	Patuakhali	Satkhira	Grand Total
Retailer	54	60	54	56
Company dealer	16	16	12	15
BADC dealer	30	24	34	29

11.1.15 Farmer's opinion regarding pesticide quality in coastal region

Table 11.1.12 showed the farmers opinion regarding pesticide quality in coastal area and the trends of farmer's statement slightly different from those of hilly areas. Here on an average majority of the bittergourd farmers (43%) opined about the quality of pesticide was good. About 29% bittergourd farmers mentioned the quality of pesticide is moderate and adultered separately. On the other hand, 41% cucumber farmers mentioned that the pesticide quality was

good. About 35% farmers stated that the pesticide quality was moderate and only 25% farmers said the quality was adultered in the coastal area.

Table 11.1.12 Farmer's opinion regarding pesticide quality in coastal area

Particulars	% of responses			
	Bittergourd			
Pesticide quality	cox's bazar	Patuakhali	Satkhira	Grand Total
Good	48	38	42	43
Moderate	26	32	28	29
Adulterate	26	30	30	29
Pesticide quality	Cucumber			
	cox's bazar	Patuakhali	Satkhira	Grand Total
Good	46	34	42	41
Moderate	30	44	30	35
Adulterate	24	22	28	25

CHAPTER 11.2

PROFITABILITY OF SELECTED VEGETABLES IN HILLY AND COASTAL REGION

Cost and return analysis is very important to find out the profitability of crop cultivation and for determination of acceptance of a crop. Profitability analysis of selected vegetables was done in two unfavorable ecosystems to identify whether it is profitable or not. This chapter contains the different cultivation methods, input use patterns, cost of cultivation, net return, and benefit cost ratio in the study areas.

11.2.1 Profitability Analysis of Selected Crops in Hilly Region

Mainly two vegetables crops were selected for profitability analysis to justify the rationality of vegetables cultivation in hilly region. Vegetables cultivation in hilly region was very difficult due to unfavorable ecosystem in those areas. Farmers have to face various difficulties for producing vegetables in hilly region such as uneven topography, acute irrigation water, low yield, less accessible market etc. But farmers get satisfactory market price of vegetables due to vegetables market were deficit in local production. Generally, three types of cultivation were found in hilly region.

11.2.1.1 Homestead cultivation
11.2.1.2 Plain land cultivation
11.2.1.3 Jhum cultivation

11.2.1.1 Homestead cultivation

Homestead areas were found to be properly utilized by the sample household in the study areas. They grow different types of vegetables such as country bean, bottle gourd, brinjal, ginger, potato, maize, snake gourd, ridge gourd, white gourd, bitter gourd, yellow pumpkin, arum, radish, tomato, chili, bean, red amaranth, Indian spinach, okra, cucumber, turmeric and many

other crops in their homestead on a small-scale. They fulfilled their daily requirement by the homestead production and not cultivated as commercial purposes. So cost and return analysis was ignored in case of homestead cultivation.

11.2.1.2 Plain land cultivation

11.2.1.2.1 Input use, cost and return of brinjal cultivation

Input use pattern in brinjal cultivation in hilly region: Table 11.2.1 showed the per hectare input use pattern in hilly region in Bangladesh. The average human labour used for producing brinjal was found to be 376 man-days per hectare of which 64% were family supplied (Table). The use of human labour was higher in Khagrachari (391 man-days/ha) followed by Rangamati (384man-days/ha) and Bandarban (352 man-days/ha). The average quantity of seeding used by the farmers were 8096 nos/ha. On an average, farmers used 2035 kg/ha of cowdung and the farmers of Khagrachari used highest quantity of cowdung (2575 kg/ha). They used chemical fertilizers like urea (439 kg/ha), TSP (350 kg/ha), MoP (212 kg/ha), boron (6 kg/ha) and gypsum (62 kg/ha).

Table 11.2.1 Per hectare input uses pattern of brinjal cultivation

Particulars	Bandarban	Khgrachari	Rangamati	All area
Human labours (Man-days)	352	391	384	376
Family labour (Man-days)	228	251	248	242
Hired labour (Man-days)	124	140	136	134
Seedling (no.)	8098	9280	6916	8096
Manure (kg)	1392	2575	2149	2035
Fertilizers:				
Urea (Kg)	466	440	411	439
TSP (Kg)	300	322	427	350
MoP (Kg)	220	294	123	212
Boron (Kg)	6	6	5	6
Gypsum (Kg)	49	98	39	62
Irrigation (no.)	3.34	4.22	3.78	3.78
Weeding (no.)	3.78	4.73	3.74	4.08
Spray (no.)	9.76	8.61	8.98	9.12

Cost of brinjal cultivation

Variable cost: Variable cost of production included all kinds of costs which vary with respect to size of production such as human labour, land preparation, seed, manure, chemical fertilizers, irrigation, pesticides, etc. which used for the brinjal cultivation. Both cash and non-cash cost such as imputed value of family supplied inputs were included in the variable cost. It was revealed from the study that total variable cost of brinjal cultivation was Tk.117928 per hectare which was 54 percent of total cost of production. Comparatively higher variable cost (Tk.143994) was recorded with the farmers of Khagrachari district than that of others district due to higher level of input used by the farmers. Among the different variable cost items hired human labour cost item was the major cost item which accounted for almost 21 percent of total cost (Table 11.2.2).

Fixed cost: Family labour and rental value of land was considered as fixed cost of production. The cost of these items was Tk. 84093 and Tk.17292 per hectare respectively which was accounted for about 46 percent of total cost of production. The highest family labour (Tk.88579/ha) was found in Bandarban district. Rental value of land (Tk.18525/ha) was also found highest in Bandarban district (Table 11.2.2).

Total cost: Total cost of production included variable costs and fixed costs incurred for brinjal cultivation. On an average, total cost of production for brinjal was Tk.219312 per hectare. Considering average level of farm location highest total cost was found in Khagrachari district which was Tk.247579/ha) and lowest in rangamati district which was Tk.203831 per hectare (Table 11.2.2).

Table 11.2.2 Per hectare cost of brinjal cultivation (Tk./ha)

Particulars	Bandarban	Khagrachari	Rangamati	All Area	% of total cost
A. Variable cost					
Land preparation	12931	13110	9430	11815	5.39
Hired labour	47359	48273	42212	45932	20.94
Seedling	10932	11136	10374	10814	4.93
Manure	2140	3415	2033	2523	1.15
Fertilizers:					
Urea	8816	7728	5436	7324	3.34
TSP	7433	8647	6366	7474	3.41
MoP	3314	5117	1597	3330	1.52
Boron	1089	965	765	940	0.43
Zypsum	865	1204	549	870	0.40
Irrigation	13462	14870	10882	13059	5.95
Pesticide/Insecticide	12285	14309	9733	12094	5.51
Bamboo stick	7461	11205	6773	8461	3.86
Boundary and Macha	2508	1678	2371	2189	1.00
Interest on operating capital	2155	2337	1791	1914	0.87
Total variable cost	132751	143994	110311	117928	53.77
B. Fixed cost					
Family labour	88579	86785	76970	84093	38.34
Land use cost	18525	16800	16550	17292	7.88
Total fixed cost	107104	103585	93520	101385	46.23
C. Total cost (A+B)	239854	247579	203831	219312	100.00

Profitability of brinjal cultivation

Per hectare average yield of brinjal was 20.07 ton/ha (Table 11.2.3). A considerable yield difference was found among the three districts. The variation of gross return was due to getting comparatively high yield of brinjal in Khagrachari district. Per hectare average gross margin was found Tk.293650.Per hectare net return and BCR from brinjal cultivation were found Tk. 192265

and 1.88 respectively which indicates brinjal cultivation is highly profitable in the study areas. Average cost of producing per kg of brinjal was Tk.10.93.

Table 11.2.3 Profitability of brinjal cultivation

Particulars	Bandarban	Khagrachari	Rangamati	All Area
Yield (ton/ha)	20.40	22.58	17.25	20.07
Price (ton/ha)	20090	18972	22449	20503
A. Total cost (Tk./ha)	239854	247579	203831	219312
Variable cost (VC) (Tk./ha)	132751	143994	110311	117928
Fixed cost (FC) (Tk./ha)	107104	103585	93520	101385
B. Gross return(Tk./ha)	409749	428313	387206	411577
C. Gross margin (B-VC) (Tk./ha)	276999	284319	276895	293650
D. Net return (B-A) (Tk./ha)	169895	180734	183376	192265
E. BCR on full cost	1.71	1.73	1.90	1.88
F. Cost per kg (Tk)	11.76	10.97	11.82	10.93

11.2.1.2.2 Input use, cost and return of yard long bean cultivation

Inputs use pattern in yard long bean cultivation in hilly region: Table 11.2.4 presented the per hectare input use pattern of yard long bean cultivation in different hilly region in Bangladesh. The average human labour used for producing yard long bean was found to be 262 man-days per hectare of which 183 man-days were family supplied and 79 man-days were hired. Higher family labour is due to vegetables cultivation in hilly area is labour intensive and they always engaged in vegetables cultivation and they hired extra labour when they cannot manage with their family labour. In case of of yard long bean cultivation higher human labour was found in Rangamati district (284 man-days/ha) followed by Khagrachari (253 man-days/ha) and Bandarban (248 man-days/ha). The average quantity of seed used by the farmers 7 kg/ha. On an average, farmers used 1668 kg/ha of cowdung and the farmers of Rangamati used highest quantity of cowdung (2472 kg/ha). They used chemical fertilizers like urea (366 kg/ha), TSP (227 kg/ha), MoP (155 kg/ha), boron (5 kg/ha) and gypsum (41 kg/ha).

Table 11.2.4 Per hectare input use pattern of yard long bean cultivation

Particulars	Bandarban	Khgrachari	Rangamati	All area
Human labours (Man-days)	248	253	284	262
Family labour (Man-days)	174	161	212	183
Hired labour (Man-days)	74	92	72	79
Seed (kg)	7	6	6	7
Manure (Kg)	1672	788	2472	1668
Fertilizers: (Kg)				
Urea (Kg)	392	341	362	366
TSP (Kg)	269	220	189	227
MoP (Kg)	179	139	145	155
Boron (Kg)	3	5	6	5
Gypsum(Kg)	38	43	42	41
Irrigation (no.)	1.13	2.02	1.52	1.54
Weeding (no.)	2.51	2.83	2.62	2.64
Spray (no.)	5.81	5.39	4.10	5.11

Cost of yard long bean cultivation

Variable cost: The study revealed that total variable cost of yard long bean cultivation was Tk.86555 per hectare which was 55 percent of total cost of production. Comparatively higher variable cost was found with the farmers of Khagrachari district (Tk.89736) and lower cost was found in Rangamati district (Tk.81803). Among the different variable cost items hired human labour cost item was the major cost item which accounted for almost 18 percent of total cost (Table 11.2.5). The variation of variable cost in different locations of the farms in the cost of yard long bean was negligible.

Table 11.2.5 Per hectare cost of yard long bean cultivation (Tk./ha.)

Particulars	Bandarban	Khagrachari	Rangamati	All Area	% of total cost
A. Variable cost	--	--	--	--	--
Land preparation	10474	12724	11753	11598	7.48
Hired labour	28543	31487	22176	27315	17.62
Seedling	4222	2194	2901	3153	2.03
Manure	2424	934	3599	2358	1.52
Fertilizers:					
Urea	7241	6230	6820	6788	4.38
TSP	7030	6317	5126	6171	3.98
MoP	3139	2290	2398	2628	1.70
Boron	521	697	1062	757	0.49
Zypsum	388	711	500	525	0.34
Irrigation	5056	6591	7361	6303	4.06
Pesticide/Insecticide	8195	9218	7515	8283	5.34
Bamboo stick	8061	6367	7634	7395	4.77
Boundary and Macha	2270	3254	2298	2583	1.67
Interest on operating capital	711	723	659	698	0.45
Total variable cost	88276	89736	81803	86555	55.82
B. Fixed cost	--	--	--	--	--
Family labour	67154	54685	66306	63020	40.64
Land use cost	9263	8400	8275	5489	3.54
Total fixed cost	76417	63085	74581	68509	44.18
C. Total cost (A+B)	164693	152821	156384	155064	100

Fixed cost: The cost of Family labour and Land use cost were Tk. 63,020 and Tk.5489 per hectare respectively which was accounted for about 44 percent of total cost of production. Highest family labour cost (Tk.67154) was found in Bandarban district. Rental value of land (Tk. 9263/ha) was also found highest in Bandarban district (Table 11.2.5).

Total cost: The total cost of production for yard long bean was Tk.155064 per hectare. Highest production cost (Tk.164693) was found in Bandarban district whereas lowest production cost (Tk.152821/ha) was found in Khagrachari district (Table 11.2.5).

Profitability of yard long bean cultivation

Per hectare average yield of yard long bean was 11.20 ton/ha (Table 5.6). Per hectre average gross margin was found Tk. 150871. Per hectare net return and BCR from yard long bean cultivation were found Tk.82362 and 1.53 respectively which indicates brinjal cultivation is profitable in the study areas. Highest yield was found in khagrachari district because the farmers of that district were comparatively trained in vegetables production. Highest BCR is also found in khagrachari district due to higher yield and lower cost. Average cost of producing per kg yard long bean was Tk.13.8 (Table 11.2.6).

Table 11.2.6 Profitability of yard long bean cultivation

Particulars	Bandarban	Khagrachari	Rangamati	All Area
Yield (ton/ha)	11.04	12.08	10.55	11.20
Price (ton/ha)	22644	21690	19228	21203
A. Total cost (Tk./ha)	164693	152821	156384	155064
Variable cost (VC) (Tk./ha)	88276	89736	81803	86555
Fixed cost (FC) (Tk./ha)	76417	63085	74581	68509
B. Gross return(Tk./ha)	250008	262095	202831	237426
C. Gross margin (B-VC) (Tk./ha)	161732	172359	121028	150871
D. Net return (B-A) (Tk./ha)	85315	109274	46448	82362
E. BCR on full cost	1.52	1.72	1.30	1.53
F. Cost per kg (Tk)	14.9	12.6	14.8	13.8

11.2.1.3 Crop production under Jhum cultivation

Jhum cultivation is a special type of cultivation which also called shifting cultivation in the hilly areas and has been practiced for a long time. In the past, Jhum was practiced with a fallow period of 15 to 20 years (Alam *et. al,* 2010). Recently this fallow period has been reduced to between two and three years. Under Jhum cultivation, vegetation is slashed and burnt between January and March. After slash and burn, land remains fallow for a month and crops are planted May to June. These are harvested within December. Jhum lands were mainly used for the production of forest tree, fruit tree and seasonal crops. The seasonal crops include rice, maize, sesame, turmeric, ginger, chili, potato, arum, brinjal, country bean, okra, sweet gourd (yellow pumpkin), white gourd, ridge gourd, yard long bean, Marfa (cucumber) etc.

Cost of production in Jhum cultivation: It was revealed from the Table 5.7 that the cost incurred for cultivation different crops production under Jhum cultivation was Tk. 68737/ha. In cultivation different mixed crops were cultivated in slope of hillocks. So costs were jointly calculated for several crops. Highest production cost was found in Khagrachari district which was Tk.70830/ha and lowest cost was found Bandarban district which was Tk.64897/ha.

Table 11.2.7 Cost of production in Jhum cultivation

Particulars	Bandarban	Khagrachari	Rangamati	All Area
Variable cost				
Hired labour	14400	16475	18835	16570
Seed	7140	6855	6225	6740
Urea	880	750	970	867
TSP	750	620	776	715
MoP	425	550	480	485
Pesticide	600	750	655	668
Interest on operating capital	308	296	292	298
A.Total variable cost	24503	26296	28233	26344
Fixed cost				
Family labour	25500	27800	25875	26392
Land use cost	14895	16734	16376	16001
B. Total Fixed cost	40395	44534	42251	42393
C. Total cost (A+ B)	64897	70830	70483	68737

Profitability of Jhum cultivation

Table 11.2.8 showed the gross margin of various crops and vegetables as well as annual cost incurred, and gross return. The gross return was calculated from different crops per hectare basis.

Table 11.2.8 Profitability in Jhum cultivation

Particulars	Bandarban	Khagrachari	Rangamati	All Area
A. Gross return from crops				
Rice	35500	42000	38500	38667
Maize	2560	2280	2720	2520
Seasame	8875	12600	9060	10178
Brinjal	9350	12000	8760	10037
Country bean	4450	2160	3200	3270
Yard long bean	8075	13200	7800	9692
Marfa	1200	700	1600	1167
Snake gourd	1560	2880	1890	2110
Pumpkin	2240	1800	1460	1833
Ginger	32450	38000	28600	33017
Turmeric	19870	15000	23450	19440
Coriander	890	1000	1200	1030
Chili	5600	4000	8070	5890
Total gross return	132620	147620	136310	138850
B. Total cost	64897	70830	70483	68737
C. Total variable cost (TVC)	24503	26296	28233	26344
D. Total fixed cost (TFC)	40395	44534	42251	42393
E. Gross margin	108117	121324	108077	112506
F.Net return	67723	76790	65827	70113
G.BCR on full cost	2.04	2.08	1.93	2.02

The total gross return was obtained summed up the gross margin obtained from the all crops produced in the Jhum cultivation. The average gross margin was Tk.138850/ha. The average net return in Jhum cultivation was Tk. 112506/ha and BCR was 2.02.

11.2.2 Profitability analysis of selected crops in coastal region

It was also found three types of production technique in the coastal areas that are widely practiced by the farmers. Farmers used this technique to recover the different stresses found in the coastal belt such as waterlogging, salinity, heavy rainfall etc. Generally, these three types of technique were found in the coastal region.

11.2.2.1 Plain land cultivation
11.2.2.2 Sorjon method
11.2.2.3 Gher based agriculture (Composite agriculture)

11.2.2.1 Profitability of plain land cultivation

In coastal region plain land cultivation was found in the slightly high land where waterlogging and salinity were not affecting the plant.

11.2.2.1.1 Input use, cost and return of bittergourd cultivation

Inputs use pattern in bittergourd cultivation in coastal areas: It was observed from the table 11.2.9 that the average human labour used for producing bittergourd was found to be 278 man-days per hectare of which 218 man-days were family supplied and 60 man-days were hired. Higher family labour is due to they always engaged in vegetables cultivation and they hired extra labour when they cannot manage with their family labour. Higher human labour was found in Satkhira district (294 man-days/ha) followed by Cox'sbazar (271 man-days/ha)

Table 11.2.9 Per hectare Input use pattern of bittergourd cultivation

Particulars	Coxbazar	Patuakhali	Satkhira	All Area
Human labours (Man-days)	271	268	294	278
Family labour (Man-days)	191	223	239	218
Hired labour (Man-days)	80	45	55	60
Seed (kg)	1.5	1.4	1.75	1.55
Manure(Kg)	1103	1575	2552	1743
Fertilizers:				
Urea (Kg)	324	334	378	345
TSP (Kg)	230	222	229	227
MoP (Kg)	193	155	208	185
DAP (Kg)	102	127	107	112
Boron (Kg)	9	6	10	8
Gypsum (Kg)	148	103	133	128
Irrigation (no.)	3.90	3.16	3.30	3.45
Weeding (no.)	3.30	3.02	3.14	3.15
Spray (no.)	11.88	10.38	10.64	10.97

and Patuakhali (268 man-days/ha).The average quantity of seed used by the farmers 1.55 kg/ha. On an average, farmers used 1743 kg/ha of cowdung. They used chemical fertilizers like urea (345 kg/ha), TSP (227 kg/ha), MoP (185 kg/ha), DAP (112 kg/ha), boron (8 kg/ha) and gypsum (128 kg/ha).

