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CONTEXTUAL ESTIMATION OF MARKETABLE AND MARKETED SURPLUS OF SELECTED SEASONAL FRUITS: A STUDY BASED ON CHITTAGONG HILL TRACTS (CHT) OF BANGLADESH

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ABSTRACT

This study is an attempt to assess the marketable and marketed surplus of selected seasonal fruits (mango, jackfruit, and litchi) in the Chittagong hill tracts of Bangladesh. Primary data were used for the study. In total, 459 sample fruit growers were selected purposively for the study. Proportionate random sampling was followed in case of selecting the sampling unit. It was apparent to interpret from the survey that in case of mango production, 78% fruit grower planted Rangui variety whereas Amrapali was ranked second highest (36%) including the eight groups of Bandarban and Rangamati of the survey. Among the three mentioned varieties of litchi, BARI litchi 2 variety was more prevalent (21%) than the other varieties. Also 69% respondent grew jackfruit whereas the average production was more in Rangamati than in Bandarban area. It is more apparent for all three of the seasonal fruits that, the marketable surplus was found to be higher than the net marketed surplus. That means farmer retains more for their consumption and other uses than the actual amount marketed. Running factor analysis, several cases were found that affect sustainable market linkage which was categorized into four factors like marketing, economic, social and environmental factor and the KMO value was found to be 0.527, generally, indicate that a factor analysis might be useful with this data. This study recommends increasing the marketed surplus with the increase of marketable surplus so that it can ultimately help fruit grower to link themselves with the market and increase their revenue.

Contribution/ Originality: The study is one of very few studies which assess the marketable and marketed surplus of seasonal fruits in the hilly areas of Bangladesh. Since most of the studies deal with the production and marketing system of crops, this study adds the momentum in linking the hill farmer with the market.

1. INTRODUCTION

Agriculture in Bangladesh works as a driving force in supporting the income of about 48% of the total labor force. This sector is closely aligned with the countries' food safety. The prime concern is to ensure food & dietary security and relieve poverty through viable progress and development of agriculture. Since the productivity and the production resources, especially the land, water, and genetic resources are steadily decreasing and degrading. In the coming years, there will be a necessity to produce more varied food with the execution of greater segments of fruit production (Uddin, 2015).

The Chittagong Hill Tracts consists of an area of 13,295 square kilometers in south-eastern Bangladesh, and borders of India and Myanmar (Burma). Topographically, the Chittagong Hill Tracts are the mere hilly area in

Bangladesh (www.en.wikipedia.org/wiki/Chittagong_ Hill_Tracts). Apart from the immense potential in terms of attracting international tourists (Murshed, 2018) the region is transforming into a seasonal fruit core with the immense prospect for the improvement of a food-processing sector (Chakma, 2013). The area constitutes 76% of the total hilly part of Bangladesh (about 13,184sq km), of which 90% of the region is hilly, 4% covers rural community, rivers and marshes and 6% only apposite for intensive agriculture (Khisa, 1997). An amount of 32,903 metric tons of mango; 1, 11,000 metric tons jackfruit, and 13,673 metric tons litchi were produced in one of the hilly areas (Rangamati) in the year of 2015 which has still been augmenting in the region (Correspondent, 2016).

In support of inspiring growth, economic progress, food safety and lessening poverty, the exploration of the marketing performance of fruits plays an imperative role in a future fruit development plan (Tadesse, 2011).

Nowadays, production of seasonal fruits are growing up but realistic data of fruits production particularly marketable and marketed surplus of seasonal fruits are absent in the hilly areas. The knowledge of marketed surplus helps in upgrading an adequate capacity of transport and storage system to handle it Rathi (2014). From the above studies, the researcher felt the necessity for conducting and analyzing the marketable and marketed surplus of seasonal fruits. With the above considerations in mind, the present study has been articulated in light of three important seasonal fruits (mango, jackfruits, and litchi) with some specific objectives:

i. To estimate the production, marketable and marketed surplus of seasonal fruits (mango, litchi, and jackfruit) in the study area.
ii. To assess the factors (social, cultural, economic, environmental and institutional) that are responsible for sustainable market linkage with the hill farmers.

