

## **Performance Analysis of Supply Chain and Value Chain of Selected Fruits in Khagrachari Hill District**

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**Abstract:** *The study was conducted at Khagrachari Sadar upozila under Khagrachari Hill District to document the socioeconomic profile of market actors of selected fruits, to know the existing supply chain of selected fruits, to identify value chain of selected fruits, and to find out constraints in value chain performance of selected fruits. Three local markets, namely Shapla chattor (town market/baro bazar), Madhupur bazaar, and Shonirvhor bazar and one assembly market in Narikal Bagan were purposively selected for data collection from both fruit growers and market intermediaries. For value chain development of selected fruits, UNIDO's approach to agro-value chain analysis and development was followed. In the study area, nine supply chains were found for mango marketing, of which three supply chains had gone out of the region. For jackfruit and litchi marketing six supply chains were found. For all fruits (mango, jackfruit and litchi), the most important supply chain, grower to customer, was supplied about 34 percent of total fruits supply. In the study area value was added in some stages. These were grading, cleaning, packaging, storing and transportation. Highest value was added on grading process, which was about 85 percent to 100 percent. For developing value chain in the study area some constraints like post harvest losses, storage problem, lack of processing center, high packaging cost etc were found.*

### **1. Introduction**

The Chittagong Hill Tracts (CHT) covers an area of 13,295 square kilometers of Himalayan range hills and hillocks measuring one tenth of Bangladesh. The major hill soils are yellow-brown to strong brown permeable friable loamy, very strongly acidic and low in moisture holding capacity. However, soil patterns generally are

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complex due to local differences in sand, silt and clay contents of the underlying sedimentary rocks and in the amount of erosion that has occurred (BBS, 2011).

The area is becoming a seasonal fruit hub with immense potential for the development of a food-processing sector. Last year the CHT produced nearly 14 lakh tonnes of fruit, officials said, while a decade ago production in the region was 6 lakh tonnes in 2002 (The Daily Star, 2012). In Khagrachari Hill District fruit was grown on 3855 acres of land in 2010/11, up from 1025 acres in 2006/07 (BBS, 2011).

Fresh tropical fruits are on winning ground in world markets as to recent statistical figures (Anonymous, 2001). Its production has risen by 7 percent annually since 1997; and the bulk of these fruits (98 percent) are grown in developing countries. Hundreds of farmers in the three hill districts produce plenty of mango, jackfruit, papaya, pineapple, orange, and banana every year, but do not get fair prices of the perishable produces, only because of the lack of proper marketing facilities.

Khagrachari hill district with an area of 2699.55 square kilometers is bounded by the Indian State of Tripura on the north, Rangamati and Chittagong districts on the south, Rangamati district on the east, Chittagong district and the Indian State of Tripura on the west.

The vast area of Khagrachari hill district is suitable for fruits production. From all fruits mango, jackfruit and litchi are dominant in production in this area. In 2010-11, the total area of mango was 912 acres and total production was 2819 m.tons. During the year, total area of jackfruits was 3066 acre and total production was 37356 m.tons whereas total area of litchi was 273 acres and total production was 1228 m.tons. Also the percentage change in yield over 1995/96 to 2010/11 was 153.9 mt/ha, 195.48 mt/ha and 140.65 mt/ha for mango, jackfruit and litchi, respectively (BBS , 2011).

Even though fruit is economically and socially important, fruit supply chain and their characteristics have not yet been studied and analyzed for Khagrachari hill district where great potential of fruit production (Mango, Jackfruit & Litchi) exists.

The changing demand in domestic and international markets for high-value products creates challenges and opportunities. Small and marginal holders produce majority of the horticultural commodities like fruits and vegetables, but due to weak and fragmented value-chain, only a small percentage of the produce reaches the urban market. Appropriate marketing infrastructure is crucial for efficient marketing of fruits and vegetables. Adequate transportation and product handling are also important for the trade of agricultural products and important factors in assuring good prices and poverty alleviation. Investment is required for improved maintenance of road and port infrastructures. In addition to infrastructure develop-

ment, modification of policies and management are also needed to improve appropriate and timely shipping of perishables (World Bank, 2005).