Cost of bitter gourd cultivation

Variable cost: The study revealed that total variable cost of bitter gourd cultivation was Tk.102158 per hectare which was 49 percent of total cost of production. Comparatively higher variable cost was recorded with the farmers of cox's bazar than that of others district due to higher level of input used by the farmers. Among the different variable cost items hired human labour cost item was the major cost item which accounted for almost 13 percent of total cost (Table 11.2.10). There was no wide variation of different locations of the farms in the cost of bitter gourd cultivation.

Table 11.2.10 Per hectare cost of bittergourd cultivation (Tk./ha)

Particulars	Cox'sbazar	Patuakhali	Satkhira	All Area	% of total cost
A. Variable cost					
Land preparation	11415	10762	9804	10660	5.12
Hired labour	36190	19278	23976	26481	12.72
Seed	8500	8200	8000	8233	3.96
Manure	1722	2104	2616	2147	1.03
Fertilizer:					
Urea	6100	5946	5264	5770	2.77
TSP	6289	5827	5501	5872	2.82
MoP	3128	2516	2958	2868	1.38
DAP	3168	3255	3407	3277	1.57
Boron	1278	1191	1797	1422	0.68
Zypsum	1975	1256	1961	1731	0.83
Irrigation	13141	10260	11577	11659	5.60
Pesticide/Insecticide	10564	10841	12439	11281	5.42
Bamboo stick	5872	6483	6685	6347	3.05
Boundary and Macha	4578	4296	4065	3413	1.64
Interest on operating capital	1131	901	987	997	0.48
Total variable cost	115051	93115	101037	102158	49.09
B. Fixed cost					
Family labour	86564	96111	104837	95837	46.05
Land use cost	12540	9560	8275	10125	4.86
Total fixed cost	99104	105671	113112	105962	50.91
C. Total cost (A+B)	214155	198786	214150	208121	100.00

Fixed cost: The cost of family labour and rental value of land was Tk. 95,837 and Tk.10,125 per hectare which was accounted for about 51 percent of total cost of production. Highest family labour was found in satkhira district. Rental value of land was found higher at coxs'bazar district (Table 11.2.10).

Total cost: The total cost of production for bitter gourd cultivation was Tk.208121 per hectare. There were not found much differences in the total cost of production of the two locations Cox'sbazar (Tk.214155/ha) and Satkhira (Tk.214150/ha) except Patuakhali (Tk.198786) (Table 11.2.10).

Profitability of bittergourd Cultivation

The average yield of bittergourd was 19.55 ton per hectare. The yield was found to be highest in Satkhira (20.12 t/ha) compared to Cox'sbazar (19.48 t/ha) and Patuakhali (19.04 t/ha). On an average, gross return from bittergourd was Tk. 432650/ha. Average gross margin was Tk. 330492 per hectare which varied from Tk. 306980 to Tk.234691 per hectare at different location. It was evident from the analysis that net return from bittergourd was Tk. 224530 per hectare. The average benefit cost ratio (BCR) was 2.08 and highest BCR was found at Patuakhali (2.21) whereas lowest BCR was found at cox'sbazar (1.97). Average cost of producing per kg of bittergourd was Tk.10.65 (Table 11.2.11).

Table 11.2.11 Profitability of bittergourd cultivation

Particulars	Cox'sbazar	Patuakhali	Satkhira	All Area
Yield (ton/ha)	19.48	19.04	20.12	19.55
Price (Tk./ton)	21661	23105	21632	22133
A. Total cost (Tk./ha)	214155	198786	214150	208121
Variable cost (VC) (Tk./ha)	115051	93115	101037	102158
Fixed cost (FC) (Tk./ha)	99104	105671	113112	105962
B. Gross return(Tk./ha)	422031	440021	435154	432650
C. Gross margin (B-VC) (Tk./ha)	306980	346906	334117	330492
D. Net return (B-A) (Tk./ha)	207876	241235	221005	224530
E. BCR on full cost	1.97	2.21	2.03	2.08
F. Cost per kg (Tk)	10.99	10.44	10.65	10.65

11.2.2.1.2 Input use, cost and return of cucumber cultivation

Inputs use pattern in cucumber cultivation: Table 11.2.12 presented the per hectare input use pattern of cucumber cultivation in different coastal region of Bangladesh. The average human labour used for producing cucumber was found to be 260 man-days per hectare of which 186 man-days were family supplied and 74 man-days were hired. Higher family labour is due to vegetables cultivation in coastal area is labour intensive and they always engaged in vegetables cultivation and they hired extra labour when they cannot manage with their family labour. Higher human labour was found in Satkhira district (282 man-days/ha) followed by Patuakhali (262 man-days/ha) and Cox'sbazar (239 man-days/ha). The average quantity of seed used by the farmers 1.26 kg/ha. On an average, farmers used 1704 kg/ha of cowdung.They used chemical fertilizers like urea (301 kg/ha), TSP (225 kg/ha), MoP (144 kg/ha), DAP (145 kg/ha), boron (10 kg/ha) and gypsum (41 kg/ha).

Table 11.2.12 Per hectare Input use pattern of cucumber cultivation

Particulars	Cox's bazar	Patuakhali	Satkhira	All Area
Human labours (Man-days)	239	262	282	260
Family labour (Man-days)	155	200	204	186
Hired labour (Man-days)	84	62	78	74
Seed (kg)	1.48	1.10	1.20	1.26
Manure (Kg)	2079	1940	1093	1704
Fertilizers:				
Urea(Kg)	345	298	261	301
TSP (Kg)	237	192	246	225

MoP (Kg)	157	130	144	144
DAP (Kg)	103	162	170	145
Boron (Kg)	8	11	12	10
Gypsum (Kg)	142	56	139	112
Irrigation (no.)	4.52	4.50	3.78	4.27
Weeding (no.)	2.80	2.68	2.88	2.79
Spray (no.)	5.14	6.42	5.38	5.65

Cost of cucumber cultivation

Variable cost: The study revealed that total variable cost of cucumber cultivation was Tk.100519 per hectare which was 52 percent of total cost of production. Comparatively higher variable cost was recorded with the farmers of cox's bazar than that of others district due to higher level of input used by the farmers. Among the different variable cost items hired human labour cost item was the major cost item which accounted for almost 17 percent of total cost (Table 11.2.13). There was no wide variation of different locations of the farms in the cost of cucumber cultivation.

Fixed cost: Family labour and rental value of land was considered as fixed cost of production. The cost of these items was Tk. 95,837 and Tk.10125 per hectare respectively which was accounted for about 48 percent of total cost of production. The Highest family labour cost (Tk.88757) was found in Patuakhali district. Rental value (Tk. 12540/ha) of land was found higher at Cox's bazar district (Table 11.2.13).

Total cost: Total cost of production included variable costs and fixed costs incurred for cucumber cultivation. On an average, total cost of production for cucumber cultivation was Tk.191902 per hectare. Considering average level of farm location there were not much differences in total cost of production. Highest production cost (Tk.197801) was found in Cox'sbazar district whereas lowest production cost (Tk.187234) was found in Satkhira district.

Table 11.2.13 Per hectare cost of cucumber cultivation (Tk./ha)

Particulars	Cox's bazar	Patuakhali	Satkhira	All Area	% of total cost
A. Variable cost					
Land preparation	13439	11441	11117	11999	6.25
Hired labour	39482	27846	30262	32530	16.95
Seed	3900.0	3080.0	3200.0	3393	1.77
Manure	2520	3472	978	2323	1.21
Fertilizers:					
Urea	6089	5534	4461	5361	2.79
TSP	6100	4569	6333	5667	2.95
MoP	2421	1995	2187	2201	1.15
DAP	3379	2870	5678	3976	2.07
Boron	1315	2810	2496	2207	1.15
Zypsum	1782	625	2510	1639	0.85
Irrigation	10151	8810	8962	9308	4.85
Pesticide/Insecticide	9423	7566	8210	8400	4.38
Bamboo stick	6057	6857	6287	6401	3.34

Boundary and Macha	4179	3899	4062	4047	2.11
Interest on operating capital	1182	980	1038	1067	0.56
Total variable cost	111421	92355	97781	100519	52.38
B. Fixed cost					
Family labour	73840	88757	81177	81258	42.34
Land use cost	12540	9560	8275	10125	5.28
Total fixed cost	86380	98317	89452	91383	47.62
C. Total cost (A+B)	197801	190672	187234	191902	100

Profitability of cucumber cultivation

The average yield of cucumber was 17.82 ton per hectare. The yield was found to be highest in Satkhira (18.66 t/ha) compared to Cox'sbazar (17.40 t/ha) and Patuakhali (17.41 t/ha. On an average, gross return from cucumber was Tk.349795/ha. Average gross margin was Tk.249276 per hectare which varied from Tk.219963 per hectare at Cox'sbazar and Tk.266149 per hectare at Patuakhali. Net return from cucumber production was calculated by deducting total fixed cost from gross margin or total cost from gross return. It was evident from the analysis that net return from cucumber was Tk. 157893 per hectare. The average benefit cost ratio (BCR) was 1.82 and highest BCR was found at Satkhira (1.92) whereas lowest BCR was found at cox'sbazar (1.68). Average cost of producing per kg of cucumber was Tk.10.77 (Table 11.2.14).

Table 11.2.14 Profitability of cucumber cultivation

Particulars	Cox'sbazar	Patuakhali	Satkhira	All Area
Yield (ton/ha)	17.40	17.41	18.66	17.82
Price (Tk./ton)	19046	20592	19240	19626
A. Total cost (Tk./ha)	197801	190672	187234	191902
Variable cost (VC) (Tk./ha)	111421	92355	97781	100519
Fixed cost (FC) (Tk./ha)	86380	98317	89452	91383
B. Gross return (Tk./ha)	331384	358504	359020	349795
C. Gross margin (B-VC) (Tk./ha)	219963	266149	261239	249276
D. Net return (B-A) (Tk./ha)	133583	167832	171787	157893
E. BCR on full cost	1.68	1.88	1.92	1.82
F. Cost per kg (Tk)	11.37	10.95	10.03	10.77

11.2.2.2 Vegetables cultivation under Sorjon method

Sorjan is a cropping system which helps the growers to cultivate fish and vegetables simultaneously on the same land. In this methods farmer uses a system that construct alternate deep sinks and raised bed in low land. It is viable in high soil salinity and water submergence in the coastal belt which reduces crop productivity. This has become a common practice in coastal belt of Bangladesh to protect the crop from salinity, submergence, flooding, erratic rainfall, sea level rice etc. If this system of cultivation can be extended to more farmers then they could get three crops in a year and also possible to cultivate crops in unfavorable condition. In some cases farmers also practiced fish culture in between Sorjon bed.

Cost of production in Sorjan method

The cost of production in Sorjon cultivation depends on the size of Sorjon bed. Farmers cultivated different winter and summer vegetables haphazardly under different size of Sorjon bed with their technology along with poor management. Different sizes of Sorjon beds were observed during the survey period. In the study areas per household average size of Sorjon bed was 0.15 hectare. The average total cost of different summer and winter vegetables production cost of Sorjon method was Tk. 366789/sorjan bed which was Tk. 244626/ha. In which human labour cost was about 54.79% of the total cost. The second highest cost was the bed preparation cost which was 21.27% of the total cost (Table 11.2.14).

Table 11.2.15 Cost of vegetables production in Sorjan methods

Particulars	Patuakhali	Satkhira	All area	% of total cost
Average size of Sorjon	0.17	0.13	0.15	
Sorjan preparation cost				
Human labour	22350	17843	20097	54.79
Bed preparation	8800	6800	7800	21.27
Seed cost	1230	850	1040	2.84
Organic fertilizer cost	800	550	675	1.84
Inorganic fertilizer cost	4200	3340	3770	10.28
Pesticide	1330	1320	1325	3.61
Irrigation	950	725	838	2.28
Boundary and macha cost	1250	1020	1135	3.09
Total cost/sorjon bed	40910	32448	36679	100.00
Total cost /ha	240647	249600	244527	

Profitability of vegetables production in Sorjan method

Table 11.2.16 that different types of summer and winter vegetables were produced in Sorjon cultivation system. The average size of Sorjan bed in Pataukhali district was 0.17 ha and total gross margin from the above Sorjon bed was Tk.57325 whereas in Satkhira district the average Sorjan bed size was 0.13 ha and total gross margin was Tk.43340.

Table 11.2.16 Profitability of vegetables production in Sorjan methods

Particulars	Patuakhali			Satkhira			All area
Average size of Sorjon bed	0.17 ha			0.13 ha			0.15 ha
Name of vegetables	Yield (Kg)	Price (Tk./kg)	Gross margin	Yield (Kg)	Price (Tk./kg)	Gross margin	Gross margin
Red amaranth	110	20	2200	90	20	1800	2000
stem amaranth	85	20	1700	75	20	1500	1600
Okra	180	25	4500	150	26	3900	4200
Indian spinach	65	22	1430	45	24	1080	1255
Cucumber	260	28	7280	180	25	4500	5890
Bottle gourd	427	20	8540	360	18	6480	7510
Snake gourd	145	25	3625	140	30	4200	3912
Bittergourd	353	25	8825	250	28	7000	7913
Radish	80	20	1600	40	15	600	1100
Tomato	180	25	4500	32	20	640	2570
Brinjal	325	25	8125	280	25	7000	7563

Yard long bean	80	22	1760	60	24	1440	1600
Potato	180	18	3240	160	20	3200	3220
Total gross margin	2470	--	57325	1862	--	43340	50333
Total cost/Sorjon bed	--	--	40910	--	--	32448	36679
Net return/ Sorjon bed	--	--	16415	--	--	10892	13653
BCR	--	--	1.40	--	--	1.34	1.37
Net return/ ha	--	--	96559	--	--	83785	91023

The average gross margin in all area was Tk.50333/bed and net margin was Tk. 13653/bed. The per hectare net return from Sorjan cultivation was Tk. 91023 in all area. The average BCR was found 1.37 in all are which was highest in Patuakhali district (1.40).

11.2.2.3 Gher based agriculture

Gher is a pond like structure used for fish culture through better management usually found in the coastal belt of Bangladesh. Gher based agriculture are predominantly used in polder areas of south-western part of Bangladesh. We found widely used gher based agriculture in Satkhira district among the three study area in coastal belt. Farmers practiced it through the assistance of different NGO of Bangladesh like BRAC and Solidarated Network Asia. Diversified used of the gher through rice-fish culture and dike farming was found to maximize the productivity and improve the livelihood. The dike farming contains cultivating deferent types of vegetable and fruits on each side of the gher. The year round activities in gher aquaculture are now gaining popularity in the costal belt of Bangladesh. The another name of gher based agriculture is composite agriculture. The aim of gher based agriculture is to bring the large fallow water bodies and seasonal flood plain area under sustainable production system and ensure food security to the coastal household.

Cost of cultivation in the dike of gher: The estimation of cost of cultivation in gher based agriculture is difficult considering all the things. Here only calculated the overhead cost of vegetables farming in the dike of Gher. An optimum measurement of 1 bigha gher is 7 decimal dikes for vegetables and fruits cultivation, 7 decimal canals for fish cultivation and 19 decimal for rice beds(Fig.11.2.1). So we estimate only the cost and return of the vegetables produce in the dike of gher.

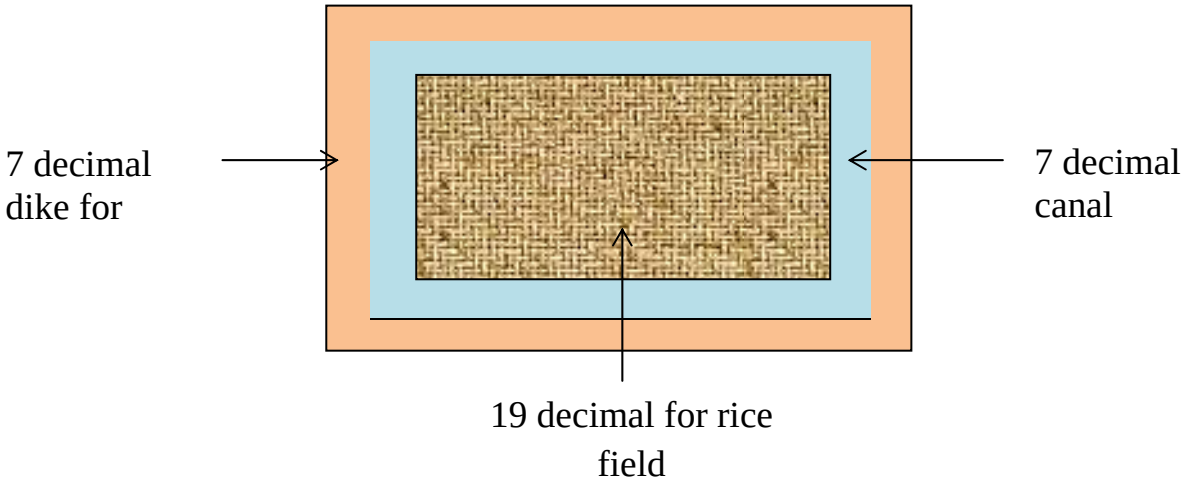

Fig. 11.2.1 Size of an optimum gher for 1 bigha

Source: field survey, 2018

It was observed from the table 11.2.17 that the cost of production per dike (0.13 ha) was Tk.22180 which was Tk. 17065/ha. Among the cost item human labour cost was the highest which was 69.88 of the total cost. The second highest cost item was the human labour cost which was inorganic fertilizer cost which was 15.06% of the total cost.

Table 11.2.17 Cost of vegetables cultivation in the dike of Gher

Particulars	Cost (Tk.)	% of total cost
Average size of gher dike	0.13 ha	
Overhead cost		
Human labour	15500	69.88
Seed cost	450	2.03
Organic fertilizer cost	550	2.48
Inorganic fertilizer cost	3340	15.06
Pesticide	1320	5.95
Boundary and macha cost	1020	4.60
Total cost/dike	22180	100
Total cost /ha	170615	

Profitability of vegetable cultivation in dike of gher

Different types of summer and winter vegetables were cultivated in the dike of cultivation with the fish and rice cultivation. It was observed from the table 11.2.18 that per dike or bigha Tk.38965 and net return wasTk.16785. So the per hectare net return was Tk.129125 in cultivating vegetables in the dike of the gher. Therefore BCR was found 1.76.