To validate the study, the rest of the paper is structured as follows. Section 2 gives a review of the related works. This is followed by the methods and models adopted in study (Section 3). Section 4 provides the estimated results and discussion on the finding of the paper. Finally the conclusion and possible policy recommendations are highlighted in the section 5 and 6.

2. LITERATURE REVIEW

In this literature, some related studies conducted in Bangladesh and other countries regarding the marketing system, trend and output growth, market linkage, marketable and marketed surplus of crops and fruits are reviewed below to get the insight of the issue.

Akter (1983) conducted a study on the marketable and marketed surplus of paddy in some selected areas of Tangail district. She found that 70% of the total production of the sample farms was sold but 5% was again bought back by the farmers during the post-harvest period. The marketed surplus in the study area was 65%. She also found that marketed surplus was positively related to farm size and income and negatively related to family size.

Alam (2002) in his study analyzed the marketable and marketed surplus of leading crops i.e. different rice varieties, wheat, potato, mustard and lentil considering the two districts namely Comilla and Chandpur of Bangladesh. The study adopted random sampling method for the seclection of household. The author found that samll farmers were worse off by the seasonal sales pattern and price variation. Large farmers received the highest prices prevailed in the market relatively with strong bargaining capacity with the market intermediaries and their pre-harvest time sales is high than other farm size group.

Kamruzzaman et al. (1998) studied the growth performance of oilseeds, pulses, and potatoes and examined the factors influencing the yield growth of these crops for the period of 1972-73 to 1992-93. The exponential growth model and decomposition analysis were done for the estimation.

Aujla et al. (2007) conducted a study where he found that market information received by producers are always partial and sketchy. Resource-poor farmers under-invest in farming inputs like pesticides and fertilizers that leads

to lower yields and poor quality products. Advance sales are also a root cause of financial constraints amongst farmers.

Jamal et al. (2016) conducted a study on "Trend and Output growth analysis of major fruits in the Chittagong region of Bangladesh". To increase the growth rate of fruits, improved variety and management practices should be disseminated through undertaking special program and strengthening research-extension linkage in the Chittagong region.

Banu (2009) conducted a study on "Stock Availability, Marketable and Marketed surplus of rice at farm level in selected areas of Bangladesh". She found from the study that marketable surplus was considerably higher than that of marketed surplus for all types of rice, all farms, and all regions. Large farms sold most of their produce during the first month after harvest. For meeting family expenditure and for social, religious and institutional purposes, farmers used to sell rice during the first month after harvest.

Sahu (2017) in his paper analyzed the marketable and marketed surpluses of mustard in Morar block of Gwalior district (Madhya Pradesh). A multistage random sampling technique was adopted for data collection. The primary data were collected by personal interview survey method. The marketable surplus generated was 1075.9 quintals by large farmers, 831.38 quintals by medium farmers and 186.75 quintals by small farmers. Also, the marketed surplus generated was 1026(86.72%) quintals by large farmers, 852.63 quintals (92.11%) by medium farmers and 198 quintals (97.53%) by small farmers.

Alagh (2014) examined the assessment of the level of marketable and marketed surpluses and their determinants based on a primary survey of different categories of farmers in the state. The determinants examined include accessibility of the market, the condition of the feeder roads, availability of storage capacity, transport methods and costs, information on prices and markets, etc.

The study by Reddy (1990) estimated marketable and marketed surplus in groundnut by the size of the farm and analyzed factors affecting marketable and marketed surplus both in rain fed as well as in irrigated groundnut. Analysis revealed that per hectare marketable surplus in case of irrigated groundnut was about two and a half times that of rain fed groundnut and exhibited positive relation with the size of the farm.