Fruit production and marketing assume an important place in the agricultural development as well as cheaper fruit based nutrient supply to the population of the country. Despite the vast utility of fruits production, its marketing system in hill region is plagued with several inadequacies. Therefore, the present study was designed to address for identifying value chain and constraints in value chain performance of selected fruits to derive policy implications for value chain development of selected fruits in Khagrachari hill district.

## 2. Methodology

**Data:** The study was confined to Khagrachari Hill District. Based on higher concentration of fruits garden, Khagrachari sadar upazila was selected purposively for the survey. Three local markets, namely Shapla chattor (town market/baro bazar), Madhupur bazaar, and Shonirvhor bazar and one assembly market in Narikal Bagan were purposively selected for data collection from both fruit growers and market intermediaries. The participants involved in fruits (mango, jackfruit and litchi) production and marketing in the study area are fruit growers, wholesaler, bepari, faria and retailer. As the population size was not readily available, the fruit growers and market intermediaries were selected considering availability at the first sight. The selected samples included 130 fruit growers (mango growers-56, jackfruits growers-34 and litchi growers-40) and 84 market intermediaries (wholesaler-16, faria-20, bepari-32 and retailer-16). Primary data were collected during the months of April to July 2014.

**Analytical tools:** The data were collected from different categories of fruit growers and from different marketing functionaries. Descriptive statistics were used to summarize the data and presented in tabular form of market actors. For identifying existing supply chain descriptive research was done and for value chain analysis UNIDO's approach to agro-value chain analysis was followed.

## 3. Results and discussions

### 3.1 Existing Supply Chain of Fruits in Khagrachari Hill District

The analysis of supply chains is intended to provide a systematic knowledge of the flow of the goods and services from their origin (producer) to the final destination (consumer). The mango, jackfruit and litchi market supply chains, depicted in Table 4.1, 4.2 and 4.3 were constructed based on the data collected in one main town market, three local markets, and two aratder markets in Chittagong. The result revealed that there were 9, 6 and 6 major supply chains for mango, jackfruit and litchi, respectively, which were obtained from traders' survey. The estimated

total volume of supplied fruits was counted as 100 percent for estimating percentage of fruit supplied of each grower and trader. The supply chains of each fruit are treated separately, and the result obtained was the following.

### 3.1.1 Existing Mango Supply Chain

Nine supply chains were identified for mango of which three have gone out of the region. The supply chain comparison was made based on percentage of volume that passed through each supply chain. Result showed that the fruit grower-local customer, the shortest supply chain, carried the largest percentage (34.83 percent) of the total percentage.

*Table 1: Existing supply chain of mango in the Khagrachari Hill District*

Sl. No.	Existing supply chain of mango in the Khagrachari Hill District	% of total fruit supplied	Rank of importance
1	Grower – Customer (local)	34.83%	1st
2	Grower – Bepari (local) – District market – Customer (local)	13.95%	3rd
3	Grower – Faria(local) – Retailer – Customer (local)	3.30%	8th
4	Grower–Faria (local) -Customer (local)	3.15%	9th
5	Grower–Bepari (local)–Aratder (Chittagong market)–Bepari (Chittagong market) – Retailer (Chittagong market) – Customer(Other district)	10.25%	4th
6	Grower– Bepari (local)– Bepari (other district)– Customer (other district)	6.25%	5th
7	Grower–Aratder (Chittagong market) -Bepari (Chittagong market)-Customer (Other district)	5.81%	7th
8	Grower - Retailer (local) – District market – Customer (local)	6.45%	6th
9	Grower-Wholesaler(local)-District market-Customer(local)	20%	2nd

Source: Field survey, 2014.