Table 11.2.18 Profitability of vegetables cultivation in the dike of Gher

Vegetables	Yield (Kg)	Price (Tk./kg)	Gross margin
Average size of gher dike	0.13 ha		
Red amaranth	50	25	1250
Okra	80	25	2000
Spinach	45	22	990
Cucumber	180	25	4500
Bottle gourd	325	20	6500
Snake gourd	170	25	4250
Bittergourd	260	25	6500
Radish	80	20	1600
Tomato	230	25	5750
Brinjal	225	25	5625
Total gross margin/dike	1645	--	38965
Total cost/dike	22180	--	22180
Net return/ dike	--	--	16785
BCR	--	--	1.76
Net return/ ha	--	--	129115

SUPPLY CHAIN OF SELECTED VEGETABLES IN HILLY AND COASTAL REGION

The sequence of stages involved in supply of input to the farm and transferring produce from farm to consumer is generally referred to as a supply chain. The consumer could be as close to the producer as in same village or on the other side of the country. The main effort of the supply chain is to reach the produces to the consumer in an efficient way. All transfers involve marketing activities in some form or other. All the activities involve costs. At the most complex level of a supply chain a product may be stored for lengthy periods, transported long distances and processed several times before reaching the form in which it is finally sold. Generally, the more complex and lengthier the marketing chain the higher are the marketing costs. Thus, simple comparison of farmer prices with retail prices is a poor indicator of marketing efficiency, as it does not take into account the costs involved in moving produce along the supply chain from farmer to consumer.

One of the vital roles of an organization trying to assist farmers to improve marketing is to oil the wheels of production marketing chain, so that businesses in the chain operate more efficiently. Very often, marketing chains are not coordinated and the participants can be blind to the existence of others role in creating opportunities for buyers and sellers to meet, to share information, to exchange ideas and to explore trading opportunities. The nature of business is that both buyers and sellers try to maximize their profit. To do this requires information, but farmers are generally the least well-informed in the marketing chain. A well-informed farmer who has some basic negotiating skills will usually obtain better prices than less well-informed farmers (Grahame Dixie, 2005 pp. 100-103).

This chapter analyzed the supply chain of vegetables marketing in hilly and coastal region of Bangladesh.

11.3.1 Vegetables market in hilly area

Brinjal and yard long bean were selected for representing the whole vegetables marketing system in the hilly area. Vegetables production in hilly area was semi-subsistence due to a lot of things; such as uneven topography, lack of irrigation water, unavailability of cultivable land etc. So, vegetables market was deficit here and maximum produced local vegetables were consumed within the district or near inter districts. A little quantity of local vegetables marketed to distance market after fulfilling local demand. The markets of the produced vegetables were, local markets within Chattagram and neighboring districts such as Comilla, Feni and Noakhali.

11.3.2 Vegetables market in coastal area

The study also considered three coastal districts for analyzing supply chain of vegetables in coastal area and considered bittergourd and cucumber for representing whole vegetables marketing system in coastal area. In coastal area marketing of selected vegetables was unorganized due to semi-substance production, lack of distance bepari, high transportation cost and crossing feri, especially in Patuakhali and Satkhira district. The coastal belt was deficit in vegetables production due to low land, intrusion of salinity, excessive rainfall and lack of irrigation water etc. and the local demand was fulfilled on the basis of import from the others

part of the country. So locally produced vegetables were consumed within the district or near inter district.

11.3.3 Actors involved in the supply chain of vegetables in hilly and coastal area

The vegetable supply chain primarily focuses on the production and marketing of vegetables in unfavorable eco-system such as hilly and coastal region. The vegetable supply chain started from input supply to the farmers and ends by retailing to the consumer. After producing vegetables, the producers sell major portion of them to local traders. Actors are the main players of the supply chain. There are many actors in the supply chain of selected vegetables. Some are more powerful than others. The main actors involved in the supply chain were discussed below:

11.3.3.1 Input dealer

Seed, fertilizer and pesticide or insecticide dealer or retailer played an important role in the supply chain. For the production of vegetables, supplies of those inputs are very important. Seed, fertilizer and pesticide dealer supply those input to the producer both in hilly and coastal region. All these inputs have own independent marketing system. BADC and seed company dealer supplied improved quality of seed to the producers. The farmers used different types of organic and inorganic fertilizers for vegetables production. They also used different types of pesticides and they bought it from the pesticide dealer or retailer. The farmers also used some other inputs such as bamboo stick, tools and equipment for the production of vegetables.

11.3.3.2 Producer

Producers are the main actor in the supply chain. In the vegetables supply chain farmers play a dominant role. In the study area most of the farmers were engaged with more or less in vegetables production. Their main occupation was agriculture. The chain started move from the production of vegetables by the farmers. The farmers used different types of inputs for the production of vegetables. Vegetable growers are consumers of many production inputs like seeds/seedlings, fertilizers, irrigation water and pesticides. They purchased those types of input from the different stakeholder for vegetables production.

11.3.3.3 Farm labourer

Both male and female labourer's are involved in the vegetable supply chain from production to marketing. In hilly areas most of the labourer's were female associated with vegetables production. Vegetables are labour intensive crop. These labourer's are engaged in transplanting, irrigating, hand weeding and harvesting of vegetables production process.

11.3.3.4 Transport agency

There are many poor people, who are engaged in truck and van driving for providing transportation services to the vegetable's producers and traders. The transport agencies provide transport facilities for carrying vegetables from the producer to consume.

11.3.3.5 Farmer-cum-retailer

Most of the times, farmers done retailing in local markets for getting higher price in hilly and coastal areas. Farmers carry their vegetables to the nearby market and sell directly to the consumer. These types of farmers mostly observed in chattagram hill tracts.

11.3.3.6 Bepari

A bepari was the part time or full-time agent of the distance market or terminal market in the production catchment area. A bepari bought selected vegetables directly from the spot (farmgate area), primary markets and sometimes from secondary markets and performed the marketing activities from purchase area to terminal market or distance market. In the study area very limited amount of vegetables handed by bepari due to low production and less surplus of vegetables in the production area.

11.3.3.7 Local arathdar

Local arathdar was the commission agent who takes commission from farmer or bepari or sometimes both parties in the primary or secondary market for providing facilities in the market or consignment. They have a permanent establishment in the market of the production catchment area and providing some marketing facilities among the both parties such as; buying and selling, weighing and providing market information etc.

11.3.3.8 Urban arathdar

Urban arathdar was the commission agent who takes commission from bepari or retailer or sometimes from both parties in the terminal market for providing some marketing facilities in the market. They have also a permanent establishment in the terminal market and provide the same facilities.

11.3.3.9 Paiker-cum-retailer

Paiker-cum-retailer bought selected vegetables directly from the farmers or local arathdar in primary markets or sometimes from secondary markets and retailing thereof to the local consumer within the district or inter-district market.

11.3.3.10 Local retailer

Local retailer bought selected vegetables directly from the farmers in primary markets or secondary markets and sold thereof to the local consumer.

11.3.3.11 Urban retailer

Urban retailer performed marketing activities in the terminal market and bought selected vegetables from the urban arathdar and sold thereof to the urban consumer.

11.3.3.12 Consumer

Consumers are the last link of the supply chain and the aim of the vegetables supply chain is to available vegetables to the consumer and satisfied them. The actors of the supply chain and others support service done this work.

11.3.4 Existing supply chain of selected vegetables in Hilly area

Major five vegetables supply chains were identified on the basis of product flow and it was ranking on the basis of percentage of product movement. Table 11.3.1 showed that, among the five chains four major chains supply vegetables within the region. The supply chain-V only supplies vegetables to the distance market whose percentage was 6.75%.

Table 11.3.1 supply chain of selected vegetables in Hilly areas

Major supply chain	Percent of selected vegetables passed	Rank
1. Farmer → Local Retailer → Local Consumer	36.25	I
2. Farmer-cum-retailer → Local Consumer	28.30	II
3. Farmer → Paiker-cum-retailer → Local consumer	18.20	III
4. Farmer → L. Arathdar → Paiker-cum-retailer → Local consumer	10.50	IV
5. Farmer → L. Arathdar → Bepari → U. Arathdar → Urban retailer → Urban consumer	6.75	V

1. Farmer → Local retailer → Local Consumer: About 36.25% of total selected vegetables supplied to the market by this supply chain during the survey period. The supply chain was found to be the first ranked important supply chain in terms of product movement. It was the most dominant chain among the supply chain.

2. Farmer-cum-retailer → Local Consumer: This supply chain represented 28.30% of total selected vegetables supplied to the market during the survey period. The supply chain was found to be the second ranked important supply chain in terms of product movement.

3. Farmer → Paiker-cum-retailer → Local consumer: This supply chain represented 18.20% of total selected vegetables supplied to the market of the hill region. The supply chain was found to be the third ranked important supply chain in terms of product movement.

4. Farmer → L.Arathdar → Paiker-cum-retailer → Local consumer: About 10.50% vegetables run through this channel. It was ranked fourth out of five supply chain.

5. Farmer → L. Arathdar → Bepari → U. Arathdar → U. Retailer → Urban consumer: The share of this supply chain was 6.75% of total supplied vegetables to the market of the hilly region. The supply chain was found to be the fifth ranked minor supply chain in terms of product movement that means only 6.75% vegetables moved out of hill district or urban market.

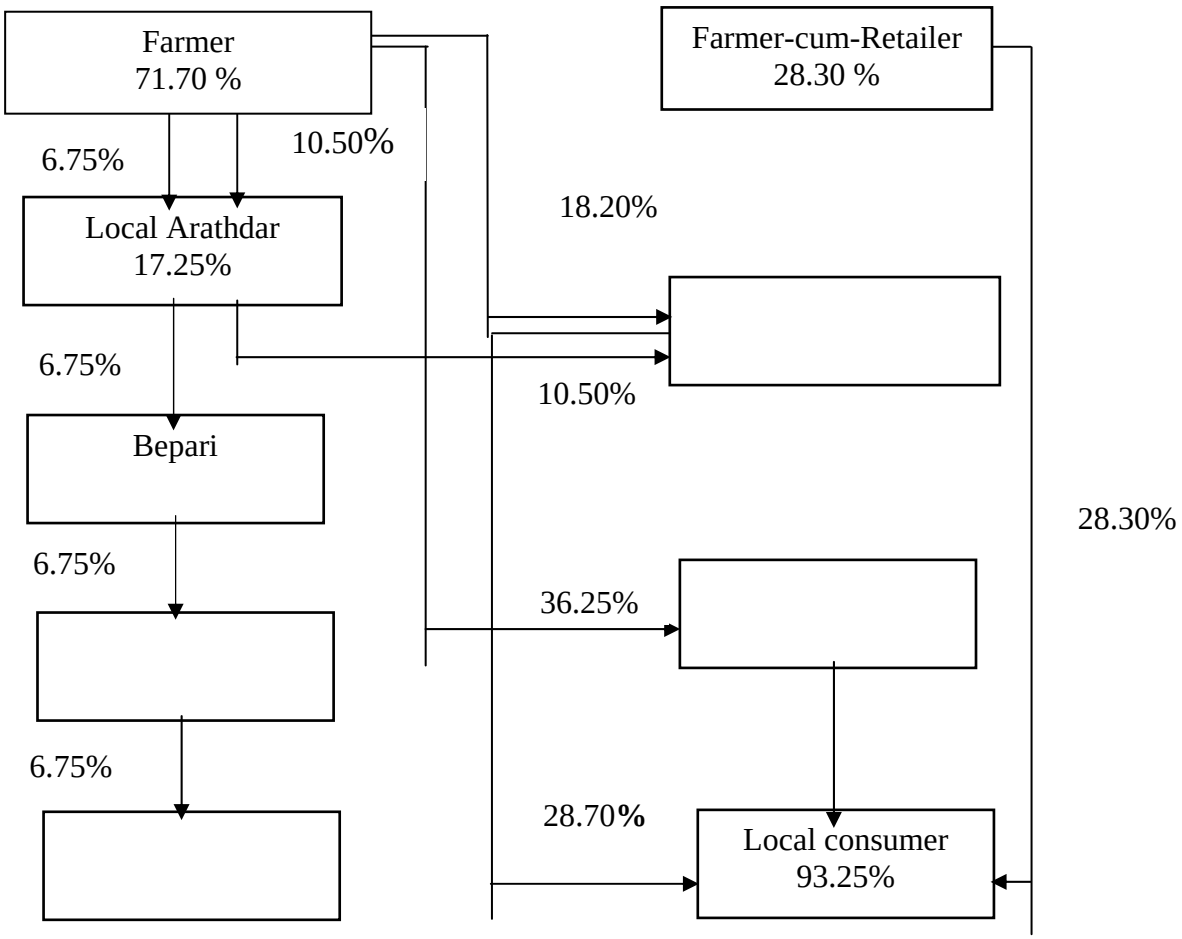

Fig: 11.3.1 Supply chain of selected vegetables in hilly areas of Bangladesh

11.3.5 Existing supply chain of selected vegetables in coastal areas

Major four vegetables supply chains were identified on the basis of product flow from producer to consumer and it was ranking on the basis of percentage of product movement. Table 11.3.2 showed that, among the four chains major three chain supplied vegetables within the region. Only one chain IV supplies vegetables to the distance market whose percentage was 5.47%.

Table 11.3.2 supply chain of selected vegetables in coastal areas

Major supply chain	Percent of selected vegetables passed	Rank
1. Farmer → Local Retailer → Consumer	38.38	I
2. Farmer → L. Arathdar → Paiker-cum- retailer → Local consumer	30.65	II
3. Farmer-cum-retailer → Consumer	25.50	III
4. Farmer → L. Arathdar → Bepari → U. Arathdar → U.Retailer → Consumer →	5.47	IV

1. Farmer ⟶ Local retailer ⟶ Local consumer: About 38.38% of total selected vegetables supplied to the market by this supply chain. The supply chain was found to be the first ranked important supply chain in terms of product movement. It was the most dominant supply chain among the supply chain.
2. Farmer ⟶ L.arathdar ⟶ Paiker-cum-retailer ⟶ Local consumer: About 30.65% vegetables run through this supply chain. It was ranked 2nd out of four supply chain.
3. Farmer-cum-retailer ⟶ Local consumer: This supply chain accounted for 25.50% of total selected vegetables supplied to the market during the survey period. The supply chain was found to be the ranked third in terms of product movement.
4. Farmer ⟶ L. arathdar ⟶ Bepari ⟶ U▶Arathdar ⟶ Retailer ⟶ Urban consumer: About 5.47% of total supplied vegetables passed through this chain to the market of coastal region. The supply chain was found to be the fourth ranked minor supply chain in terms of product movement that means only 5.47% vegetables moved out of coastal district or terminal market.

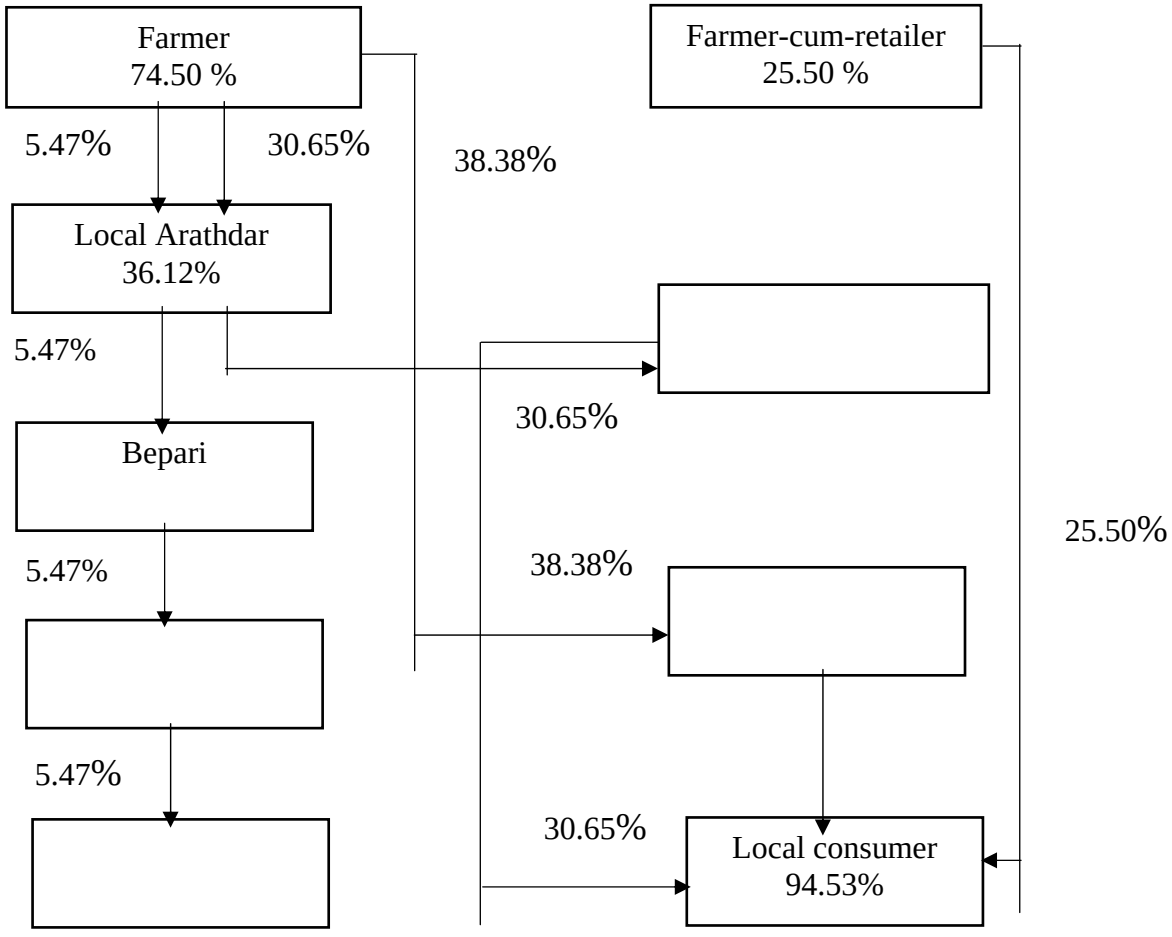

Fig: 11.3.1 Supply chain of selected vegetables in coastal areas of Bangladesh

MARKETING COST AND MARGIN AT DIFFERENT LEVELS IN SUPPLY CHAIN

This chapter focused on to understand the different marketing cost and margin of the different actors involved in the selected vegetables supply chain in hilly and coastal areas of Bangladesh.

11.4 Marketing cost and margin of different actors

The cost of marketing represents the cost of performing the various marketing functions and operation by various agencies involved in the marketing process. In other words, the costs which are incurred to move the product from producers to consumers are generally known as marketing cost. Marketing margin is the difference between selling and buying prices of the commodities. According to Tomek and Robinson (1990), marketing margin may be defined alternatively as (i) a difference between the price paid by the consumers and that obtained by producers or as (2) the price of a collection of marketing services which is the outcome of the demand for and the supply of such services. The total marketing margin usually consists of margins at different stages of marketing and in each case the margin is the difference between the buying and selling prices of each intermediary (Patniak, 1989).