Mukhopadhyay (1973) conducted a study on general impression that the bigger farmers hold on to their marketable surplus for a longer period than do small farmers. The study was conducted on 149 households from 15 villages in Hooghly district of West Bengal. The unambiguous finding of the study was that at least for paddy in the study area, the small farmers spread out their sales over a longer-span than the bigger farmers. Another major finding contradicting the general impression was that, the average price secured by the small farmers is actually higher than that secured by the bigger farmers, may be because big farmers go for HYV seeds which fetches a lower price in the market than the ordinary crop.

Siddique (2000) conducted a study of Boro rice marketing system in some selected areas of Mymensingh district. He found that the marketable and marketed surpluses were 67% and 47% of the total quantity produced respectively. The major marketing problems were poor communication and transportation system, low price at harvest period, lack of adequate storage and credit facilities, lack of physical facilities.

Upender and Chay (1996) analyzed the influence of agricultural prices on market arrivals of rice in selected agricultural markets in Karim Nagar district of Telangana region of Andhra Pradesh in India. The main factors contributing to increasing market arrivals over time were increased productivity and production of rice.

Tuteja (2013) directed a study in assessing the Marketable and Marketed Surplus of Major Food grains in Haryana by examining growth, domestic consumption, retention for seed, feed and kind payments. Primary as well as secondary sources of data have been used in order to fulfill these objectives. A positive relationship emerged between farm size and share in the total marketed surplus of selected food grains since quantum of production was found to be the major determinant of marketed surplus. Infrastructural, institutional and technological factors together facilitated growth in marketed surplus and production.

Kumar et al. (2015) in his study on assessing the marketable and marketed surplus of rice in relation to farm size found that the percentage of the produce retained with the farmer reduced with the increase in the farm size. For conducting the research work, a three stage random sampling technique was adopted for selection of block, villages and paddy growers. The quantity of marketable surplus both in absolute and percentage term increased with increase in the farm size. However, the quantity of marketed surplus increased in the absolute terms but reduced in percentage term with the increase in farm size

Most of the studies dealt with the production and marketing system of crops. Although those are essential from the marketing point of view, the study on the marketable and marketed surplus of fruits for the market linkage with the farmer is of great significance for the policymaker.

3. METHODOLOGY

The methodology of the present study is related to the selection of the study area, selection of the farmers, data source, the period of data collection, data collection tool, data collection methods, processing of data and analytical techniques adopted. For the present study, three types of seasonal fruits namely mango, jackfruit and litchi were selected. The study was conducted to assess the marketable and marketed surplus of this selected seasonal fruits for linking hill farmers with the market. Necessary primary data were collected from the eight FGO (Fruits Growers' Organization) among the twenty listed farmers association formed by the help of the project in different areas of Bandarban, Rangamati, and Khagrachari.

The following steps were involved in the methodology used for conducting the research work:

3.1. Selection of Study Area

As the selection of the study area is an important step and it largely depends upon the objectives of the study. On the basis of the high concentration of fruits production and cultivation, Bandarban and Rangamati districts were considered for the study purpose.

Table-1. Name of surveyed location for the sample fruit grower.

Regions	Locations	Selected Areas
1	Bandarban	Laymipara, Farukpara, Getsimanipara, Ramripara, Paglachora para, Munlay para
2	Rangamati	Mohajon para (Ghagra), Manikchori

3.2. Selection of Sample and Sampling Techniques

The population for this research is defined as those persons who are involved in the production system of seasonal fruits. In total, 459 samples (351 from Bandarban and 108 from Rangamati) were collected from eight fruit growers' organizations. Proportionate random sampling techniques were followed for selecting the sample size in each location. Focus Group Discussion (FGD), key informant interviews and household survey through semi-structured questionnaire was used for data collection.

3.3. Sources and Period of Data Collection

Primary data were collected through personal interview with the respondents using interview schedule. In this study, no secondary data were also collected. Data were collected by the researcher himself during the period from the fruit growers of Bandarban and Rangamati region. Primary data were collected from Bandarban and Rangamati district from April 2016 to August 2016.