- 1. Grower – Customer (local) supply chain:** This supply chain represented 34.83 % of total mango supplied to the market during the survey period. The supply chain was found to be the first important supply chain in terms of importance.
- 2. Grower – Bepari (local) – District market – Customer (local):** According to survey, this supply chain accounted for 13.95% of total mango supplied to the market. The supply chain was found to be third most important mango supply chain in the study area.

3. **Grower – Faria (local) – Retailer – Customer (local)** : Represented 3.30% of total mango supplied to market and found to be eighth mango supply chain in the survey area.
4. **Grower–Faria (local)-Customer (local)**: This supply chain represented 3.15% of total mango supplied to the customer and found to be ninth most important mango supply chain.
5. **Grower–Bepari (local) –Aratder (Chittagong market) –Bepari (Chittagong market) – Retailer (Chittagong market) – Customer (Other district)**: It accounted for 10.25% of total mango supplied to Chittagong market and was fourth most important supply chain in the district.
6. **Grower–Bepari (local) –Bepari (other district) –Customer (other district)**: The supply chain accounted for 6.25 % percent of mango supplied and was fifth most important mango supply chain.
7. **Grower–Aratder (Chittagong market) - Bepari (Chittagong market)-Customer (Other district)**: This supply chain was seventh most important Supply chain of mango and supplied 5.81% of total supplied.
8. **Grower - Retailer (local) – District market – Customer (local)**: This supply chain accounted for 6.45% of total mango supply during the survey period and it was found to be sixth important mango supply chain in Khagrachari Hill District.
9. **Grower-Wholesaler(local) -District market-Customer (local)**: This supply chain represented 20% mango supplied in the Survey area and it was placed second most important mango supply chain in the study area.

### 3.1.2 Existing Jackfruit Supply Chain

Six supply chains were identified for jackfruit of which two have gone out of the region. The supply chain comparison was made based on percentage of volume that passed through each supply chain. Accordingly, the fruit grower-local customer the shortest supply chain carried the largest percentage (35.88 percent) of the total.

*Table 2: Existing supply chain of jackfruit in the Khagrachari Hill District*

Sl. No.	Existing supply chain of jackfruit in the Khagrachari Hill District	% of total fruit supplied	Rank of importance
1	Grower – Customer (local)	35.88%	1st
2	Grower – Bepari (local) – District market – Customer (local)	15%	4th
3	Grower – Faria (local) – Retailer – Customer (local)	8.78%	5th

4	Grower–Wholesaler (local)–Aratder (Other market)–Bepari (Other market) – Retailer (Other district) – Customer(Other district)	6.50%	6th
5	Grower–Bepari (local)–Bepari (other district)– Retailer (Other district) - Customer (other district):	15.45%	3rd
6	Grower-Wholesaler (local) -Retailer (local) -District market-Customer (local):	18.48%	2nd

Source: Field survey, 2014.

- 1. Grower – Customer (local) supply chain:** This supply chain represented 35.88 % of total Jackfruit supplied to the market during the survey period. The supply chain was found to be the first important supply chain in terms of importance.
- 2. Grower – Bepari (local) – District market – Customer (local) :** According to survey, this supply chain accounted for 15% of total jackfruit supplied to the market. The supply chain was found to be fourth most important jackfruit supply chain in the study area.
- 3. Grower – Faria (local) – Retailer – Customer (local) :** Represented 8.78% of total jackfruit supplied to market and found to be fifth jackfruit supply chain in the survey area.
- 4. Grower–Wholesaler (local)–Aratder (Other market)–Bepari (Other market) – Retailer (Other district) – Customer (Other district):** It accounted for 6.50% of total jackfruit supplied to other district market and was sixth most important supply chain in the district.
- 5. Grower–Bepari (local)–Bepari (other district)– Retailer (Other district) –Customer (other district):** The supply chain accounted for 15.45 % percent of jackfruit supplied and was third most important jackfruit supply chain.
- 6. Grower-Wholesaler (local)-District market - Customer (local):** This supply chain represented 18.48% jackfruit supplied in the survey area and it was second most important jackfruit supply chain in the study area.