11.4.1 Marketing cost of different actors in vegetables supply chain of hilly areas

Marketing costs among farmers and various intermediaries is very important for improving the efficiency of marketing system. Nature and extent of business marketing cost varies from traders to traders. The marketing cost included the cost of transportation, packing, binding, loading, and unloading, market toll and entertainment for the movement of the product from one market to another. In chattagram hill tracts marketing cost is higher than other plain land of the country due to a lot of things such as, uneven topography, high transportation cost, different kinds of subscription etc. Marketing cost of different actors in brinjal and yard long bean supply chain was presented in the following subsequent part.

11.4.1.1 Farmer's marketing cost

The per quintal marketing cost of brinjal and yard long bean by farmers was Tk.114.54 and 119.18 respectively (Table 11.4.1). Among the cost items, transportation cost was the highest, which was about 39.19% for brinjal and 41.02% for yard long bean because of high carrying cost of vegetables from home to market. The second highest cost item was weighing charge which was 21.83% for brinjal and 20.98% for yard long bean. The other cost items recorded for the farmers were loading & unloading (15.78%), market toll (9.28%) and personal expenses (13.92%) for brinjal marketing whereas in case of yard long bean it was 15.72%, 9.48% and 12.80% respectively. It was observed from the table 11.4.1 that there was no significant difference among the cost items between brinjal and yard long bean in hilly areas.

Table 11.4.1 Farmers marketing cost in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation cost	44.89	39.19	48.89	41.02
Loading and unloading	18.08	15.78	18.73	15.72
Khajna/market toll	10.63	9.28	11.30	9.48
Weighing charge	25.00	21.83	25.00	20.98
Personal expenses	15.94	13.92	15.26	12.80
Total	114.54	100.00	119.18	100.00

11.4.1.2 Marketing cost of farmer-cum-retailer

In hilly region, most of the time farmers done retailing in local markets for getting higher price. So, they have to incur some additional cost for this purpose. The per quintal marketing cost of brinjal and yard long bean by farmers-cum-retailer was Tk.119.20 and Tk.125.85 respectively (Table 11.4.2). Among the cost items, transportation cost is the highest, which was about 39.85% for brinjal and 42.05% for yard long bean. The other major cost items were the loading & unloading (20.68%), gunny or shopping bag (15.73%), personal expenses (13%) and market toll (6.90%) for brinjal marketing. In case of yard long bean, it was accounted for 20.10% for loading & unloading, 14.59% for personal expenses, 12.91% gunny or shopping bag and 5.57% for market toll.

Table 11.4.2 Marketing cost of farmer-cum-retailer in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation	47.50	39.85	52.92	42.05
Loading & unloading	24.65	20.68	25.30	20.10
Gunny bag/shopping bag	18.75	15.73	16.25	12.91
Market toll/Khajna	8.22	6.90	7.02	5.57
Sweeper	4.58	3.84	6.00	4.77
Personal expenses	15.50	13.00	18.36	14.59
Total	119.20	100.00	125.85	100.00

11.4.1.3 Marketing cost of bepari for selected vegetables

A bepari bought selected vegetables directly from the spot (farm gate area), primary markets and sometimes from secondary markets and performed the marketing activities from purchase area to terminal market or distance market. The per quintal marketing cost of brinjal and yard long bean by bepari was Tk.355.40 and Tk.344.19 respectively (Table 11.4.3). Among the cost items, transportation cost was the highest representing 34.33 % brinjal and 34.28% for yard long bean of total cost. The second highest cost item was commission to arathdar which accounted for 31.51% brinjal and 33.70% for yard long bean of total cost. Other cost items were loading, unloading, gunny bag, market toll, personal expenses, tips and donation etc.

Table 11.4.3 Marketing cost of bepari in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation	122.00	34.33	118.00	34.28
Loading	28.00	7.88	24.20	7.03
Unloading (to arathdar)	20.35	5.72	18.50	5.37
Commission to arathadr	112.00	31.51	116.00	33.70
Market toll	8.50	2.39	10.25	2.98
Gunny bag	20.00	5.63	18.00	5.23
Subscription to:				
Poura tax	10.50	2.95	8.50	2.47
Terminal sommittee	5.50	1.55	5.00	1.45
Hill line charge (token)	7.50	2.11	8.24	2.39
Mobile bill	3.75	1.06	4.50	1.31
Tips and donation	9.30	2.62	7.00	2.03
Entertainment and Personal expenses	8.00	2.25	6.00	1.74
Total	355.40	100.00	344.19	100.00

11.4.1.4 Marketing cost of local arathdar

Local arathdar was the commission agent who takes commission from farmer or bepari or sometimes both parties in the primary or secondary market for providing facilities in the market or consignment. The per quintal marketing cost of brinjal and yard long bean by local arathdar was Tk.36.26 and Tk.37.94 respectively which indicated that marketing cost for both vegetables was more or less same for the local arathdar (Table 11.4.4). Other minor cost items were sweeper cost, electricity bill, mobile bill, entertainment and personal expenses which accounted for 5.17%, 7.89%,7.89%, 9.13% and 10.48% for brinjal and 4.38%,9.92%, 9.92%, 10.21% and 11.93% for yard long bean respectively.

Table 11.4.4 Marketing cost of local arathdar in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Wages and Salaries	15.75	43.43	14.85	39.14
Shop rent	5.80	15.99	5.50	14.50
Sweeper cost	1.88	5.17	1.66	4.38
Electricity bill	2.86	7.89	3.76	9.92
Moblie bill	2.86	7.89	3.76	9.92
Entertainment	3.31	9.13	3.88	10.21
Personal Expenses	3.80	10.48	4.53	11.93
Total	36.26	100.00	37.94	100.00

11.4.1.5 Marketing cost of urban arathdar

Urban arathdar was the commission agents who take commission from bepari or retailer or sometimes both parties in the terminal market for providing some marketing facilities in the market. The per quintal marketing cost of brinjal and yard long bean by urban arathdar was Tk.47.85 and Tk.43.32 respectively (Table 11.4.5). Among the cost items, wages and salaries cost was the highest contributing 33.86% for brinjal and 32.74% for yard long bean of total cost, because arathdar's have to pay a remarkable amount of money for full time and part time labour

. Other cost items were shop rent, sweeper cost, electricity bill, mobile bill, entertainment and personal expenses which accounted for 10.87%, 5.22%, 4.60%, 9.30%, 18.39% and 17.76% for brinjal and 12.34%, 5.29%, 5.40%, 8.29%, 17.19% and 18.74% for yard long bean respectively.

Table 11.4.5 Marketing cost of urban arathdar in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Wages and Salaries	16.20	33.86	14.85	32.74
Shop rent	5.20	10.87	5.60	12.34
Sweeper cost	2.50	5.22	2.40	5.29
Electricity bill	2.20	4.60	2.45	5.40
Moblie bill	4.45	9.30	3.76	8.29
Entertainment	8.80	18.39	7.80	17.19
Personal Expenses	8.50	17.76	8.50	18.74
Total	47.85	100.00	45.36	100.00

11.4.1.6 Marketing cost of paiker-cum-retailer

Paiker-cum-retailer bought selected vegetables directly from the farmers or local arathdar in primary markets or sometimes from secondary markets and retailing thereof to distance market within the district. The per quintal marketing cost of brinjal and yard long bean by paiker-cum-retailer was Tk.211.96 and Tk.197.13 respectively (Table 11.4.6). Among the cost items, transportation cost was the highest contributing 26.51% for brinjal and 25.62% for yard long bean. The second highest cost item was wastage and damage which accounted for 23.83% for brinjal and 24.60% for yard long bean of total cost. Other cost items were loading, unloading, gunny bag, market toll, personal expenses, tips and donation etc.

Table 11.4.6 Marketing cost of paiker-cum-retailer in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation	56.20	26.51	50.50	25.62
Loading & unloading	24.00	11.32	22.00	11.16
Gunny bag	18.65	8.80	15.00	7.61
Wsatage and damage	50.50	23.83	48.50	24.60
Market toll	4.86	2.29	4.13	2.09
Subscription	12.80	6.04	14.50	7.36
Poura tax	10.50	4.95	8.50	4.31
Hill line charge (token)	15.00	7.08	16.50	8.37
Sweeper	3.75	1.77	4.50	2.28
Mobile bill	3.50	1.65	3.00	1.52
Personal expenses	12.20	5.76	10.00	5.07
Total	211.96	100.00	197.13	100.00

11.4.1.7 Marketing cost of local retailer

Local retailer bought selected vegetables directly from the farmers in primary markets or secondary markets and sold thereof to consumer. The per quintal marketing cost of brinjal and yard long bean by local retailer was Tk.154.96 and Tk.144.95 respectively (Table 11.4.7). Retailer sold small quantity of vegetables for 2-3 days long that is why spoilage and damage cost was the highest cost item for retailer and contributing 29.43% for brinjal and 30.77% for yard long bean. The second highest cost item was transportation cost which accounted for 13.87% for brinjal and

14.35% for yard long bean of total cost. Other cost items were loading & unloading, gunny bag, shop rent, market toll, electricity bill, Mobile bill, personal expenses etc. which covered rest of the percentage.

Table 11.4.7 Marketing cost of local retailer in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation	21.50	13.87	20.80	14.35
Loading & unloading	18.50	11.94	18.90	13.04
Gunny bag/poly bag	20.60	13.29	18.80	12.97
Spoilage and damage	45.60	29.43	44.60	30.77
Shop rent	10.80	6.97	8.40	5.80
Market toll	5.30	3.42	4.13	2.85
Sweeper cost	3.68	2.38	3.36	2.32
Electricity bill	4.58	2.96	4.46	3.07
Mobile bill	5.60	3.61	4.80	3.31
Personal expenses	18.79	12.13	16.70	11.52
Total	154.96	100.00	144.95	100.00

11.4.1.8 Marketing cost of urban retailer

Urban retailer performed marketing activities in the terminal market and bought selected vegetables from the urban arathdar and sold thereof to urban consumer. The per quintal marketing cost of brinjal and yard long bean by urban retailer was Tk.197.22 and Tk.189.81 respectively (Table11.4.8). Retailer sold small quantity of vegetables for long time that is why, Spoilage and damage cost was the highest cost item for urban retailer which accounted for 18.41% for brinjal and 19.49% for yard long bean. The second highest cost item was commission to arathdar which accounted for 13.87% for brinjal and 14.35% for yard long bean of total cost. Other cost items were transportation, loading & unloading, gunny bag, shop rent, market toll, Sweeper, electricity bill, Mobile bill, personal expenses etc. which covered rest of the percentage of the total cost.

Table 11.4.8 Marketing cost of urban retailer in hilly areas

Cost Items	Brinjal (Tk./qt)	% of total cost	Yard long bean (Tk./qt)	% of total cost
Transportation	25.50	12.93	22.38	11.79
Loading & unloading	20.80	10.55	18.50	9.75
Gunny bag/poly bag	18.30	9.28	18.90	9.96
Spoilage and damage	44.80	22.72	46.60	24.55
Commission to arathdar	36.30	18.41	37.00	19.49
Shop rent	15.50	7.86	14.48	7.63
Market toll	5.30	2.69	4.13	2.17
Sweeper	3.85	1.95	3.36	1.77
Electricity	2.58	1.31	3.26	1.72
Mobile bill	5.50	2.79	4.50	2.37

Personal expenses	18.79	9.53	16.70	8.80
Total	197.22	100.00	189.81	100.00

11.4.2 Marketing margin of different actors for selected vegetables in hilly areas

The marketing margin of different actor's in brinjal and yard long bean supply chain was calculated in hilly areas. There was five major supply chain found in the hilly areas by which most of the vegetables were moved from producer and consumer.

11.4.2.1 Marketing margin of brinjal in hilly area

The average marketing margins received by different actors in various supply chain of brinjal were discussed in the Table 11.4.9. In supply chain-I, only one intermediary was found which local retailer was and his marketing margin was around Tk.515/qt.

Table 11.4.9 Marketing margin of brinjal in the hilly area (Tk./quintal)

Supply chain	Actors	Average sale price	Average purchase price/ farm price	Gross margin/ Commission	Marketing cost	Net margin
Supply chain-I	Local retailer	2720.00	2050.00	670.00	154.96	515.04
Supply chain-II	Farmer-cum-retailer	2700.00	2050.00	650.00	119.20	530.81
Supply chain-III	Paiker-cum-retailer	2750.00	2050.00	700.00	211.96	488.04
Supply chain-IV	Local arathdar			116.00	37.94	78.06
	Paiker-cum-retailer	2735.00	2050.00	685.00	211.96	473.04
Supply chain-v	Local arathdar	--	--	116.00	36.26	79.74
	Bepari	2650.00	2050.00	600.00	355.40	246.60
	Urban arathdar			157.00	47.85	109.15
	Urban retailer	3250.00	2650.00	600.00	197.00	403.00

There was no intermediary found in supply chain-II, farmers himself done retailing brinjal in the market and his marketing margin was found to be Tk.530.81/qt. over farm price if he sells his brinjal in the market. In supply chain-III, here also one intermediary paiker-cum-retailer was found whose net margin was almost Tk.488/qt. Two intermediaries were found in supply chain-IV which was local arathdar and paiker-cum-retailer whose marketing margin was Tk.78.06/qt and Tk.473.04 /qt. respectively. There were four intermediaries found in the supply chain-V which was the longest supply chain. The marketing margin of actors involved in the supply chain-V was Tk.79.74/qt. for local arathdar, 246.60/qt. for bepari, Tk.109.15/qt. for urban arathdar and Tk.403/qt. for urban retailer.

11.4.2.2 Marketing margin of yard long bean in hilly area

The average marketing margin of different actors involved in various supply chain of yard long bean was calculated in the Table 11.4.10. It was observed from the table that only one intermediary was found in supply chain-I, which was local retailer and his marketing margin was around Tk.535/qt. There was no intermediary found in supply chain-II and farmers himself done retailing to the consumer. The net marketing margin was found to be Tk.504.15/qt. for marketing

of yard long bean to the market. In supply chain-III, the net margin of paiker-cum-retailer was almost Tk.492/qt. Two intermediaries were found in supply chain-V which was local arathdar and and paiker-cum-retailer whose marketing margin was Tk.78.06/qt and Tk.502.87/qt respectively. The marketing margin of four actors in supply chain-V was Tk.78.04/qt. for local arathdar, 235.81/qt. for bepari, Tk.114.64/qt. for urban arathdar and Tk.410/qt. for urban retailer.

Table 11.4.10 Marketing margin of yard long bean in hilly area (Tk./quintal)

Supply chain	Actors	Average sale price	Average purchase price /farm price	Gross margin/ Commission	Marketing cost	Net margin
Supply chain-I	Local retailer	2800.00	2120.00	680.00	144.95	535.05
Supply chain-II	Farmer-cum-retailer	2750.00	2120.00	630.00	125.85	504.15
Supply chain-III	Paiker-cum-retailer	2810.00	2120.00	690.00	197.13	492.87
Supply chain-IV	Local arathdar	--	--	116.00	37.94	78.06
	Paiker-cum-retailer	2820.00	2120.00	700.00	197.13	502.87
Supply chain-V	Local arathdar			116.00	37.94	78.06
	Bepari	2700.00	2120.00	580.00	344.19	235.81
	Urban arathdar			160.00	45.36	114.64
	Urban retailer	3300.00	2700.00	600.00	190.00	410.00

11.4.3 Marketing cost of different actors for selected vegetables in coastal areas

Marketing cost incurred due to product movement from farm level to consumer. In coastal area marketing of selected vegetables was unorganized due to semi-substance production, lack of distance bepari and high transportation cost especially in Patuakhali and Satkhira district. The actors in the selected vegetables supply chain performed different marketing functions such as transportation, loading, unloading, and packaging etc. to reach the product from producer to consumer. These types of functions incurred marketing cost. The marketing costs of different actors were discussed in the below.

11.4.3.1 Farmers marketing cost in coastal area

Farmers are the starting points of the marketing chain and cost were involved due to carrying vegetables from farmyard to primary markets. It was revealed from the table 11.4.11 that the marketing cost of farmer was highest for bittergourd which was Tk.120.15/quintal followed by cucumber which was Tk.113.25/quintal. Among the cost items, transportation cost was the major cost item for all the studied vegetables which was 34.90% for bittergourd and 38.90% for cucumber of total marketing cost. The second highest cost item was weighing charge which was 24.97% for bittergourd and 26.49% for cucumber. The per quintal loading and unloading, market toll and personal expenses cost were 14.51%, 11.64% and 13.99% for bittergourd and 13.93%, 9.23% and 11.45% for cucumber respectively.

Table 11.4.11 Farmers marketing cost in coastal area

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation cost	41.93	34.90	44.05	38.90
Loading and unloading	17.43	14.51	15.78	13.93
Khajna/market toll	13.98	11.64	10.45	9.23
Weighing charge	30.00	24.97	30.00	26.49
Personal expenses	16.81	13.99	12.97	11.45
Total	120.15	100.00	113.25	100.00

11.4.3.2 Marketing cost of farmer-cum-retailer

The per quintal marketing cost of bittergourd and cucumber by farmers-cum-retailer was Tk. 105.76 and Tk.110.38 respectively (Table 11.4.12). Among the cost items, transportation cost is the highest, which was about 38.33% for brinjal and 39.29 % for yard long bean. The other major cost items were the loading & unloading, gunny or shopping bag, market toll, sweeper and personal expenses which covered the rest of percentage of the total cost.

Table 11.4.12 Marketing cost of farmer-cum-retailer in coastal area

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation	40.54	38.33	43.37	39.29
Loading & unloading	22.54	21.31	18.50	16.76
Gunny bag	15.64	14.79	14.89	13.49
Market toll/Khajna	6.50	6.15	7.02	6.36
Sweeper	3.56	3.37	4.59	4.16
Personal expenses	16.98	16.06	22.02	19.95
Total	105.76	100.00	110.38	100.00

11.4.3.3 Marketing cost of bepari in coastal area

Table 11.4.13 showed the average marketing cost of *bepari* for selected vegetables namely bittergourd and cucumber in coastal area. The marketing cost of bittergourd was Tk.321.72/qt. which was higher than the marketing cost of cumcumber which was Tk.302.70/qt. Among the cost items commission to arathdar was the highest for both vegetables which covered 35.75% for bittergourd and 36.34% for cucumber. The second highest cost item of b*epari* was transportation cost which covered almost 29.53% for bittergourd and 27.44% for cucumber of total marketing cost. Other cost items were loading, unloading, gunny bag, market toll, personal expenses, tips and donation etc. which covered rest of the percentage.

Table 11.4.13 Marketing cost of bepari in coastal areas

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation	95.00	29.53	83.06	27.44
Loading	14.50	4.51	16.88	5.57
Unloading (to Arathdar)	12.00	3.73	14.38	4.75
Commission to arathadr	115.00	35.75	110.00	36.34

Gunny bag	25.00	7.77	21.77	7.19
Market toll	10.50	3.26	11.07	3.66
Subscription	12.34	3.84	10.30	3.40
Sweeper	3.48	1.08	2.24	0.74
Mobile bill	6.90	2.14	5.33	1.76
Tips and donation	11.51	3.58	9.35	3.09
Entertainment & personal expenses	15.50	4.82	18.32	6.05
Total	321.72	100.00	302.70	100.00

11.4.3.4 Marketing cost of local arathdar in coastal area

The per quintal marketing cost of bittergourd and cucumber by local arathdar was Tk.37.33 and Tk.30.46 respectively in costal best (Table 11.4.14). Among the cost items, wages and salaries cost shared the highest cost contributing 42.19% for bittergourd and 40.99% for cucumber of total cost. The second highest cost item was personal expenses and entertainment which accounted for 17.68% and 12.77 % for bittergourd and 18.10% and 13.25% for cucumber of total cost. Other minor cost items were sweeper cost, electricity bill, mobile bil etc.