3.4. Collection of Data

During data collection, the objectives of the study were clearly explained to the respondents so that they could understand and respond freely. After completion of each interview, each schedule was checked and verified to make

sure that the answer to each item had been properly recorded. Fruit growers were selected from the two selected hill districts. Growers were selected from a different area of Bandarban and Rangamati district.

Table-2. Sample Distribution of Fruit Grower.

Sl. No.	Locations	Distributions of sample (no.)			Total
		Mango	**Jackfruit**	**Litchi**	
A.	**Bandarban:**				
1	Laymipara	30	10	15	55
2	Farukpara	30	15	18	63
3	Getsimanipara	30	18	15	63
4	Ramripara	30	13	14	57
5	Paglachora para	30	12	13	55
6	Munlaypara	30	13	15	58
	Sub-total	**180**	**81**	**90**	**351**
B.	**Rangamati:**				
7	Mohajonpara (Ghagra)	12	15	15	42
8	Manikchori	30	12	22	64
	Sub-total	**42**	**27**	**37**	**108**
	All (A+B)	**222**	**108**	**117**	**459**

3.5. Computation of Marketable and Marketed Surplus

The marketable surplus was considered as the total production minus the portion used for total needs and requirements. The needs and requirement of farmer equal the consumption at home, plus distribution, plus seed and plus non-human feed usages. A marketable surplus is derived from the formula:

$MS = P - R$

Where MS is the Marketable surplus

P is total production

R is the total requirement at the farm level.

The total produce sold by the farm household is termed as the marketed surplus i.e. the surplus of the product which is sold in the market irrespective of the actual requirement of the farm household. The marketed surplus has been calculated by subtracting buy back from the total sale (gross sale). Here, the following formula has been used to estimate marketed surplus:

$M = G - B$

Where, M = Marketed Surplus

G = Gross Sales

B = Buy-backs

3.6. The Relationship between Marketed Surplus and Marketable Surplus

The marketed surplus is more than marketable surplus when the farmer retains a smaller quantity of the crop than the actual requirements for family and farm needs. It is especially true for small and marginal farmers whose need for cash is immediate (Distress Sales). In case of large farmers, having better retention capacity or in case of fall in relative price to a competing crop leading to substitution there is retention of the crop and marketed surplus may be less than the marketable surplus. In the case of perishable commodities and for the average farmer, the marketed surplus is equal to the marketable surplus.

3.7. Data Analysis and Analytical Techniques

Data obtained from questionnaire and interviews were coded where appropriate, entered into a database system using Microsoft EXCEL, and analysis was done using SPSS Statistical Software. Average and percentage ratio was

estimated using the EXCEL sheet. Descriptive statistics (percentage, mean, range, standard deviation, etc.) were used to describe the variables.

3.8. Factor Analysis

Factor analysis is a multivariate statistical technique that addresses itself to the study of interrelationships among a total set of observed variables. The technique allows looking at groups of variables that tend to be correlated to one another and identify underlying dimensions that explain these correlations. While in multiple regression model, one variable is explicitly considered as the dependent variable and all the other variables as the predictors; in factor analysis, all the variables are considered as dependent variables simultaneously. In a sense, each of the observed variables is considered as a dependent variable that is a function of some underlying, latent, and hypothetical set of factors. Conversely, one can look at each factor as the dependent variable that is a function of the observed variables.

If $\{X_1, X_2, ----, X_n\}$ be a set of n observed variables and $\{F1, F2, -----, F_m\}$ be a set of unobservable variables then the factor analysis model can be expressed as,

$$\left.\begin{array}{l} X_1 - \mu_1 = l_{11}F_1 + l_{12}F2 + ----- + l_{1m}F_m + \varepsilon_1 \\ X_2 - \mu_2 = l_{21}F_1 + l_{22}F_2 + ----- + l_{2m}F_m + \varepsilon_2 \\ ------------------------- \\ ------------------------- \\ X_n - \mu_n = l_{n1}F_1 + l_{n2}F_2 + ----- + l_{nm}F_m + \varepsilon_m \end{array}\right\} \quad (1.1)$$

Where, μ_i is mean of X_i, ε_i is an error or specific factor. The coefficient l_{ij} is the loading of the i-th variable on the j-th factor. In matrix notation, the factor analysis model can be expressed as,

$$X - \mu = LF + \varepsilon \quad (1.2)$$

Where, $L_{n \times m}$ is the matrix of factor loadings.