### 3.1.3 Existing Litchi Supply Chain

Six Supply chains were identified in the study area where all supply chains remained in the region except one. The supply chain comparison was made based on percentage of volume that passed through each supply chain. According to the report, the fruit grower-local customer, the shortest supply chain, carried the largest percentage (34.23 percent) of the total litchi supplied.

1. **Grower – Customer (local) supply chain:** This supply chain represented 34.23 % of total litchi supplied to the market during the survey period. The supply chain was found to be the first important supply chain in terms of importance.
2. **Grower – Bepari (local) – District market – Customer (local):** According to survey, this supply chain accounted for 20% of total litchi supplied to the market. The supply chain was found to be second most important litchi supply chain in the study area.

*Table 3: Existing supply chain of litchi in the Khagrachari Hill District*

Sl. No.	Existing supply chain of litchi in the Khagrachari Hill District	% of total fruit supplied	Rank of importance
1	Grower – Customer (local)	34.23%	1 <sup>st</sup>
2	Grower – Bepari (local) – District market – Customer (local)	20%	2 <sup>nd</sup>
3	Grower – Faria(local) – District market – Customer (local)	7.21%	6 <sup>th</sup>
4	Grower–Wholesaler (local)- District market – Customer (local):	12.7%	3 <sup>rd</sup>
5	Grower–Bepari (local)–Aratder (Other district market)– Retailer (Chittagong market) – Customer(Other district):	8.42%	5 <sup>th</sup>
6	Grower-Wholesaler (local) -Retailer (local) - District market-Customer (local)	11.11%	4 <sup>th</sup>

Source: Field survey,2014.

3. **Grower – Faria (local) – District market – Customer (local) :** Represented 7.21% of total litchi supplied to market and found to be sixth most important litchi supply chain in the survey area.
4. **Grower–Wholesaler (local) - District market – Customer (local):** This supply chain represented 12.7% of total litchi supplied to the customer and found to be third most important litchi supply chain.
5. **Grower–Bepari (local) – Aratder (Other district market)– Retailer (Chittagong market) – Customer(Other district):** It accounted 8.42% of total litchi supplied to other district market and was fifth most important supply chain in the district.
6. **Grower-Wholesaler (local)-Retailer (local)-District market-Customer(local):** This supply chain represented 11.11% mango supplied in the Survey area and it was fourth most important litchi supply chain in the study area.

### **3.2 UNIDO's Approach to Value Chain Analysis of selected fruits (Mango, Jackfruit, Litchi) in Khagrachari district**

#### **Selection and prioritization of value chains**

The selection and prioritization of value chains to be analyzed are the first steps and they certainly entail some of the most important decisions to be taken in any value chain development. The selection of sectors, sub-sectors, products or commodities determines to a large extent the prospects for a value chain's impact on socio-economic indicators. (UNIDO, 2009)

#### **Mapping the value chain**

Mapping a value chain facility requires a clear understanding of the sequence of activities and the key actors and relationships involved in the value chain. In Khagrachari district, different actors like financial institutions, Govt. institutions, traders, growers and customers are involved in the value chain of fruits. In the whole chain there are flows of fruits, knowledge, information. These flows can be both tangible and intangible, for instance, product, money, information and services. Mango was processed into pickle and one packet (5gm) was sold at tk 10. From one kg of raw mango at tk 30, 20 packets of pickle can be produced and processor gains tk 200. Value was also added in some stages of marketing like grading, cleaning, packaging and transporting (Figure 1).

#### **Analyzing value chain technical capacities**

This analysis is made in order to assess the value chain production system and tools; evaluate their technical performance; and determine the principal technical actions that need to be carried out to upgrade individual enterprises within the chain and to enhance their competitiveness.