Table 11.4.14 Marketing cost of local arathdar in coastal areas

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Wages and Salaries	15.75	42.19	12.49	40.99
Shop rent	3.65	9.78	3.39	11.12
Sweeper cost	2.88	7.70	2.50	8.21
Electricity bill	0.78	2.09	0.85	2.79
Moblie bill	2.91	7.79	1.69	5.54
Entertainment	4.77	12.77	4.04	13.25
Personal Expenses	6.60	17.68	5.51	18.10
Total	37.33	100.00	30.46	100.00

11.4.3.5 Marketing cost of urban arathdar in coastal area

Urban arathdar was the commission agent who takes commission from bepari or retailer or sometimes both parties in the terminal market for providing some marketing facilities in the market. The per quintal marketing cost of bittergourd and cucumber by urban arathdar was Tk.42.32 and Tk.40.97 respectively in coastal area (Table 11.4.15). Among the cost items, wages and salaries cost shared the highest cost contributing 37.22% for bittergourd and 32.92% for cucumber of total cost. The second highest cost item was entertainment and personal expenses which accounted for 17.72% and 15.60 % for bittergourd and 19.04% and 15.87% for cucumber of total cost. Other minor cost items were sweeper cost, electricity bill, mobile bil etc.

Table 11.4.15 Marketing cost of urban arathdar in coastal areas

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Wages and salaries	15.75	37.22	13.49	32.92
Shop rent	5.28	12.48	5.50	13.43
Sweeper	2.88	6.79	2.90	7.08
Electricity	1.78	4.21	2.10	5.13

Moblie	2.53	5.98	2.68	6.54
Entertainment	7.50	17.72	7.80	19.04
Personal Expenses	6.60	15.60	6.50	15.87
Total	42.32	100.00	40.97	100.00

11.4.3.6 Marketing cost of paiker-cum-retailer in coastal areas

Paiker-cum-retailer bought selected vegetables directly from the farmers or local arathdar in primary markets or sometimes from secondary markets and retailing thereof to distance market within the district. The per quintal marketing cost of bittergourd and cucumber by paiker-cum-retailer was Tk.167.94 and Tk.161.64 respectively (Table 11.4.16).

Table 11.4.16 Marketing cost of paiker-cum-retailer in coastal areas

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation	50.00	29.77	45.50	28.15
Loading & unloading	24.00	14.29	22.00	13.61
Gunny bag/poly bag	18.65	11.11	15.00	9.28
Wsatage and damage	42.30	25.19	46.90	29.02
Market toll/Khajna	8.86	5.28	9.20	5.69
Sweeper	4.28	2.55	4.00	2.47
Mobile bill	5.55	3.30	6.50	4.02
Personal expenses	14.30	8.51	12.54	7.76
Total	167.94	100.00	161.64	100.00

Among the cost items, transportation cost was the highest contributing 29.77% for brinjal and 28.15% for yard long bean. The second highest cost item was wastage and damage which accounted for 25.19% bittergourd and 29.02% for cucumber of total cost. Other cost items were loading, unloading, gunny bag, market toll, personal expenses, tips and donation etc.

11.4.3.7 Marketing cost of local retailer in coastal area

The per quintal marketing cost of bittergourd and cucumber by local retailer was Tk.148.31 and Tk.142.70 respectively (Table 11.4.17). Retailer sold small quantity of vegetables for 2-3 days long that is why spoilage and damage cost was the highest cost item for retailer and contributing 26.16% for bittergourd and 28.45% for cucumber of total cost. The second highest cost item was transportation cost which accounted for 17.79% for bittergourd and 16.69% for cucumber of total cost. Other cost items were loading & unloading, gunny bag, shop rent, market toll, electricity bill, Mobile bill, personal expenses etc. which covered rest of the percentage of total cost

Table 11.4.17 Marketing cost of local retailer in coastal areas

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation	24.60	17.79	22.65	16.69
Loading & unloading	18.75	13.56	18.00	13.26
Gunny bag/poly bag	18.50	13.38	16.60	12.23
Spoilage and damage	38.80	28.05	40.60	29.92
Shop rent	8.54	6.17	9.85	7.26

Market toll	3.65	2.64	3.62	2.67
Sweeper	3.05	2.21	1.19	0.88
Electricity	1.49	1.08	2.13	1.57
Mobile bill	4.92	3.56	4.04	2.98
Personal expenses	16.02	11.58	17.02	12.54
Total	138.31	100.00	135.70	100.00

11.4.3.8 Marketing cost of urban retailer in coastal area

Table 11.4.18 showed the per quintal marketing cost of bittergourd and cucumber by local retailer was Tk.187.87 and Tk.180.65 respectively. It was revealed from the table that spoilage and damage cost was the highest cost item for urban retailer and contributing 24.86% for bittergourd and 26.96% for cucumber of total cost. The second highest cost item was commission to arathdar which accounted for 18.26% for bittergourd and 16.79% for cucumber of total cost. Other cost items were transportation, loading & unloading, gunny bag, shop rent, market toll, sweeper cost, electricity bill, Mobile bill and personal expenses etc. which covered rest of the percentage of total cost.

Table 11.4.18 Marketing cost of urban retailer in coastal area

Cost Items	Bittergourd (Tk./qt)	% of total cost	Cucumber (Tk./qt)	% of total cost
Transportation	21.85	11.63	22.80	12.62
Loading & unloading	20.90	11.12	18.70	10.35
Gunny bag/poly bag	18.50	9.85	16.60	9.19
Wsatage and damage	46.70	24.86	48.70	26.96
Commission to arathdar	34.30	18.26	30.34	16.79
Shop rent	14.50	7.72	12.50	6.92
Market toll	3.65	1.94	3.62	2.00
Sweeper	3.05	1.62	2.19	1.21
Electricity	3.49	1.86	4.14	2.29
Mobile bill	4.92	2.62	4.04	2.24
personal expenses	16.02	8.53	17.02	9.42
Total	187.87	100.00	180.65	100.00

11.4.4 Marketing margin of different actors for selected vegetables in coastal areas

Four major supply chains were identified for bittergourd and cucumber marketing in coastal areas. The marketing margin of different actors was calculated along the supply chain of selected vegetables in coastal area. Four major supply chains were found in the coastal belt by which most of the vegetables were moved from producer and consumer.

11.4.4.1 Marketing margin of bittergourd in the coastal areas

The average marketing margin received by different actors in various supply chain of bittergourd was presented in the Table 11.4.19. It was observed from the table that only one intermediary was found in supply chain-I which was local retailer and his marketing margin was around Tk.548/qt. In supply chain-II, the net margin of two intermediaries' local arathdar and paiker-cum-retailer was Tk.77.67/qt. and 529.06/qt. respectively. There was no any intermediary found

in supply chain-III, farmers himself done retailing bittergourd to the consumer and his marketing margin was Tk.531.24/qt. The marketing margin of the actors in supply chain-IV was Tk.77.67/qt. for local arathdar, 345.28/qt. for bepari, Tk.119.68 for urban arathdar and Tk. 432.13/qt. for urban retailer. Supply chain-IV was the longest supply chain and its percentage of product flow is very low.

Table 11.4.19 Marketing margin of biitergourd in the coastal areas (Tk./qt.)

Supply chain	Actors	Average sale price	Average purchase price/farm price	Gross margin/ Commission	Marketing cost	Net margin
Supply chain-I	Local retailer	2900.00	2213.00	687.00	138.31	548.69
Supply chain-II	Local arathdar	--	--	115.00	37.33	77.67
	Paiker-cum-retailer	2910.00	2213.00	697.00	167.94	529.06
Supply chain-III	Farmer-cum-retailer	2850.00	2213.00	637.00	105.76	531.24
supply chain-IV	Local arathdar	--	--	115.00	37.33	77.67
	Bepari	2880.00	2213.00	667.00	321.72	345.28
	Urban arathdar	--	--	162.00	42.32	119.68
	Urban retailer	3500.00	2880.00	620.00	187.87	432.13

11.4.4.2 Marketing margin of cucumber in the coastal areas

Table 11.4.20 presented the average marketing margin of different actors involved in various supply chain of cucumber. It was observed from the table that, local retailer was the only intermediaries in supply chain-I and his marketing margin was Tk.452.30/qt. In supply chain-II, two intermediaries were found namely local arathdar and paiker-cum-retailer whose net margin was Tk.79.54/qt. and 456.36/qt. respectively. There was no intermediary found in supply chain-III, farmers himself act as a reatiler and his marketing margin was found to be Tk.427.62/qt. The marketing margin of the actors in supply chain-IV was Tk.79.54/qt. for local arathdar, 185.30/qt. for bepari, Tk.117.03/qt for urban arathdar and Tk. 369.35/qt. for urban retailer

Table 11.4.20 Marketing margin of cucumber in the coastal areas (Tk./qt.)

Supply chain	Actors	Average sale price	Average purchase price/farm price	Gross margin/ Commission	Marketing cost	Net margin
Supply chain-I	Local retailer	2550	1962	588	135.7	452.30
Supply chain-II	Local arathdar	--	--	110	30.46	79.54
	Paiker-cum-retailer	2580	1962	618	161.64	456.36
Supply chain-III	Farmer-cum-retailer	2500	1962	538	110.38	427.62
supply chain-IV	Local arathdar	--	--	110	30.46	79.54
	Bepari	2450	1962	488	302.7	185.30
	Urban arathdar	--	--	158	40.97	117.03
	Urban retailer	3000	2450	550	180.65	369.35

MARKETING EFFICIENCY OF SELECTED VEGETABLES IN HILLY AND COASTAL AREA

Marketing efficiency is directly related to the cost and margin involved in moving goods from the producer to the consumer and the quantity of services offered. If the incurred cost is low with compared to the service involved, it will be efficient marketing system. The improvement of marketing efficiency means the reduction of marketing cost without reducing the quantum of services offered to the consumer. Marketing efficiency is a complicated topic to be defined. It varies different meaning to different persons. Marketing efficiency is the maximization of input output ratio (Kohls and Uhls, 1990)

Efficient marketing of vegetables is considered to be more complex than its production. In hilly and coastal areas due to little access to the urban market and the involvement of a number of intermediaries in the selected vegetables marketing, the smallholder farmers mostly sell their vegetables to the local consumers and traders at a lower price. Thus, the aim of the study is to identify the efficient marketing chain of the selected vegetables.

11.5.1 Marketing efficiency of selected vegetables in hilly areas

There were five major supply chains identified in the hilly areas. Among the five supply chains, four chains supplied vegetables within the local consumer. Only one chain delivered local vegetables to the urban consumer which was supply chain-V. The marketing efficiency of brinjal and yard long been supply chain was discussed in the following section.

11.5.1.1 Marketing efficiency of different supply chain of brinjal

Marketing efficiency of different supply chain of brinjal was identified in terms of four performance indicators out six performances indicators such as producer share, marketing cost, middlemen marketing margin and deviation between maximum and minimum prices. Peak and lean season price variability is ignored here because it was difficult to identify peak and lean season prices in the study areas. Because selected vegetables were produced year round in the study areas.

11.5.1.1.1 Producer's share of different brinjal supply chain

The producers' share in the consumer's prices of brinjal in different supply chain was shown in Table 11.5.1. Producers' share was the highest in supply chain-II and lowest in channel-V in the study areas. It means that the farmers got highest benefit by selling their vegetables directly to the consumer instead of intermediaries. Producers share was found to be lowest in the supply chain V, it was due to large number of intermediaries involved here and it was ranked V. The producers share of other others supply chains were more or less the same.

11.5.1.1.2 Marketing cost and margin of actors in different brinjal supply chain

The supply chain-V of brinjal marketing has incurred highest marketing cost whereas the lowest in case of supply chain II (Table 11.5.1). It was revealed that if farmer sell their brinjal through supply chain-V the marketing cost becomes high. On the other hand, if farmer sell the brinjal through supply chain-II then the marketing cost was the lowest because farmer sell directly to the consumer. The calculated marketing cost of supply chain-III and supply chain IV was same for both supply chain. Here only on middlemen was found in supply chain-III which was paiker-cum-retailer and two middlemen was found in supply chain-IV which was local arathdar and paiker-cum-retailer. But marketing cost of the both chain was same in the sense that arathdar commission was the marketing cost of another intermediaries, so arathdar's cost and margin was

not repeated in the chain. The same approach was followed in ranking the margin of middlemen in each supply chain.

Table 11.5.1 Producer share, marketing cost and margin of brinjal supply chain

Particulars	Different supply chain of Brinjal				
	chain-I	Chain-II	chain-III	Chain-IV	Chain-V
	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)
A**. Gross price received by the farmer-cum-retailer/farmer**	2050.00	2700.00	2050.00	2050.00	2050.00
a. Marketing cost incurred by the farmer-cum-retailer/farmer	114.54	119.20	114.54	114.54	114.54
b. Net price received by the farmer-cum-retailer/farmer	1935.46	2580.80	1935.46	1935.46	1935.46
B. Gross margin received by the *Bepari*	**--**	**--**	**--**	**--**	600.00
a. Marketing cost incurred by *the Bepari*	--	--	--	--	355.40
b. Net margin received by the *Bepari*	--	--	--	--	244.60
C. Gross margin received by the paiker-cum-retailer	--	--	700.00	685.00	--
a. Marketing cost incurred by the paiker-cum-retailer	--	--	211.96	211.96	--
b. Net margin received by the paiker-cum-retailer	--	--	488.04	473.04	--
D. Gross margin received by the local retailer	670.00	--	--	--	--
a. Marketing cost incurred by the local retailer	154.96		--	--	--
b. Net margin received by the local retailer	515.04	--	--	--	--
E. Gross margin received by the urban retailer	--	-	--	--	600.00
a. Marketing cost incurred by the urban retailer	--	--	--	--	197.00
b. Net margin received by the urban retailer	--	--	--	--	403.00
F. Price paid by the consumers (A+B+C+D+E+F)	2720.00	2700.00	2750.00	2735.00	3250.00
G. Producer share in consumer Taka (%)	71.16	95.59	70.38	70.77	59.55
Rank (I_1)	II	I	IV	III	V
H. Total marketing cost	269.50	119.20	326.50	326.50	666.94
Rank (I_2)	II	I	III	III	IV
I. Total marketing margin	515.04	0.00	488.04	473.04	647.60
Rank (I_3)	IV	I	III	II	V

11.5.1.1.3 Deviation between maximum and minimum prices brinjal supply chains

Price deviation means the differences of maximum and minimum prices of brinjal in a month. The differences between maximum and minimum prices of each month were calculated and finally the differences of all months were summed up and then the average deviation was calculated. It may be observed from the table 11.5.2 that Chain-II incurred lowest price deviation followed by

Channel-I. Price deviation was the highest in Channel-V. It might be reason of longest supply chain among the five chains.

Table 11.5.2 Price deviation between of brinjal in different supply chain

Month	Chain-I	Chain-II	Chain-III	Chain-IV	Chain-V
January	675	650	730	700	850
February	775	750	820	800	900
March	800	780	850	820	950
April	930	880	943	980	970
May	850	830	890	880	1080
June	735	720	785	750	880
July	720	700	760	740	850
August	695	680	720	710	750
September	638	625	678	650	760
October	550	550	600	550	700
November	545	510	580	580	650
December	525	500	580	550	690
∑d	8438	8175	8973	8710	10030
N	12	12	12	12	12
D	703	681	748	726	836
Rank (I_4)	II	I	IV	III	V

11.5.1.1.4 Efficient supply chain of brinjal marketing

The efficiency of different supply chain of brinjal was drawn on the basis of ranks of four different performance indicators by using composite index formula. The performance indicator revealed that the supply chain-III and V were not relatively efficient in the hilly areas of Bangladesh. It was due to comparatively lower prices received by the farmers in the supply chain-III and V. It was revealed from the table 11.5.3 that the score of final ranking of the supply chain-II is lowest among the supply chain and it was the most efficient supply chain. It implies that farmers were more benefited if they performed as a retailer.

Table 11.5.3 Final ranking of the efficiency of different brinjal supply chains

Performance indicator	**Supply Chain -I**	**Supply Chain -II**	**Supply Chain -III**	**Supply Chain -IV**	**Supply Chain -V**
Producers' share (I_1)	II	I	IV	III	V
Marketing costs (I_2)	II	I	III	III	IV
Margin to middlemen (I_3)	IV	I	III	II	V
Price deviation (I_4)	II	I	IV	III	V
Composite index (Ri ÷ Ni)	2.5	1	3.5	2.75	4.75
Final ranking	2	1	4	3	5

Ri = Total value of the ranks of performance indicators
Ni = Total number of performance indicators

11.5.1.2 Marketing efficiency of different supply chain of yard long bean

The marketing efficiency of yard long bean was estimated in term of producer share, total marketing cost, middlemen marketing margin and price deviation. Table 11.5.4 showed the

ranking of producer share, marketing cost and marketing margin of different supply chain of yard long bean.

11.5.1.2.1 Producer's share of different yard long bean supply chain

The producers' shares in the consumer's prices of yard long bean in different supply chain were shown in table 11.5.4. Producers' share was the highest in supply chain-II and lowest in channel-V in the study areas. It means that the farmers got highest benefit by selling their vegetables directly to the consumer instead of intermediaries. Producers share was found to be lowest in the supply chain-V, it's due to large number of intermediaries involved here and it was ranked V.

11.5.1.2.2 Marketing costs and margins of actors in different yard long bean supply chain

The supply chain-V of yard long bean marketing has incurred highest marketing cost whereas the lowest marketing cost incurred in case of supply chain-II (table 11.5.4). It revealed that if farmer sell their yard long bean through supply chain-V the marketing cost becomes high. On the other hand, if farmer sell their yard long bean through supply chain-II then the marketing cost was the lowest. Because farmers direct sell to the consumer and no intermediary was involved in supply chain-II. The cost of marketing in the supply chain-III and supply chain IV was same for both supply chain. Here only on middlemen was found in supply chain-III which was paiker-cum-retailer and two intermediaries were found in supply chain-V which was local arathdar and paiker-cum-retailer. But marketing cost of the both chains was same because arathdar's commission was the marketing cost of other intermediaries, so arathdar's cost and margin was not repeated in the chain.