Several methods are available in the literature to estimate factor loadings and factor scores. The study considers the principal component method to estimate the factor loadings and communalities. The descriptive statistics (percentage, mean, mean comparison, correlation coefficient, coefficient of variation, etc.) were used to describe the other variables in the study.

4. RESULTS AND DISCUSSION

The main focus of this research is to measure the extent of production, marketable and marketed surplus of seasonal fruits (mango, jackfruit, and litchi), various disposal patterns and use of the fruits.

4.1. Fruit Variety Owned by the Respondent

In the study area, fruit growers grew some variety of fruits like mango (Amrapali, Rangui, Mallika, local variety), Litchi (BARI litchi 2, BARI litchi 3, local), jackfruit etc. According to the Table 3, it is apparent that, 78% fruit growers adopted Rangui variety, whereas Amrapali variety was second highest (36%) among the eight groups of Bandarban and Rangamati districts. Among the three varieties of litchi, BARI litchi 2 variety was more prevalent (21%) compared to the other two varieties. Also 69% respondent grew jackfruit whereas the average number was more in Rangamati region than in Bandarban Table 3.

Table-3. Type of fruit variety owned by the respondent.

Variety / Location	Mango				Litchi			
	Amrapali (BARI Aam-3)	Rangui	Mallika	Local	BARI Litchi 2	BARI Litchi 3	Local	Jackfruit
Bandarban	In % of respondents who owned the respective fruits variety							
Laymipara	17	100	-	-	-	8	-	58
Farukpara	-	100	-	-	45	18	-	64
Getsimanipara	17	100	-	8	-	-	8	75
Ramripara	67	100	-	42	-	8	8	67
Paglachora	25	100	-	50	42	-	-	33
Munlaypara	17	100	-	8	67	8	58	83
All	**24**	**100**	**-**	**18**	**25**	**7**	**13**	**63**
Rangamati								
Mohajonpara	50	8	-	75	17	-	8	75
Manikchori	92	17	17	83	-	50	-	100
All	**36**	**78**	**2**	**34**	**21**	**12**	**11**	**69**

4.2. Total Production of Selected Seasonal Fruits

Among the four fruits variety of mango, total production of Amrapali, rangui, mallika and local variety was 69.16 kg, 3527.474 kg, 0.93 kg and 31.16 kg per household respectively Table 4. We see notably that Rangui variety ranks the highest average than the others. In the case of litchi varieties, total production of BARI Litchi 2, BARI Litchi 3 and local variety were found as 822, 665 and 674 pieces per household respectively. Total production of jackfruit is (on an average) 122 in numbers per household respectively from the selected study areas of Bandarban and Rangamati Table 4. This increasing trend is observed because of their awareness in the adoption of management issue and practices.

Table-4. Total Production of seasonal fruits according to variety by the farmer.

| Location | Types of fruits variety | | | | | | | Jackfruit |
| | Mango (In Kgs per household) | | | | Litchi (in no.) | | | |
	Amrapali	Rangui	Mallika	Deshi	BARI Litchi 2	BARI Litchi 3	Local	(In no.)
Bandarban								
Laymipara	120.83	6763.33	-	-	-	250	-	48
Farukpara	-	7745.45	-	-	1863	363	-	61
Getsimanipara	106.67	1900	-	5	417	-	-	91
Ramripara	100	1965.83	-	36.67	-	433	-	93
Paglachora para	11.67	1000	-	41.67	1216	-	-	27
Munlaypara	62.5	9183.33	-	2.5	2708	417	4500	113
Rangamati								
Mohajonpara	104.17	6.67	-	135	460	-	833	465
Manikchori	41.67	6.67	7.5	25.83	-	3833.33	-	74
All	69.16	3527.48	0.93	31.16	822	665	674	122