Three aspects of production are to be assessed:

1. Utilization of inputs (raw materials and supplies, labour, water and energy, production materials, equipment etc.). In Khagrachari district fruit growers purchase their input materials from town market. Most of respondents reported that they purchased their own inputs from town market.
2. The production system (technology and process). This is compared with systems used in the sector by the main competitors in terms of the utilization of raw materials, labour, etc; the capacity of the enterprise to provide finished products that meet the needs of customers in terms of quality, delivery time and cost is also assessed. Respondents reported that they transfer technology to each other for improving their fruit production. Fruit growers are all time careful to maintain quality. They adopt new technology, hot water treatment to store fruits for some days without any preservative chemicals.



3. In the study it was observed that for mango marketing fruit growers were personally involved in mango marketing. They personally carried fruit to market and sold it. Large size mango growers rested at small shop personally and sold their fruits. For jackfruit and litchi marketing intermediaries were more involved in marketing than fruit growers.

### **Analyzing the value chain economic performance:**

This analysis entails the measuring of economic factors (production cost, margins, added value etc). In the study area, majority of respondents reported that from all of production cost fertilizer cost, pesticide cost was so much high. Small fruit growers could not use fertilizer timely because of lower capital. Also irrigation facilities were lower in the study area. But most of the respondents reported that the production of fruits was better than in the last decade; it's because of value chain performance. Most of fruit growers practiced grading, packaging etc., which increased their profits.

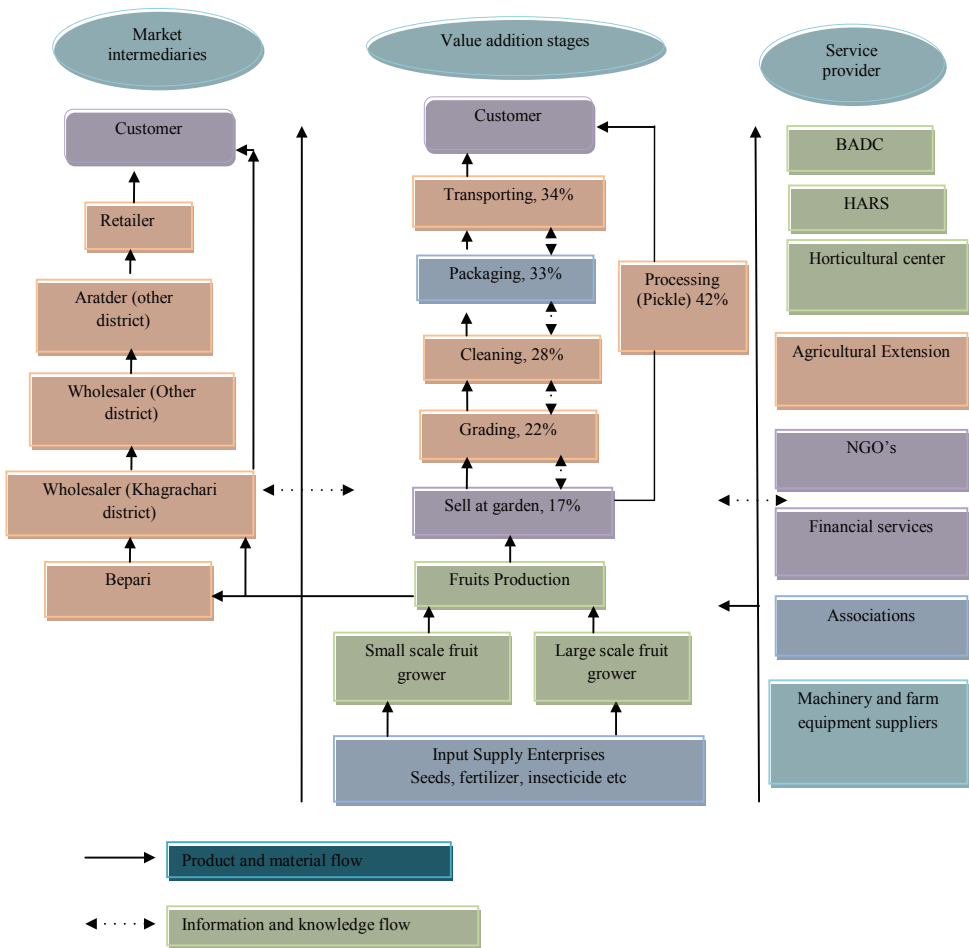
### **Formulating an upgrading strategy for the selected value chain**