Table 11.5.4 Producer share, marketing cost and margin of yard long bean supply chain

Particulars	Different supply chain of yard long bean				
	chain-I	Chain-II	chain-III	Chain-IV	Chain-V
	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)
A. Gross price received by the farmer-cum-retailer	2120.00	2750.00	2120.00	2120.00	2120.00
a. Marketing cost incurred by the farmer-cum-retailer	119.18	125.85	119.18	119.18	119.18
b. Net price received by the farmer-cum-retailer	2000.82	2624.15	2000.82	2000.82	2000.82
B. Gross margin received by the bepari	--	--	--	--	580.00
a. Marketing cost incurred by the *Bepari*	--	--	--	--	344.19
b. Net margin received by the *Bepari*	--	--	--	--	235.81
C. Gross margin received by the paiker-cum-retailer	--	**--**	690.00	700.00	--
a. Marketing cost incurred by the paiker-cum-retailer	--	--	197.13	197.13	--
b. Net margin received by the paiker-cum-retailer	--	--	492.87	502.87	--
D. Gross margin received by the local retailer	680.00	--	--	--	--
a. Marketing cost incurred by the local retailer	144.95	--	--	--	--
b. Net margin received by the local retailer	535.05	--	--	--	--
E. Gross margin received by the urban	--	--	--	--	600.00

retailer					
a. Marketing cost incurred by the urban retailer	--	--	--	--	190.00
b. Net margin received by the urban retailer	--	--	--	--	410.00
F. Price paid by the consumers (A+B+C+D+E)	2800.00	2750.00	2810.00	2820.00	3300.00
G. Producer share in consumer Taka (%)	**71.46**	**95.42**	**71.20**	**70.95**	**60.63**
Rank (I)	II	I	III	IV	V
H. Total marketing cost	**264.13**	**125.85**	**316.31**	**316.31**	**653.37**
Rank (II)	II	I	III	III	IV
I. Total marketing margin	**535.05**	**0.00**	**492.87**	**502.87**	**645.81**
Rank (III)	IV	I	II	III	V

11.5.1.2.3 Deviation between maximum and minimum prices of yard long bean

It was revealed from the table 11.5.5 that the highest price differences were found in the month of April, May and June, it may be due to harvesting period of yard long bean and price frequently fluctuated in this period. It was also observed from the table that chain-II incurred lowest price deviation followed by Channel-I, IV, III and V. Price deviation was the highest in Channel-V. It might be due to longest supply chain among the five chains.

Table 11.5.5 Price deviation of Yard long bean in different supply chain

Month	Chain-I	Chain-II	Chain-III	Chain-IV	Chain-V
April	850	800	880	855	930
May	960	980	1020	955	1050
June	800	880	790	775	820
July	750	700	770	740	780
August	700	680	735	725	750
September	680	750	678	655	725
October	700	650	650	585	725
November	558	535	580	630	650
∑d	5998	5975	6103	5920	6430
N	8	8	8	8	8
D	750	747	763	740	804
Rank (I)	II	I	IV	III	V

11.5.1.2.4 Efficient supply chain of yard long bean

The efficiency of different supply chain of yard long bean was calculated on the basis of ranks of four different performance indicators by using composite index formula. It was revealed from the table 11.5.6 that the score of final ranking of the supply chain-II was the lowest among the supply chain and it was the most efficient supply chain of yard long bean marketing. It implies that farmers were more benefited if they performed as a retailer. The rest efficient supply chain was supply chain-I, III, IV and V.

Table 11.5.6 Final ranking of the efficiency of different yard long bean supply chains

Performance indicator	Supply Chain -I	Supply Chain -II	Supply Chain -III	Supply Chain -IV	Supply Chain -V
Producers' share (I_1)	II	I	III	IV	V
Marketing costs (I_2)	II	I	III	III	IV
Margin to actors (I_3)	IV	I	II	III	V
Price deviation (I_4)	II	I	IV	III	V
Composite index (Ri ÷ Ni)	2.5	1	3	3.25	4.75
Final ranking	2	1	3	4	5

Ri = Total value of the ranks of performance indicators
Ni = Total number of performance indicators

11.5.2 Marketing efficiency of selected vegetables in coastal areas

In coastal area, there were four major supply chains were identified. Among the supply chains three chains were confined within the local consumer. Only one supply chain delivered local vegetables to the urban consumer.

11.5.2.1 Marketing efficiency of different supply chains of bittergourd

The producer shares in consumer price, marketing cost and marketing margin of bittergourd was presented in the table 11.5.7. The ranking of the producer share, marketing cost and marketing margin was also presented in this table.

11.5.2.1.1 Producer's share of bittergourd in different supply chain

The producers' share was the highest in supply chain-III and lowest in chain-IV in bittergourd marketing. It implies that the farmers got highest benefit by selling bittergourd directly to the consumer instead of intermediaries. Producers share was found to be lowest in the supply chain IV, it's due to large number of actors involved here and it was ranked IV. The producers share of other others intermediaries were more or less the same (Table 11.5.7).

Table 11.5.7 Producer share, marketing cost and margin of bittergourd supply chain

Particulars	Different supply chain of bittergourd			
	chain-I	chain-II	Chain-III	Chain-IV
	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)
A. Gross price received by the farmer-cum-retailer/farmer	**2213**	**2213**	**2850**	**2213**
a. Marketing cost incurred by the farmer-cum-retailer/farmer	120.15	120.15	105.76	120.15
b. Net price received by the farmer-cum-retailer/farmer	2092.85	2092.85	2744.24	2092.85
B. **Gross margin received by the bepari**	**--**	**--**	**--**	667.00
a. Marketing cost incurred by the bepari	--	--	--	321.72
b. Net margin received by the bepari	--		--	345.28
C. **Gross margin received by the paiker-cum-retailer**	--	697.00	--	--
a. Marketing cost incurred by the paiker-cum-retailer	--	167.94	--	--
b. Net margin received by the paiker-cum-	--	529.06	--	--

retailer				
D. **Gross margin received by the local retailer**	687.00	--	--	--
a. Marketing cost incurred by the local retailer	138.31	--	--	--
b. Net margin received by the local retailer	548.69	--	--	--
E. **Gross margin received by the urban retailer**	--	--	--	620.00
a. Marketing cost incurred by the urban retailer	--	--	--	187.87
b. Net margin received by the urban retailer	--	--	--	432.13
F. Price paid by the consumers (A+B+C+D+E)	2900	2910	2850	3500
G. Price share in consumer Taka (%)	**72.17**	**71.92**	**96.29**	**59.80**
Rank (I_1)	II	III	I	IV
H. Total marketing cost (Tk.)	**258.46**	**288.09**	**105.76**	**629.74**
Rank (I_2)	II	III	I	IV
I. Total marketing margin (Tk.)	**548.69**	**529.06**	**0**	**777.41**
Rank (I_3)	II	III	I	IV

11.5.2.1.2 Marketing cost and margin of actors in different supply chain of bittergourd

The supply chain-IV of bittergourd marketing has incurred highest marketing cost whereas the lowest marketing cost incurred in case of supply chain-III (Table 11.5.7). It revealed that if farmer sell their bittergourd through supply chain-IV the marketing cost becomes high, on the other hand, if farmer sell their bittergourd through supply chain-III, the marketing cost was the lowest because no intermediary was involved in supply chain-III. Marketing margins of supply chain-IV was the highest and lowest in supply chain-III.

11.5.2.1.3 Deviation between maximum and minimum prices of bittergourd

Table 11.5.8 showed that the highest price differences were found in the month of March, April and May, it also may be due to harvesting period of bittergourd. It was also observed from the table 11.5.8 that supply chain-III incurred lowest price deviation followed by Channel-I, II and IV. Price deviation was the highest in Channel-IV. It might be due to longest supply chain among the four chains.

Table 11.5.8 Price deviation of bittergourd in different supply chain

Month	Chain-I	Chain-II	Chain-III	Chain-IV
January	830	870	780	910
February	855	875	820	895
March	880	923	845	965
April	930	1015	870	1100
May	850	950	840	1050
June	745	815	720	885
July	735	793	700	850
August	715	745	680	775
September	640	700	700	760
October	635	688	650	740
November	545	595	530	645
December	540	600	540	660

∑d	8900	9568	8675	10235
D	742	797	723	853
N	12	12	12	12
Rank (I)	II	III	I	IV

11.5.2.1.4 Efficient supply chain of bittergourd

The efficiency of different supply chain of bittergourd was calculated on the table 11.5.9. The final score of ranking of the supply chain-III was lowest among the supply chain and it was the most efficient supply chain of bittergourd marketing due to lower score. It implied that farmers were more benefited if they act as a retailer. The afterward efficient supply chains were supply chain- I, II and IV respectively.

Table 11.5.9 Final ranking of the efficiency of different bittergourd supply chains

Performance indicator	**Supply Chain-I**	**Supply Chain-II**	**Supply Chain-III**	**Supply Chain-IV**
Producers' share (I_1)	II	III	I	IV
Marketing costs (I_2)	II	III	I	IV
Margin to actors (I_3)	II	III	I	IV
Price deviation (I_4)	II	III	I	IV
Composite index (Ri ÷ Ni)	2	3	1	4
Final ranking	2	3	1	4

Ri = Total value of the ranks of performance indicators
Ni = Total number of performance indicators

11.5.2.2 Marketing efficiency of different supply chain of cucumber

The ranking of producer shares in consumer price, marketing cost and marketing margin of cucumber was presented in the table 11.5.10.

11.5.2.2.1 Producers share of different cucumber supply chain

The producers' share was the highest in supply chain-III and lowest in supply chain-IV in the cucumber marketing. It indicates that the farmers got highest benefit by selling their cucumber directly to the consumer instead of intermediaries. Producers share was found to be lowest in the supply chain IV, it's due to large number of intermediaries involved in the chain.

11.5.2.2.2 Marketing cost and margin of actors in different cucumber supply chain

The supply chain-IV of cucumber marketing has incurred highest marketing cost whereas the lowest marketing cost incurred in case of supply chain-III because farmers sell direct to the consumer (Table 11.5.10). The ranking of the margin of actors in each supply chain of cucumber marketing was also estimated in the same way. Marketing margins of the supply chain-IV was the highest and lowest in the supply chain-III.

Table 11.5.10 Producer share, marketing cost and margin of cucumber supply chain

Particulars	Different supply chain of cucumber			
	chain-I	chain-II	Chain-III	Chain-IV
	(Tk./qt)	(Tk./qt)	(Tk./qt)	(Tk./qt)
A. Gross price received by the farmer-cum-retailer/farmer	1962.00	1962.00	2500.00	1962.00
a. Marketing cost incurred by the farmer-cum-retailer/farmer	113.25	113.25	110.38	113.25
b. Net price received by the farmer-cum-retailer/farmer	1848.75	1848.75	2389.62	1848.75
B. Gross margin received by the Bepari	**--**	**--**	**--**	**488.00**
a. Marketing cost incurred by the Bepari	--	--	--	302.70
b. Net margin received by the Bepari	--	--	--	185.30
C. Gross margin received by the paiker-cum-retailer	**--**	**618.00**	**--**	**--**
a. Marketing cost incurred by the paiker-cum-retailer	--	161.64	--	--
b. Net margin received by the paiker-cum-retailer	--	456.36	--	--
D. Gross margin received by the local retailer	**588.00**	**--**	**--**	**--**
a. Marketing cost incurred by the local retailer	135.70	--	--	--
b. Net margin received by the local retailer	452.30	--	--	--
E. Gross margin received by the urban retailer	**--**	**--**	**--**	**550.00**
a. Marketing cost incurred by the urban retailer	--	--	--	180.65
b. Net margin received by the urban retailer	--	--	--	369.35
F. Price paid by the consumers (A+B+C+D+E)	**2550.00**	**2580.00**	**2500.00**	**3000.00**
G. Price share in consumer Taka (%)	72.50	71.66	95.58	61.63
Rank (I_1)	II	III	I	IV
H. Total marketing cost	**248.95**	**274.89**	**110.38**	**596.60**
Rank (II_2)	II	III	I	IV
I. Total marketing margin	**452.30**	**456.36**	**0.00**	**554.65**
Rank (III_3)	II	III	I	IV

11.5.2.2.3 Deviation between maximum and minimum prices of cucumber

Table 11.5.11 showed the deviation between maximum and minimum price difference of cucumber in each month. The price differences were found in the different month of the year and this difference is varying in month to month and did not follow any trends. It may be due to year round production of the cucumber. It was also observed from the table 11.5.11 that Channel-III incurred lowest price deviation followed by Channel-I, II and IV. Price deviation was the highest in Channel-IV. It might be due to longest chain among the five supply chains of cucumber.

Table 11.5.11 Price deviation of cucumber in different supply chain

Month	**Chain-I**	**Chain-II**	**Chain-III**	**Chain-IV**
January	898	915	880	950
February	875	910	840	980
March	900	930	870	990
April	868	895	840	950
May	975	1000	950	1050
June	868	895	840	950
July	800	790	735	850
August	780	825	700	950
September	740	720	680	760
October	673	695	650	740
November	630	620	580	645
December	638	645	630	660
∑d	9643	9840	9195	10475
D	804	820	766	873
N	12	12	12	12
Rank (I_4)	II	III	I	IV

11.5.2.2.4 Efficient supply chain of cucumber marketing

It was revealed from the table 11.5.12 that the final score of ranking of the supply chain-III was the lowest among the supply chain and it was the most efficient supply chain of cucumber marketing. It implies that farmers were more benefited if they work as a retailer of cucumber marketing though the supply chain-III followed by supply chain- I, II and IV. So supply chain-IV was the most inefficient and farmers become loser if they marketed cucumber through supply chain-IV.

Table 11.5.12 Final ranking of the efficiency of different cucumber supply chains

Performance indicator	**Supply Chain -I**	**Supply Chain -II**	**Supply Chain -III**	**Supply Chain -IV**
Producers' share (I_1)	II	III	I	IV
Marketing costs (I_2)	II	III	I	IV
Margin to actors (I_3)	II	III	I	IV
Price deviation (I_4)	II	III	I	IV
Composite index (Ri ÷ Ni)	2	3	1	4
Final ranking	2	3	1	4

Ri = Total value of the ranks of performance indicators
Ni = Total number of performance indicators

CONSTRAINTS TO PRODUCTION, MARKETING AND URBAN MARKET LINKAGE

Different types of constraints in production and marketing made the vegetables production subsistence in hill and coastal area though it has great potentialities. So various types of constraints related to production, marketing and urban market linkage has been discussed in this section.

11.6.1 Production constraints faced by the farmers in hilly area

The farmers identified various problems regarding vegetables production in the hilly areas. All these problems were ranked according to the farmer's perceptions. The following major problems faced by the farmer in the hilly areas are mentioned in the table 11.6.1.

Table 11.6.1 Constraint faced by the farmers for production in hilly area

Production constraints	% of responses			
	Bandarban	Khagrachari	Rangamati	All Area
High price of input	48	67	54	56
Acute irrigation problem	62	54	75	64
Scarcity of quality seed	42	56	65	54
Low yield	48	55	70	58
Insect & pest attack	80	88	82	83
Poor technical knowledge	60	65	68	64
Poor production practices	65	63	70	66
Less use of farm machinery	48	42	62	51
Low quality pesticide and fertilizer	58	46	60	55
Uneven rainfall and drought	52	40	44	45
Scarcity of cultivable land	54	65	62	60
Poor linkage between farmers and extension personnel	68	58	70	65

High price of input: High cost of various input make the production cost high. About 56% farmers opined that the cost of production of vegetables is high due to high price input such as; seed, labour, fertilizer and pesticides. Such a high cost prevents the farmers to expand the area under vegetables cultivation in hilly areas.

Acute irrigation problem: Water supply is essential for the vegetables growth and yield. But in the hilly areas irrigation water is a great problem and farmers do not get adequate water for irrigation. Some farmers provide irrigation manually from distance area like valley of the hill. About 64% farmers stated that lack of irrigation facility during dry season as a problem in the study areas.

Scarcity of quality seed: In the study areas quality seed was inadequate. Various company seed was available in the market but farmers were confused about their quality. Seed supplied by the authorized institution suppose BADC is good but they supplied a small quantity of seed, which do not meet the farmers' requirement. Problems of good quality seeds were a barrier in the way of expansion of its cultivation and it was reported by 54% farmers.

Low yield: Farmers got lower yield in the study areas due to various reason. Lack of quality seed and improved technology, traditional management practices and lack of suitable land per hectare yield was very low.

Insect & pest attack: The attack of insect and pest was found greater extent in the hill areas. The range of severity is much higher in the remote distance vegetables garden. Different types of insect and pest like fruit fly, fruit borer, shoot borer and leaf disease were found to attack the vegetables field at different location. Most of farmers were ignorance about this insect and pest, so they could not take any preventive measure to control the situation and 83% farmer reported it.

Poor technical knowledge: Farmers knowledge was not sufficient about modern production technology of vegetables cultivation in the hilly areas. They were also very much reluctant to vegetables cultivation due to their ignorance and lack of modern technical knowledge. About 64% farmers mentioned that ignorance about technical knowledge is a problem for vegetables cultivation in the hilly areas.

Poor production practices: Awareness of the farmers about improved production practices was very poor in the hilly area. Lack of improved technology in the study area, the farmers had to depend on the traditional practices for vegetables cultivation. About 66% opined that farmers in the hilly areas practiced traditional methods rather than improved technology and got lower yield.

Less use of farm machinery: Mechanization is rare in hilly areas and land is not also suitable for mechanization. Most of the farmers used local machinery for vegetables cultivation. About 51% opined that farmers in the hilly areas used traditional farm machinery such as manual irrigation, land preparation by spade and indigenous farm machinery rather than mechanization.

Low quality pesticide and fertilizer: Some of the farmers have identified the problem of adulteration in pesticide and artificial scarcity of fertilizer. About 55% farmers reported that traders were engaged in selling low quality pesticide and fertilizer. As a result they did not get expected yield.

Uneven rainfall and drought: About 54% farmers reported that excess rainfall during monsoon and drought was a major problem in the hilly areas. Because vegetables were grown in valley of hill areas and inundation situation occurs after heavy rainfall. So it is not possible to maintain cropping season for this reason especially in summer vegetables. Another problem is drought in the hill areas because of scarcity of irrigation water in dry season.

Scarcity of cultivable land: Sixty percent farmers opined that land not suitable for vegetables production in hilly areas. Land generally appeared different level of slopping and thus it is very difficult to operate different inter cultural activities like fertilization, weeding, insecticide application etc. Level land only found valley of the hill which was very insufficient.

Poor linkage between farmers and extension personnel: Poor linkage between farmers and extension personnel was a problem and it was reported by 65% farmers. Due to lack of technical knowledge farmers were using traditional method of cultivation and receiving low yield. If proper supervision, suggestions and field visit were made by the extension personnel at farm level on modern production technology they can obtained higher yield.

11.6.2 Production constraints faced by the farmers in coastal area

In coastal areas farmers also faced various production problems due to salinity and natural hazards. The farmers in the coastal areas encountered various problems during production of selected vegetables. Most of the problems were same as hilly areas except salinity related problems. The following major problems faced by the farmer in the hilly areas are mentioned in the table 11.6.2.