4.3. The Marketable and Marketed Surplus of Mango by Fruits Growers' Location

Table 5 shows that the share of total requirement to (1335 kg) to total mango production was highest in Laymipara of Bandarban followed by other five zone of Bandarban such as farukpara (959 kg), Getsimanipara (428

kg), Ramripara (321 kg), Paglachora para (208 kg), Munlaypara (1053 kg) and two zone of Rangamati such as Mohajon para (104 kg) and Manikchori (41 kg) recorded as the lowest in requirement. That means only requirement share was highest in Laymipara and for the other areas, its share was lowest. The consumption and other requirement played an important role in determining marketable surplus. The notable things to mention that while the total requirement was higher for laymipara but in case of marketable surplus, it can be interpreted from the table that Munlaypara had the highest marketable surplus because of the fact that their average total production was higher than the other areas. The share of the marketable surplus was lower for manikchori (40 kg), followed by mohajon para (142 kg) of Rangamati. It can be visible to mention that share of marketable surplus is positively related to the total production of seasonal fruits. Same things also happen when estimating for net marketed surplus. Among all the eight farmers' organization, Munlaypara was in the highest position for net marketed surplus while manikchori had negative net marketed surplus. As their total production was lower, they had to buy back more from the market than their sold amount. For that case, marketable and marketed surplus was lower in case of manikchori. It can be interpreted from the table that in all the cases, the marketable surplus was found to be greater than the net marketed surplus.

Table-5. Disposal of production and marketable and marketed surplus of mango.

Items	Location: Bandarban (amount expressed in kg)						Rangamati (in kg)	
	Laymipara	farukpara	Getsimani para	Ramripara	Paglachora para	Munlay para	Mohajon para	Manikchori
Total Production	6884	7745	2012	2103	1053	9248	246	82
Consumption	681	355	173	118	81	500	58	30
Distribution	220	105	43	23	22	93	14	4
Wastage	434	500	211	179	106	459	33	8
Total requirement	1335	959	428	321	208	1053	104	41
Marketable surplus	5549	6786	1584	1782	845	8196	142	40
Total sales	5358	5177	1592	1777	845	8721	142	40
Total purchase	175	355	76	300	451	2000	75	50
Net marketed surplus	5183	4822	1516	1477	394	6721	66	-10

***Here the numerical were expressed as an average value.
Note: [Marketable surplus = Total production – Consumption – Distribution – wastage.
***Net Marketed Surplus = Gross marketed surplus – Buyback (Total purchase).
***Gross marketed surplus = Total sale].

4.4. The Marketable and Marketed Surplus of Jackfruit by Fruits Growers' Location

Table 6 shows that share of total requirement (61 pcs) to total jackfruit production was highest in Ghagra, Mohajon para of Rangamati followed by the remaining area of Rangamati such as Manikchori (23 pcs) and other six zones of Bandarban such as Laimipara (20 pcs), farukpara (16 pcs), Getsimanipara (21 pcs), Ramripara (22 pcs), Paglachora para (11 pcs), Munlaypara (23 pcs). That means only requirement share was highest in Mohajon para and for the other areas, its share was lower. The consumption and other requirement played an important role in determining marketable surplus. Notably the total requirement for jackfruit was higher for Ghagra in Mohajon para. The same pattern was also observed in case of marketable surplus. In case of a marketable surplus, it can be interpreted from the table that Mohajon para had the highest marketable surplus for jackfruit (405 pcs) because of the fact that their average total production was higher than the other areas. The share of the marketable surplus was lower for Paglachora para (16 pcs), followed by laymipara (27 pcs), Farukpara (45 pcs), Getsimanipara (70 pcs), Ramripara (71 pcs), and Munlaypara (89 pcs) of Bandarban. Among all the eight farmers' organization, Mohajon para was in the highest position for net marketed surplus (365 pcs) while Paglachora para had the lowest marketed surplus (11 pcs).

Table-6. Disposal of Production and Marketable and marketed surplus of Jackfruit.