At this stage, upgrading plans are drawn up which describe the interventions required in fruit value chain, including policy and institutional recommendation. Specific interventions at growers level also happened in the study area. Fruit growers were more concerned about the good quality of fruits. Most of the respondents reported that if Govt. took any initiatives for fruit production in this area, the production of fruits also increased. Some action taken by local govt. like formalin usages restriction, free distribution of sampling to fruit growers etc helped to maintain the good quality of fruits in the study area.

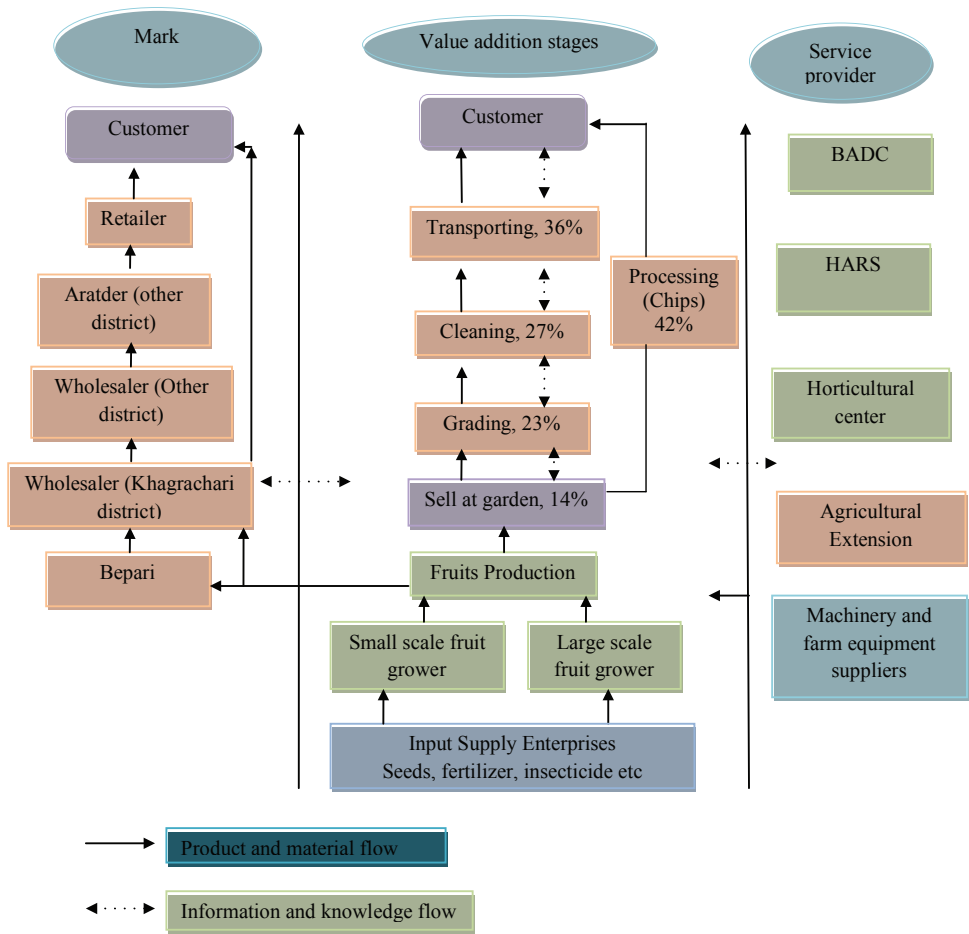
### **Implementing the upgrading, monitoring and impact assessment**

After formulating policy recommendation, all market actors need to implement those policies. Govt. body should be monitoring the whole value chain process.