Table 11.6.2 Constraint faced by the farmers for production in coastal area

Production constraints	% of responses			
	Cox's bazar	Patuakhali	Satkhira	All Area
High price of fertilizer and pesticide	56	54	65	58
Unavailability of fresh irrigation water	82	74	78	78
Incidence of Salinity in the soil	75	68	78	73
Disease and insect infestation due to salinity	68	65	70	68
Intrusion of salinity due to heavy rainfall and drought	75	69	72	72
Scarcity of quality seed	42	46	40	43
Poor yield	45	52	65	54
Poor technical knowledge	67	65	76	69
Poor production practices	65	70	73	69
Less use of farm machinery	57	63	65	62
Low quality pesticide and fertilizer	68	58	70	65
High cost of land preparation	54	60	64	59
Poor linkage between farmers and extension personnel	62	58	72	64

High price of fertilizer and pesticide: On an average about 58% farmers opined that the cost of production of vegetables is high due to high price of input especially fertilizer and pesticides. Such a high cost prevents the farmers to expand the area under vegetables cultivation in coastal areas.

Unavailability of fresh irrigation water: Irrigation water is a problem in the coastal area due to existence of salinity in the available water. For these reason farmers in the coastal area faced acute irrigation problem and it was also reported by 78% farmers. Generally farmers provide embankment on river to protect saline water intrusion in the field.

Incidence of salinity in the soil: Soil salinity is the salt content in the soil. Salt occurred naturally in the soil and water. Soil salinity made more difficult for plants to intake water from the soil. About 73% farmers reported that due to soil salinity yield become low.

Disease and insect infestation due to salinity: A different type of disease and insect infestation was found in the vegetables production due to salinity. Different leaf and fruit disease were found in the crops which farmer not clearly explained. Due to salinity plant and fruits growth seriously hampered. Sometimes plants become death due to incidence of salinity and it was reported by 68% farmers in the coastal area.

Intrusion of salinity due to heavy rainfall and drought: Too much rain and drought caused the intrusion of salinity in the soil. Salt from the sea is carried inland by rain water during heavy

rainfall. Drought also concentrates salt in the surface level of the soil. In both cases a remarkable yield loss occurred and it was reported by 72% farmers.

Scarcity of quality seed: In coastal areas scarcity of quality seed is also is a problem look like hilly areas. In coastal areas, various company seed is also available in the market but farmers were confused about their quality. So Problems of good quality seeds were reported by 43% farmers.

Poor yield: Farmers got poor yield in the study areas due to various reason. Lack of quality seed and improved technology, traditional management practices and effect of salinity on plant per hectare yield was very low.

Poor technical knowledge: Farmers were ignorance about modern production technology and salinity management of vegetables cultivation in the coastal areas. They were also very much reluctant to vegetables cultivation due to their ignorance and lack of modern technical knowledge about production technology and salinity management and it was reported by 69% farmers in the coastal areas.

Poor production practices: In coastal areas, some indigenous production technologies were found which were practiced by farmers very poorly. Farmer's awareness about improved production practices and salinity management was very poor in the coastal area. About 69% opined that farmers in the coastal areas practiced traditional methods rather than improved technology and got lower yield.

Less use of farm machinery: Mechanization is also rare in coastal areas and land is not also suitable for mechanization because of waterlogging in the coastal belt. Vegetable cultivation technique is also different from plain land such as sorjon method and gher based agriculture. About 62% of the farmers used local machinery for vegetables cultivation in such method.

Low quality pesticide and fertilizer: Some of the farmers in coastal areas also have identified the problem of adulteration in pesticide and artificial scarcity of fertilizer. About 65% farmers reported that they did not get expected yield due to low quality pesticide and fertilizer in the coastal areas.

High cost of land preparation: In 'sorjon' technique and 'gher' based agriculture, vegetables production is labour intensive due to bed preparation, 'madha' preparation and gher dike preparation. For this reason land preparation cost of vegetables cultivation in the coastal area is high. About 59% farmers reported that land preparation for the vegetables cultivation in the coastal area is laborious.

Poor linkage between farmers and extension personnel: Poor linkage between farmers and extension personnel was problem in coastal areas as well as in hilly areas and it was reported by 64% farmers. Due to lack of technical knowledge farmers were using traditional method of cultivation and receiving low yield. If proper supervision, suggestions about salinity management and field visit were made by the extension personnel at farm level on modern production technology they can obtained higher yield.

11.6.3 Marketing problems faced by the farmers and traders

There were various problems faced by the farmers and traders in the study areas during marketing of the selected vegetables from producer to consumer. All the constraints were presented in the table 11.6.3 according to the frequencies of responses.

11.6.3.1 Marketing problems faced by the farmers and traders: The farmers level marketing problems were presented in the table 11.6.3 and discussed in the following;

Price fluctuation: Price fluctuation is an important problem which was expressed by 70% of the hill region farmers and 64% of the coastal region farmers. The farmers in hill region and coastal region are poor and unorganized. Existing marketing systems of selected vegetables were found inefficient and dominated by a few middlemen traders. Present study also revealed that there is indirect price control in the supply chain. Price fluctuation is prevailed at the study areas due to the supply of the produce vegetables and availability buyers during the respective pick season.

High transportation cost: Transportation cost was the major cost item in both hill and coastal region. About 68% farmers in the hilly region and 65% farmers in the coastal region opined that lack of transportation facilities were the main problems in different market. Due to lack of proper transportation facilities the farmers cannot bring their produce vegetables to the market in time. Sometimes they have to pay higher price to bring the product to the market especially in the hilly region due to undulated road.

Lack of appropriate road & transportation: Farmers also faced difficulties in carrying their product from farmyard to market place due to lack of appropriate road and transport. This problem found severe in hilly areas due to undulated road and appropriate transport. About 70% hill region farmers and 40% coastal region farmers mentioned that it was a severe problem in the study areas.

Table 11.6.3 Marketing problems faced by the farmers and traders

Marketing problem	Hill region	Coastal region	All area
Farmers level	% of responses		
Price fluctuation	70	64	67
High transportation cost	68	65	67
Lack of appropriate road & transportation	76	40	58
Lack of market information	60	55	58
Lack of distance traders	65	60	63
Lack of proper market place	72	68	70
Traders level	% of responses		
High transportation cost	75	65	70
Lack of market information	60	65	63
High arathdar commission	55	58	57
Undulate road & transport	80	60	70
Price fluctuation	65	60	63
Credit sale	45	50	48
Unethical subscription	80	65	73
Lack of cash capital	72	68	70
Retail level	% of responses		
Post-harvest loss	65	70	68
Absence permanent retail market place	80	75	78
Lack of storage facilities	72	68	70

Insufficient market information: Farmers have to sell their vegetables without getting any price information due to inefficient marketing system and traders syndicate. Because farmers situated far behind of the information regarding demand, supply and every day market price of the vegetables due to the insufficient market information system. This problem was expressed by 60% hill region farmers and 55% coastal region farmers.

Lack of distance traders: In both study areas farmers have to compel to sell their produced vegetables in local traders or directly to the consumer due to lack of distance traders. Due to long distance, high transportation cost and poor production distance *bepari* do not come to the study areas. This problem reported by the 65% hill farmers and 60% coastal farmers.

Lack of proper market place: Most of the marketing activities are performed in open space for different vegetables marketing in both study areas. There is no shed to protect different vegetables from sunshine, rain, storm and dust. About 72% of the hill farmers and 68% of the coastal farmers reported that poor consistency marketing system operating in the study areas.

11.6.3.2 Marketing problems faced by the traders: The traders found various marketing problems during trading of vegetables which were presented in the table 9.3 and discussed in the following;

High transportation cost: Transportation cost was the major cost item for traders in both hilly and coastal region. About 75% farmers in the hill region and 65% farmers in the coastal region opined that they have to pay high transportation cost due to long distance coverage. Due to lack of proper transportation facilities and undulated road in hilly areas traders have to pay higher price to bring the product from farmers to distance market.

Lack of market information: Traders also suffered lack of sufficient market information about distance market. For this reason they have to buy and sell their vegetables without getting any price information based on assumption. Because traders were unable to know about daily information regarding demand, supply and market price of the vegetables due to the insufficient market information system which was reported by 60% hill region farmers and 65% coastal region farmers.

High arathdar commission: Arathdars take only commission from the both party for providing facilities for the buying and selling of vegetables. The commission they took is very high which was reported by the 55% hill region traders and 58% coastal region farmers. Our study revealed that arathdar took commission 32-34% in hill region and around 36% in coastal region of total marketing cost.

Undulated road & transport: This problem mostly found in hilly areas and general types of vehicles were not appropriate in such condition. It was reported by 80% traders in the hilly areas. The infrastructure of the road in the coastal areas is also poor and it was reported by 60% of the traders.

Price fluctuation: Price fluctuation is an important problem which was expressed by 63% of the hill region farmers and 57% of the coastal region farmers. Existing marketing systems of selected vegetables were found inefficient and sometimes they get lower price than purchase price. Price fluctuation is prevailed at the study areas due to the lack of maladjustment of demand and supply situation and less bargaining power of the traders in the terminal market.

Credit sale: Sometimes beperi have to sell their vegetables in credit to the traders through arathdar and recovery of this money is very troublesome in most cases. This problem was reported by on average 48% traders.

Unethical subscription: Traders have to pay different types of subscription at different level due to run their business. This problem was severe in hilly areas and it was reported 80% traders. Different types of unethical subscription such as; poura tax, line charge, terminal charge etc. found in hill areas which make marketing cost high. On the other hand in coastal areas different kinds of tolls in bridge and ferry make marketing cost high which was reported by 65% traders.

Lack of cash capital: Traders often suffered lack of cash capital and they have to depend on arathdar or others money lending institution frequently. On an average 70% traders reported that they suffered lack of sufficient cash capital for their business.

11.6.3.3 Marketing problems faced by the retailer: The retailer also faced some marketing problems during retailing of vegetables which were presented in the table 11.6.3 and discussed below;

Post-harvest loss: Post harvest loss incurred due to spoilage and damage during the selling period. Our study revealed that retailer have to sell small quantity of vegetables for 2-3 days long that is why spoilage and damage cost was the highest cost item for retailer. This problem encountered by 68% retailer in all area.

Lack of permanent retail market place: Retailer performed most of the marketing activities in open space or in both side of the coward road in the market. There is no shed to protect different vegetables from sunshine, rain and dust. Seventy percent of the retailer complained that there is no specific retail place and management system is very poor in the both study areas.

Lack of storage facilities: Most of the retailers (70%) opined that lack of storage facilities was also a dominant problem in retail level of the study areas. Because retailers have to hold the vegetables 2-3 days in most cases. In this cases short term storage facilities is demanded by the retailer which was reported by 70% traders in all areas.

11.6.4 Constraints to linkage rural market with urban market

Supply chains are changing rapidly in abundant vegetables growing areas with the coordination of different linking organizations which are working with farmers, such as donors, NGOs and government extension services are seeking to promote farmer welfare links between farmers, traders, processors and retailers. It is against this background by using the “linking farmers to markets” approach, which usually involves organizing farmers into groups to supply identified markets. The study revealed that only small quantity vegetables marketed to the urban market. The followings constraints were identified to liking rural market with urban market (Table 11.6.4).

Communication gap: There is a gap exit between rural traders and urban traders and the rural traders were hesitate to done business with urban traders especially in terminal market because they suffered lack of sufficient market information. For this reason rural farmers and traders were reluctant to send their vegetables in distance urban market. Rural traders were unable to know about daily information regarding demand, supply and market price of the vegetables to the distance market due to the insufficient market information system which was reported by 72% traders.

High transportation cost: High transportation cost was also a major problem in sending vegetables to the urban market from both hilly and coastal region. About 77% traders in the hilly region and 74% traders in the coastal region opined that they have to pay high transportation cost for sending vegetables to the distance market. Due to lack of proper transportation facilities, undulated road in hilly areas and crossing ferry in coastal areas traders have to pay higher price to bring the product from farmers to distance market.

Table 11.6.4 Constraints to linkage rural market with urban market

Constraint to urban market linkage	% of responses		
	Hill region	Coastal region	All area
Communication gap	74	70	72
High transportation cost	77	74	76
Poor production	62	65	64
Lack of distance traders	72	75	74
High local demand	67	58	63
Different kinds of subscription	70	68	69
Long distance coverage	78	80	79

Poor production: The yield per hectare is very poor due to lack of modern technology, traditional method of cultivation and different stress in production process. So surplus production is very rare in those unfavorable ecosystem and commercialization is also limited which was reported by 64% traders.

Lack of distance traders: As surplus production is very limited in the study areas, so most of the production is consumed in locally through local traders. Distance traders do not find required amount of vegetables for their consignment and it was reported by 74% traders.

High local demand: The demand of indigenous vegetables is very high in the study areas especially in hilly areas. A little quantity of local vegetables marketed in distance market after fulfilling local demand. Because local demand is deficit with the local production in both study areas and it was reported by 63% traders.

Different kinds of subscription: Traders have to pay different types of subscription at different level for sending vegetables to urban markets. Different types of unethical subscription such as; poura tax, line charge, terminal charge etc. found in hilly areas which make marketing cost high in sending vegetables to the urban markets which was reported by 70% traders. On the other hand in coastal areas, traders also have to pay different kinds of tolls in bridge and ferry for sending vegetables to distance market which make marketing cost high which was reported by 68% traders.

Long distance coverage: Another barrier of sending vegetables from hilly and coastal region to urban market is traders have to cover long distance. For this reason traders have to bear high transportation cost and significant post-harvest losses. About 79% traders identified as a problem for not sending vegetables from rural to urban markets.

SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

11.7.1 Summary

The study was conducted in hilly and coastal region of Bangladesh for understanding input distribution system, profitability of different production practices, supply chain system, marketing cost and margin of different supply chain and different drawbacks of production and marketing of selected crops. The study areas covered three hill districts namely Rangamati, Khagrachari and Bndarban and three coastal districts namely Patuakhali, Satkhira and Cox's bazar where vegetables production is very limited due to different production stress. Both primary and secondary data were used in the study. Primary data were collected through face to face interview method. Secondary data related to this study were collected from different published sources.The major findings of the study are summarized in the below:

- ✓ In the study the sources and distribution system of the most dominant inputs namely; seed, fertilizer and pesticide were identified.
- ✓ There were three production techniques such as; homestead, plain land and Jhum cultivation were found in the hilly areas and also three production techniques such as; plain land, sorjon method and gher based cultivation were found in the coastal region of Bangladseh.
- ✓ The net return of the selected crops such as; brinjal and yard long bean in plain land cultivation was Tk. 1, 92,265/ ha and Tk.82362/ha respectively in hilly region and the BCR was found 1.88 and 1.53 respectively. The net return of Jhum cultivation was Tk.70,113/ha and the BCR was 2.02.
- ✓ On the other hand, the net return in coastal area for the selected crops such as; bittergourd and cucumber was Tk. 2,24,530/ ha and Tk. 1,57,893/ha and the BCR was found 2.08 and 1.82 respectively in plain land cultivation. The profitability of sorjon cultivation and gher based agriculture system was Tk. 91023/ha and Tk. 1,29,115/ha respectively and the BCR was 1.37 and 1.76 respectively.
- ✓ Five supply chains were identified in hill areas of Bangladesh. Among the supply chains four chains were important, by which 93.25% vegetables moved from producer to consumer. These four chains were:
  - Chain I: Farmer -> local Retailer -> Local Consumer
  - Chain II: Farmer-cum-retailer -> Local Consumer
  - Chain III: Farmer-> Paiker-cum-retailer-> Local consumer
  - Chain IV: Farmer-> L. Arathdar-> Paiker-cum-retailer->Local consumer
- ✓ According to the number of intermediaries involved in each chain and volume of product run through the chain, supply chain-I (Farmer-cum-retailer - Local Consumer) is the most

efficient chain for the vegetables marketing system in hilly areas. Because no intermediaries were involved in the chain and farmer himself done retailing to the consumer. About 28.30% products run though this chain and the producer's share of this chain was 95.59% for brinjal and 95.42% for yard long bean.

- ✓ On the other hand four supply chains were identified in coastal areas of Bangladesh. Among the supply chains three chains were important, by which 94.43% vegetables moved from producer to consumer. These three chains were:
  Chain I: Farmer -> local Retailer -> Local Consumer
  Chain II: Farmer -> L. Arathdar- Paiker-cum-retailer->Local consumer
  Chain III: Farmer-cum-retailer -> Local Consumer

- ✓ In coastal area, we also found supply chain-I (Farmer-cum-retailer - Local Consumer) is the most efficient chain for the vegetables marketing system. Because no intermediaries were involved in the chain and farmer himself done retailing to the consumer. About 25.50% products run though this chain and the producer's share of this chain was 96.29% for bittergourd and 95.58 % for cucumber.

- ✓ Total marketing margin was found highest in supply chain-IV for brinjal and yard long bean marketing which was Tk. 647.60 for brinjal and Tk. 645.81 for yard long in hilly area**.**

- ✓ Total marketing margin was found highest in supply chain-IV for bitter gourd and cucumber marketing which was Tk. 777.41 for bittergourd and Tk.554.65 for cucumber in coastal area**.**

- ✓ Farmers faced different production problem in the hilly areas of Bangladesh such as; high price of input, irrigation water, scarcity of quality seed, low yield, Insect & pest attack, poor technical knowledge, poor production practices, less use of farm machinery, low quality pesticide and fertilizer, uneven rainfall and drought, crop damage by wild animal, poor linkage between farmers and extension personnel etc. for vegetables cultivation.

- ✓ In the coastal belt, farmers also faced some production problems in vegetables cultivation such as; high price of fertilizer and pesticide, unavailability of fresh irrigation water, incidence of salinity in the soil, disease and insect infestation due to salinity, intrusion of salinity due to heavy rainfall and drought, scarcity of quality seed, poor yield, poor technical knowledge, less use of farm machinery, poor linkage between farmers and extension personnel etc.
- ✓ Farmers and traders also faced some marketing problems for marketing of produced vegetables such as; price fluctuation, high transportation cost, lack of market information, undulate road & transport, unethical subscription, credit sale, absence of permanent retail market place and lack of storage facilities etc. both in hilly and coastal region of Bangladesh.

- ✓ Communication gap, high transportation cost, poor production, lack of distance traders, high local demand, different kinds of subscription, long distance coverage were the major constraints for the traders to linkage with urban market.

- ✓ Farmers in hilly areas are very much reluctant to vegetables production due to their ignorance and lack of modern technical knowledge. In this respect, awareness of the farmers should be developed through providing training for proper utilization of the input factors for optimum yield. Modern vegetables production technologies should be disseminated at hill and coastal region for increasing yield and income of the farmer.

11.7.2 Conclusion

It was revealed from the study that vegetables production and marketing both for farmers and traders level were found profitable in the both locations. Due to poor knowledge and lack of modern technology they get poor production but they get satisfactory price due to high local demand and deficit of vegetables production in the study areas. There were lots of imperfections found in the vegetables marketing system in the hilly and coastal regions. High price gap was found between producers and consumers level due to inefficient marketing system. Different types of production stress and lack of appropriate technology they were reluctant to vegetables cultivation. But recently farmers were getting interest for vegetables production due to highly profitable of vegetables cultivation in those areas. Nevertheless, both farmers and traders encountered various problems during marketing of vegetables. In the recent years, some of the technologies found in coastal areas such as sorjon cultivation and gher based agriculture which is very promising and encouraging by the farmers at farm level. Whatever technologies so far developed by BARI now need to be disseminated for obtaining higher yield. Extension personnel also have to play vital role in dissemination of the modern technology in those unfavourable ecosystems. In this regard, some recommendations were made for sustainable vegetables production and adopting of new technology at hilly and coastal region in future. The following steps were recommended for its greater expansion and dissemination at farmer's field.