Items	Bandarban (Pieces/Household)						Rangamati (Pieces/Household)	
	Laymipara	farukpara	Getsimani para	Ramripara	Paglachora para	Munlay para	Mohajon para	Manikchori
Total Production	48	61	91	93	27	113	465	74
Consumption	13	12	13	12	7	13	32	16
Distribution	4	2	4	4	3	5	12	5
Wastage	3	2	4	6	2	5	16	2
Total requirements	20	16	21	22	11	23	60	23
Marketable surplus	28	45	70	71	16	89	405	51
Total sales	28	45	70	71	16	89	405	51
Total purchase	10	20	25	15	5	10	40	18
Net marketed surplus	18	25	45	56	11	72	365	33

*** Here the numerical were expressed as an average value.
Note: [Marketable surplus = Total production − Consumption − Distribution − wastage.
***Net Marketed Surplus = Gross marketed surplus − Buyback (Total purchase).
***Gross marketed surplus = Total sale].

4.5. The Marketable and Marketed Surplus of Litchi by Fruits Growers' Location

Table 7 shows that the share of total requirement (1100 pcs) to total litchi production was highest in Munlaypara of Bandarban followed by other five zones of Bandarban such as laymipara (83 pcs), farukpara (355 pcs), Getsimanipara (125 pcs), Ramripara (139 pcs), Paglachora para (428 pcs), and the remaining two zones of Rangamati such as Mohajon para (233 pcs) and Manikchori (583 pcs). That implies, only requirement share was highest in Munlaypara and for the other areas, its share was lower. The consumption and other requirement played an important role in determining marketable surplus. Notably the total requirement was higher for Munlaypara in Bandarban, the same pattern was also observed for marketable surplus. In case of marketable surplus, it can be interpreted from the table that Munlaypara had also the highest marketable surplus for litchi (6525 pcs/household) because of the fact that their average total production was higher than the other areas. The share of the marketable surplus was lower for laymipara (167 pcs/household). The second highest marketable surplus was counted for Manikchori in Rangamati and the marketable surplus for litchi was 3250 pcs per household. Among all the eight farmers' organization, Munlaypara of Bandarban had the highest net marketed surplus (5400 pcs/household) in litchi production. While laymipara and Getsimanipara had the lowest net marketed surplus (92 pieces/household) in litchi production.

Table-7. Disposal of production and marketable and marketed surplus of litchi.

Items	Location: Bandarban (Pieces/Household)						Rangamati(Piece/Household)	
	Laymipara	farukpara	Getsimani para	Ramripara	Paglachora para	Munlay para	Mohajon para	Manikchori
Total Production	250	2227	417	433	1217	7625	1292	3833
Consumption	42	155	67	67	229	567	133	300
Distribution	8	36	25	27	75	163	33	108
Wastage	33	164	33	46	121	371	67	175
Total requirements	83	355	125	139	425	1100	233	583
Marketable surplus	167	1873	292	294	792	6525	1058	3250
Total sales	167	1873	292	292	767	5900	1058	3250
Total purchase	75	300	200	0	250	500	75	1000
Net marketed surplus	92	1573	92	292	517	5400	983	2250

***Here the numerical were expressed as an average value.
Note: [Marketable surplus = Total production − Consumption − Distribution − wastage.
***Net Marketed Surplus = Gross marketed surplus − Buyback (Total purchase).
***Gross marketed surplus = Total sale].

4.6. Factors Affecting Sustainable Market Linkage

For enhancing sustainable market linkage of selected fruits in Chittagong hill tracts, it was observed that some factors were responsible for the sustainable market linkage development. This part has been presented to illustrate factor analysis to identify the major dimensions for the market linkage.

Table-8. Factors affecting sustainable market linkage.