**Figure 1: Mapping of mango value chain in Khagrachari Hill District**

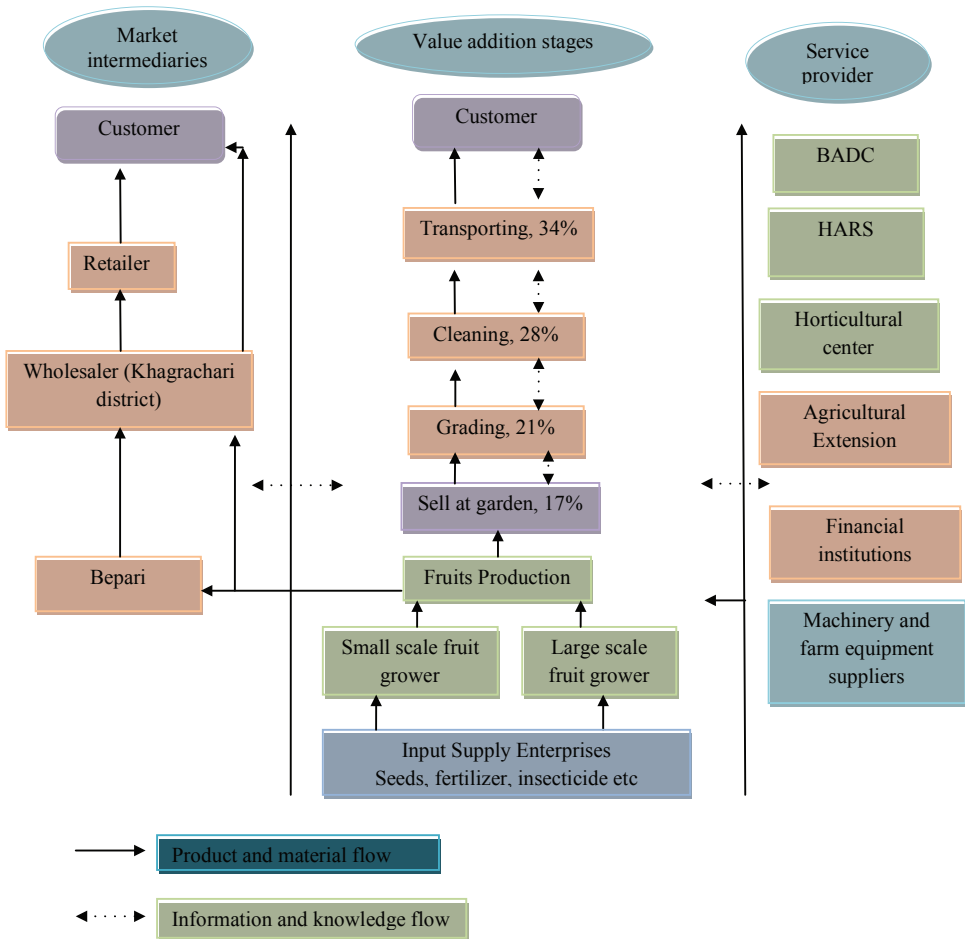


**Figure 2: Mapping of jackfruit value chain in Khagrachari hill District**



In the study area, jackfruit was processed in only one form of chips. When it was processed the price was raised 42 percent from its fruit price. Value was added in some stages like grading, cleaning, transporting.

**Figure 3: Mapping of litchi value chain in Khagrachari Hill Districts**



In the study area, litchi was not processed in any form. Value was added in different stages, when litchi was sold in garden the price was tk 3000 per piece and when it was graded the price was increased 21 percent and after cleaning the price was increased 28 percent. Finally when litchi was transported the price was raised to tk 5000 per 1000 piece.