11.7.3 Policy recommendations

The following detailed policy recommendation should be implemented with the special attention for improving the supply chain of vegetables along with existing production and marketing system in hilly and coastal region of Bangladesh.This policy options were also presented in brief in the policy support options.

11.7.3.1 Production aspects

Development of HYV variety and technology

Improved varieties of seed should be increased for getting higher yield. Therefore, continuous effort should be given by the breeders for developing high yielding vegetables seed varieties. Moreover salt tolerant HYV vegetables seed varieties should be developed by the researchers to fit saline area in the coastal belt of Bangladesh. The infestation by different insects and diseases is a common constraint in coastal area for vegetables cultivation due to salinity. Therefore, researchers should develop integrated pest, disease and nutrient management technology which are environment friendly and ecologically sound.

Dissemination of technology for fallow land utilization

Most of the hill slopes and coastal belt are remain fallow. If the technologies what are available according to hill slopes and salinity or waterlogging management to coastal belt, should be disseminated to the farmers field so that they could avail the opportunities of growing vegetables in different hill and coastal region of Bangladesh. So whatever the technologies are presently available in the hand of researcher that needs to be provided to the farmers.

Wider expansion of existing modern technology

Some indigenous modern technologies especially in coastal region were found which needs to be wider expansion. Suppose sorjon cultivation and gher based agriculture are very effective production technique in coastal belt in salinity and waterlogging condition which needs to be wider expansion. But farmers use these techniques with very poor management. So appropriate training programme should be launched regarding those types of technology in coastal area.

Training programme regarding improved technology

Farmers in hilly areas and coastal areas are very much reluctant to vegetables cultivation due to their ignorance of modern technical knowledge. In this respect, appropriate training programme will be helpful for buiding awareness of the farmers for appropriate package of production technology . In this regard upazila's extension personnel should be given training regarding the modern production technology of different vegetables cultivation. This will be helpful for wider adoption of modern the technologies of the vegetables cultivation.

Building linkage with farmers, researcher and extension personnel

Extension contact plays a significant role in achieving higher production. Through regular extension contact, farmers can receive information regarding production technology, new varieties, etc. So far, BARI has developed improved production technologies for vegetables cultivation. More demonstration of vegetables production at different upazila level should be initiated to encourage farmers for dissemination of the modern production technologies. Therefore measures should be taken to strengthen more linkage between DAE, research organizations and farmers.

Utilization of available water for irrigation

Irrigation is the major problem in hill and coastal region. Farmers kept land fallow due to lack of irrigation facilities. But there is much small canals/rivulet water available in the basin of the hill. So, appropriate technique should be developed for utilization of available water for irrigation in vegetables field at upland hilly areas. In coastal region salinity free fresh water supply should be ensured by harvesting of rain water and building embankment in fresh water body so that saline water cannot entrance.

Crop zoning according to hill

Farmers grow different vegetables without knowing about suitability of the soil. According to soil texture and pattern of hill slopes and salinity and waterlogging condition of the coastal belt, appropriate crop zoning should be developed for proper utilization of land.

11.7.3.2 Marketing aspects

Training on post-harvest loss management

The estimated post-harvest losses of major vegetables are enormous. Loss reduction strategies must be strengthening for the interest of the country. To reduce post-harvest losses, an appropriate training programme on different post-harvest activities like handling, grading, packaging, carrying etc. should be provided with a view to increasing the efficiency as well as awareness of the farmers and traders.

Development of short term storage facilities

Short term storage facilities should be developed in hill and coastal areas to reduce post-harvest losses and to ensure fair price of their product. Private entrepreneur should come forward to establish storage facilities at farm level and different wholesale and retail markets. This is the only way to reduce the post-harvest losses of vegetables at peak harvesting period in one hand and to ensure better price for the producers on the other. Facilities should be developed for short term reservation for unsold vegetables at market place.

Improvement of transportation and communication system

Transportation and communication system should be developed through constructing of different local road. Low cost transportation facilities which were appropriate in hilly and coastal area will be ensured to carry their vegetables from farmyard to local market or in distant urban market for the farmers and traders, where they are likely to get better price for their products. Then both farmers and traders will receive fair prices.

Introducing group marketing system

Forming group among the farmers can take facilities of group marketing such as dominancy of market, receiving better price and proper bargaining power through collective action. It would be better for the farmers if they would organize themselves into a producer group. As an organized body, they would always hold a better bargaining power for their products over the middlemen who dominant the price of the product.

Step regarding unethical tips and donation during transportation

Market taxes, undesired tips and donation while carrying vegetables in distant places make marketing cost high and cause of a much suffering. The traders mentioned that they have to pay subscription at different points while transporting different vegetables by truck or other vehicle. The traders also mentioned that they have to pay subscription to the different point of the transportation system and other social and religious festivals. This problem can be monitored and checked by the proper authority.

Provide market information system: Marketing information like marketing cost, margin, price spread and marketing problems at different levels are the important consideration. At present infrastructure there are a little scope to obtain such information easily and quickly in hilly and coastal areas. If the producers and traders come to know about the price of their produce in different markets, it will help them a lot to fix their sell price. Respective authority support is necessary to provide that information to the prospective markets.

Arrangement of institutional credit

Traders always suffer lacks of sufficient capital to run their business. They have limited sources for income generation activities. So, emphasis should be given for providing institutional credit to the traders for accelerating their business activities. This programme needs to be intensified in different financial institution that can play vital role in providing loan to the traders.

12. Research Highlights (bullet points-max.10 nos.):

- There are some production techniques found in both hilly and coastal areas, such as homestead cultivation, plain land cultivation and jhum cultivation were found in hilly areas and plain land cultivation, sorjon cultivation and gher based cultivation were found in the coastal region of Bangladseh.
- The net return of selected crops (brinjal and yard long bean) in hilly areas under plain land cultivation was Tk. 1,92,265/ha for brinjal and Tk.82362/ha for yard long bean and the BCR was found 1.88 and 1.53 respectively. The net return of jhum cultivation was Tk.70,113/ha and the BCR was found 2.02 in hilly areas.
- The net return of selected crops in plain land cultivation of coastal belt was Tk.2,24,530/ ha for bittergourd and Tk.1,57,893/ha for cucumber and the BCR was found 2.08 and 1.82 respectively.The profitability of sorjon cultivation system and gher based agriculture system was Tk. 91023/ha and Tk. 1,29,115/ha respectively and the BCR was found 1.37 and 1.76 respectively.
- Five supply chains were identified in hill areas. Among the supply chains 93.25% vegetables moved from producer to consumer through the following four chains.
  Chain I: Farmer -> local Retailer -> Local Consumer
  Chain II: Farmer-cum-retailer -> Local Consumer
  Chain III: Farmer-> Paiker-cum-retailer-> Local consumer
  Chain IV: Farmer-> L. Arathdar-> Paiker-cum-retailer->Local consumer
- On the other hand, four supply chains were identified in coastal areas of Bangladesh. Among the supply chains following three chains were important, by which 94.43% vegetables moved from producer to consumer
  Chain I: Farmer -> local Retailer -> Local Consumer
  Chain II: Farmer-cum-retailer -> Local Consumer
  Chain III: Farmer -> L. Arathdar-> Paiker-cum-retailer->Local consumer
- We found supply chain-II (Farmer-cum-retailer -> Local Consumer) is the most efficient chain for vegetables marketing system in both hilly and coastal area. Because no intermediaries were involved in the chain and farmer himself done retailing to the consumer.

- Farmers faced different production problem in the hilly and coastal areas of Bangladesh for vegetables cultivation, such as; high price of input, unavailability of irrigation water, incidence of salinity in the soil, disease and insect infestation due to salinity, intrusion of salinity due to heavy rainfall and drought, scarcity of quality seed, low yield, Insect & pest attack, poor technical knowledge, poor production practices, less use of farm machinery, low quality pesticide and fertilizer, poor linkage between farmers and extension personnel etc.

- Farmers and traders also faced some marketing problems for marketing of produced vegetables such as; price fluctuation, high transportation cost, lack of market information, undulate road & transport, unethical subscription, credit sale, absence of permanent retail place and lack of storage facilities etc. both in hilly and coastal region of Bangladesh.
- Communication gap, high transportation cost, poor production, lack of distance traders, high local demand, different kinds of subscription, long distance coverage were the major constraints for the traders to linkage with urban market.

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B. Implementation Position

1. Procurement

Sl. No	Description of equipment and capital items	PP Target		Achievement		Remarks
		Phy (#)	Fin (Tk.)	Phy (#)	Fin (Tk.)	
1.	**Office equipment**					
	Desktop computer	1	60000	1	60000	100%
	UPS (Offline)	1	10000	1	10000	
	Laptop	1	60000	1	60000	
	Digital camera	1	25000	1	25000	
	Lesser printer	1	20000	1	20000	
	Scanner	1	10000	1	10000	
	Executive table	1	20000	1	20000	
	Executive chair	1	10000	1	10000	
	Visitor/Front chair	2	8000	2	8000	
	Computer table	1	5000	1	5000	
	Computer chair	1	7000	1	7000	
	File cabinet	1	20000	1	20000	
	Steel Almira	1	24000	1	24000	
	Total	14	**279000**	14	**279000**	

2. Establishment /renovation facilities: Not applicable

Description of facilities	Newly established		Upgraded/refurbished		Remarks
	PP Target	Achievement	PP Target	Achievement	

3. Training/Study tour/ Seminar/Workshop/Conference organized: Not applicable

Description	Number of participant			Duration (Days/Weeks/Months)	Remarks
	Male	Female	Total		
(a)					Seminar and workshop were organized by NATP-2, BARC, and Dhaka.
(b)					

C. Financial and physical progress

Sl. No	Major Head	Total approved budget received (Tk.)	Fund received (Tk.)	Actual Expenditure (Tk.)	Balance Unspent (Tk)	Physical Progress (%)	Reasons for deviation
A.	Contractual Staff Salary	225395	112030	110094	1936	48.84	Not duly fund released and

B.	Field Research/Lab expenses and supplies	388500	387624	315500	72124	81.21	late signing of LOA.
C.	Operating Expenses	365000	354525	216230	138295	59.24	
D.	Vehicle hire and Fuel, Oil and Maintenance	470000	470000	402900	67100	85.72	
E.	Training/Workshop /Seminar etc.	95000	95000	0	95000	0.00	
F.	Publications and printing	125000	106250	0	106250	0.00	
G.	Miscellaneous	50000	40000	39805	195	79.61	
H.	Capital Expenses	279000	270000	279000	0	100.00	
	Grand Total	1997895	1844429	1363529	480900	68.25	

D. Achievement of sub-project by objectives *(Tangible form)*:

Specific objective of the Sub-project	Major technic al activities performed in respect of the objectives	Output (i.e. product obtained, visible, measurable)	Outcome (short term effect of the research)
i. To analyze input supply, production system and profitability of major vegetables in hilly and coastal region	• Field survey • Primary data collection • Secondary data collection	• Production technique in unfavorable condition • Different stresses in vegetable production • Cost and return estimation	• There were three production techniques such as; homestead, plain land and Jhum cultivation were found in the hilly areas • Three production techniques such as; plain land, sorjon method and gher based cultivation were found in the coastal region of Bangladseh. • The net return of the selected crops such as; brinjal and yard long bean in plain land cultivation was Tk. 1, 92,265/ ha and Tk.82362/ha respectively. • The net return of Jhum cultivation was Tk.70,113/ha and the BCR was 2.02. • The net return of bittergourd and cucumber was Tk. 2,24,530/ ha and Tk. 1,57,893/ha respectively in coastal area. • The profitability of sorjon cultivation system and gher based agriculture system was Tk. 91023/ha and Tk.

			1,29,115/ha respectively .
ii. To examine the existing market, marketing system and supply chain of selected vegetables in those areas	• Field survey • Primary data collection • Secondary data collection	• Identify supply chains of selected vegetables; • Detailed cost and margin at traders level • Estimation efficiency of supply chain	• Five supply chains were identified in hill areas and four supply chains were identified in coastal areas of Bangladesh. • Total marketing margin was found highest in supply chain-V for brinjal and yard long bean marketing which was Tk. 647.60 for brinjal and Tk. 645.81 for yard long in hilly area**.** • Total marketing margin was found highest in supply chain-IV for bitter gourd and cucumber marketing which was Tk. 777.41 for bittergourd and Tk.554.65 for cucumber in coastal area**.**
ii. To identify the constraints to production, marketing and urban market linkage of vegetables and suggest some policy recommendations for improving the existing vegetables supply chain	• Field survey • Primary data collection from farmers and traders through face to face interview	• Different constraints of production and marketing of farmers and traders • Different constraints for urban market linkage	• Farmers faced different production problem such as; high price of input, unavailability of irrigation water, incidence of salinity in the soil, scarcity of quality seed, low yield, Insect & pest attack, poor technical knowledge, poor production practices, less use of farm machinery, poor linkage between farmers and extension personnel etc. • Farmers and traders also faced some marketing problems such as; price fluctuation, high transportation cost, undulate road & transport, unethical subscription, , absence of permanent retail place and lack of storage facilities etc. both in hilly and coastal region of Bangladesh. • Communication gap, high transportation cost, poor production, lack of distance traders, high local demand, different kinds of subscription, long distance coverage were the major constraints for the traders to linkage with urban market.

E. Materials development/Publications under the sub-project

Type of material/publication	Number of publication		Remarks (Paper title, name of journal, conference name, etc.)
	Under preparation	Complete published	
Technology/bulletin/booklet/ leaflet/flyer etc.			NA
Journal development			NA
Information development	Information regarding input supply system, financial profitability of vegetables production, supply chain, cost and margin of vegetables marketing, marketing efficiency, constraints to vegetables production, marketing and urban market linkage in hilly and coastal region of Bangladesh .		
Other publication, if any			NA

F. Technology/Knowledge generation/Policy support (as applied):

i. Generation of technology (Commodity and Non-commodity)

- Identification of input supply system and farmer's perceptions about availability of inputs and its pricing.
- Financial profitability of different production technologies
- Detailed supply chain of selected vegetables in hilly and coastal areas of Bangladesh
- Detailed costs and margins of selected vegetables at different levels of supply chain.
- Suggesting most efficient supply chain by measuring marketing efficiency,
- Recommendation for development of market infrastructure
- Recommendation for development of low cost transportation facilities and road infrastructure

ii. Generation of new knowledge that in developing more technology in future

- Vegetables production is still primitive stage in hilly and coastal region in Bangladesh due to different stress such as; lack of quality seed, adulteration in fertilizer and pesticide, salinity in coastal area, difficulties in use of farm machineries etc.
- With the help of data and information of this report, policy makers can formulate appropriate plan for improving the existing vegetables supply chain in hilly and coastal region of Bangladesh.

- ❖ Moreover new research regarding adoption of HYV varieties or development of salt tolerant variety, impact of mechanization on vegetables production, undertaking training and demonstration program of vegetables cultivation, value addition in vegetables cultivation should be new issue for further research and development.

iii. Technology transferred that help increased agricultural productivity and farmers income

If the above information and knowledge properly taken into consideration as a policy issue, it is expected that it will be helpful for increasing agricultural productivity and farmers income.

iv. Policy support

- ❖ Improved varieties of seed should be increased for getting higher yield. Therefore, continuous effort should be given by the breeders for developing high yielding vegetables seed varieties.
- ❖ Some indigenous modern technologies especially in coastal region were found which needs to be wider expansion. Suppose sorjon cultivation and gher based agriculture are very effective production technique in coastal belt in salinity and waterlogging condition which needs to be wider expansion.
- ❖ Building awareness of the farmers by providing training regarding appropriate production technology that can encourage farmers because farmers in hilly areas and coastal areas are ignorance and lack of modern technical knowledge.
- ❖ More demonstration of vegetables production technology should be initiated to encourage farmers for dissemination of the modern production technologies. Therefore measures should be taken to strengthen more linkage between DAE, research organizations and farmers.
- ❖ Salt tolerant HYV vegetables seed should be developed by the researchers to fit saline area in the coastal belt of Bangladesh.
- ❖ Farmers grow different vegetables without knowing about suitability of the soil. According to soil texture and pattern of hill slopes and salinity and waterlogging condition of the coastal belt, appropriate crop zoning should be developed for proper utilization of land.
- ❖ Short term storage facilities should be developed in hill and coastal areas to reduce post-harvest losses and to ensure fair price of their product.
- ❖ Transportation and communication system should be developed through constructing of different local road. Low cost appropriate transportation facilities in hilly and coastal areas will be ensured to carry their vegetables from farmyard to local market or in distant urban market for the farmers and traders.
- ❖ To reduce post-harvest losses, an appropriate training programme on different post-harvest activities like handling, grading, packaging, carrying etc. should be provided with a view to increasing the efficiency as well as awareness of the farmers and traders.

G. Information regarding desk and field monitoring

i) Desk monitoring [description & output of consultation meeting, monitoring, workshops/seminars etc.): Not applicable

ii) Field monitoring (Time and no of visit, Team visit and output):

Types of Audit	Major observations /issues/objections raised, if any	Status at the sub-project end	Time of visit
BARC T\team	Verified and found correct		06/02/18
GoB audit (Foreign aid)	Verified and found correct		20/10/18

H. Lesson learned (if any)

- Though vegetables production and marketing is complex in hilly and coastal areas, it is very much promising and profitable for the farmers and traders.
- Removing constraints of the vegetables production, marketing and urban market linkage in vegetables supply chain, it may become a profitable livelihood of the farmers and traders
- There is an opportunity regarding new research on adoption and development of HYV and salt tolerant variety, impact of mechanization on vegetables production, irrigation system, training and demonstration programme on vegetables cultivation, value addition in vegetables cultivation

I. Challenges (if any)

Challenges in hilly region :

- Acute irrigation problem
- Scarcity of cultivable land
- High price of input
- Poor technical knowledge
- Low yield
- Less use of farm machinery
- Crop damage by wild animal

J. Challenges in costal région :

- Unavailability of fresh irrigation water
- Incidence of Salinity in the soil
- Disease and insect infestation due to salinity
- Intrusion of salinity due to heavy rainfall and drought
- Poor production practices
- High cost of land preparation

Signature of the Coordinator/Principal Investigator (as applicable)

Date …….

Seal

Counter signature of the Head of the agency/authorized representative

Date ……..

Seal

APPENDICES

Pictorial view of different project activities

	
Field visit of yard long bean in Khagrachari district.	Field visit of Brinjal in Rangamati district.
	
Data collection in sapchari, Rangamati.	Data collection in Ghagra, Kawkhali, Rangamati.
	
Data collection from retailer	Data collection from retailer

Bepari loaded Brinjal for Chittagong Arath

Data collection from farmer-cum-retailer

Bepari loaded vegetables for distance market

Transportation System in Khagrachari district

Sorjon cultivation in patuakhali

Jhum cultivation in Khagrachari