Causes that affect market linkage	Factor loading				Communalities
F1= Marketing factor					
Number of consumers	0.407				0.662
Consumer choice	0.25				0.716
Supply of product	–0.057				0.887
Demand of product	0.049				0.877
Product variety	0.272				0.777
Availability of product in the market	0.439				0.767
Number of competitor in the market	0.528				0.635
Location of the market	–0.001				0.814
Number of traders	0.029				0.825
Different marketing policy	–0.454				0.68
High product prices	0.174				0.628
F2= Economic factor					
Family members		0.043			0.556
Inflation rate		0.229			0.691
Poverty		0.264			0.743
Money supply		0.039			0.623
Insurance		–0.165			0.781
Market price		–0.154			0.764
Lower product price		0.146			0.619
Higher input price		0.24			0.79
Capital		–0.013			0.657
Credit availability		0.048			0.651
Market structure		–0.051			0.689
					0.678
F3= Social factor					
Religion			0.414		0.676
Education			0.286		0.748
Family size			0.425		0.698
Ethnicity			0.207		0.755
Culture			0.467		0.702
Political system			0.491		0.719
F4= Environmental factor					
Heavy rainfall				0.04	0.587
Long term summer				0.39	0.737
High temperature				0.319	0.785
Fruit disease				0.07	0.583
Climate change				0.647	0.735
Product perishability				0.26	0.745

Contd.

Factors affecting sustainable market linkage		
Eigen value	F1= 3.583	
	F2= 2.489	
	F3= 2.260	
	F4= 2.150	
Percent of variation		F1= 10.238
		F2= 7.111
		F3= 6.458
		F4= 6.142
Cumulative percent of variation		F1= 10.238
		F2= 17.349
		F3= 23.807
		F4= 29.948
KMO= **0.527**		
Only factor loading ≥56 has been shown in the table		

Extraction method: Principle Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Source: Authors Calculation, 2016.

4.6.1. Factor Analysis

This analysis that explains most of the variance observed in the much larger number of manifest variables by reducing the number of causes to a few factors. The analysis determined causes that affect market linkage in the development of selected fruits in the study area. The analysis used principle component method to extract the factors with varimax rotation technique. Table 8 shows the results of the factor analysis for the sustainable market linkage of seasonal fruits. Based on the total variance explained, it was confirmed that there were 14 components that influence sustainable market linkage with 56% since their total loading is more than one. Since from 14 to 35th component were having total Eigen values less than one, but because of lower loading factor, only four components were selected from the particular variable which has been included as a factor that was made on the basis of whether the correlation value (factor loadings) was high or not Table 8. The result suggested that these factors were mainly responsible for affecting the market linkage development in the study area. In this model, factors were considered as a variable. This model was also fruitful to find out the relationship between dependent variable and independent variable. Here, dependent variable was fruit supplied (mango, jackfruit and litchi) by fruit growers and independent variables were heavy rainfall, long term summer, fruit disease, climate change, product perishability, religion, education, family size, culture, poverty, market price, high input price, capital, credit availability, labor wages, fruit variety, location of market, market structure, marketing policy, consumer choice, consumer number, fruit supply, number of traders etc. Table 8.

5. CONCLUSION

The frequent and common variety for mango that was sent to different market was Rangui variety as the productions of other varieties was not more to supply. It was also observed that other fruits like jackfruit and litchi were sold more in the local market rather than supplying it to the distant market. It is more apparent for all three of the seasonal fruits that, the marketable surplus was found to be higher than the net marketed surplus. That means farmer retains more for their consumption and other uses than the actual amount marketed. Analyzing the factors that are affecting sustainable market linkage, it was found that the results of factor analysis is useful and have good extraction value.

6. RECOMMENDATIONS

As here we found that marketable surplus was greater than the net marketed surplus. It means farmer retains more for consumption and other uses than the actual amount marketed. If marketed surplus could be enhanced with the increase of marketable surplus, it would ultimately help fruit grower to link themselves with the market and increase their revenue. So, proper steps regarding this matter need to be taken by the relevant bodies. Since some varieties are found to be dominant (i.e. for mango; Amrapali in Rangamati area, Rangui in Bandarban area) in some areas. So, Government and local body should take initiatives to encourage the farmer to adopt some varieties which were not so prevalent in some areas.

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