**4. Constraints in Value Chain Development**

The main advantages to commercial stakeholders from being part of an effective value chain are reductions in the costs of doing business, increased bargaining power, and improved access to technology, information and capital, leading to innovations in production and marketing processes to gain higher value and provide higher quality to customers. ( AGRICO, 2004)

From a business perspective, ineffective value chain linkages cause failure among commercial stakeholders and service providers translate into ineffective value chains. Value chains are organized linkages among groups of producers, traders, processors and service providers who join together in order to improve productivity and add value to their activities. By joining together, the actors in a value chain increase competitiveness and are able to maintain competitiveness through innovation. The limitations of each single actor in the chain are overcome by establishing synergies and governance rules aimed at producing higher value. (AGRICO.2004)

In the study area some constraints were faced during value chain development of selected fruits. Ranked these problems, the first problem was lack of training facilities and second was post harvest loss. Lack of processing center was the third problem. Also, lack of credit facilities, less institutional support etc were problems in value addition (Table 4).

**Table 4: Problems faced by the market actors for upgrading value chain of selected fruits**

Sl. No.	Constraints	Rank
1	Post harvest loss	2
2	Lack of communication	10
3	Storage problem	9
4	Lack of processing center	3
5	Lack of institutional support	5
6	Credit unavailability	4
7	Transport problem	6
8	Lack of rules and regulations	7
9	High license cost	11
10	Packaging cost	8
11	Lack of training facilities	1

Source: Field Survey 2014

## 5. Conclusions and Policy Implications

Given the large potential for fruit production in the country, their contribution to the total GDP has been extremely low for many reasons. The most cited reasons include lack of market oriented production, which is too traditional and poorly supported by scientific recommendations, excessive margin mainly due to inefficient and costly transport, absence of fruit market information, inadequate government interventions and absence of market regulations and legislations, and

its marketing activity is principally attributed to poor actors skill. As a result, fruit marketing needs due attention in any on-going or future fruit development plan. Although comparative rewards, such as suitable agro-ecology, proximity to national market and cheap provision of labor are opportunities, declining prices, occurrence of deadly fungal disease, poor market integration, absence of improved technologies and provision of extension packages are major factors that hinder production-marketing task of mango, jackfruit and litchi. With existing prominent organic production the product is not yet certified in the study area. Constraints hindering the development of mango, jackfruit and litchi are found in all the stages of the chain. At the farm-level, lack of quality sapling has compelled fruit growers to use inferior and low yielding materials. Storage facilities and absence of collective bargaining power has also forced individual fruit growers to accept unfavorable deals. Therefore, a number of actions need to be undertaken in order to promote the development of mango, jackfruit and litchi value chain. This particularly includes capacity building, technological applications, improved extension and plant breeding activities. Infrastructural development is also a key to support the sub-sector. In this arena, emphasis should be given to improved storage and transportation system and offering credit and other services to improve effective production and marketing of the crops.

## 6. Recommendations

**Provide credit facilities:** Govt. may provide credit facilities to market actors and processors to encourage in developing value chain of fruits. This initiative can help to provide job opportunities to people as well as to grow entrepreneurship in this area.

**Technology dissemination:** Both Govt. and NGOs can help to value chain development by disseminating technical information for improvement of fruits production and marketing in this area.

**Strengthening research on marketing:** Continuous research is crucial to identify and mitigate constraints in value chain development. It can also help in identifying the potential entrepreneurs and processors who were already involved in this profession. Capacity strengthening in terms of research on post harvest management and marketing of the important research organizations, including universities (BAU, SAU and BSMRAU) and research organizations (BARI and BINA) is needed.

**Training facilities:** Different Govt. organizations and NGOs can provide training facilities to both market actors and processors including harvesting, grading, sorting, packaging, transportation, storage (conventional and modern), processing (small and large-scale) and nutrition. All the market actors in the value chain should be given adequate training.

**Transfer of technology:** Development of appropriate technology by experts and conducting training by appropriate trainers on different aspects of post harvest management are needed. Bangladesh Agricultural University may play a leading role in this regard in collaboration with BARC, DAE, BARI and BSTI.

**Introducing affordable packaging system:** Packaging sector for perishables has not been developed in the study area. For long-distance transportation, still voluminous package made of bamboo baskets and gunny sacks are predominantly used, which result in high spoilage due to impact, vibration and heat generation. Recently, mango intermediaries adopted plastic crates in transportation which has created positive impacts in minimizing loss and maintaining quality.

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