

Case Study

Supply Chain Management of Litchi: A Case Study in Sonitpur District of Assam

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ABSTRACT

Litchi (*Litchi chinensis* Sonn), an important sub-tropical evergreen fruit crop belonging to family Sapindaceae, is believed to have originated in China, where it has been grown in Southern Guangdong state for thousands of years. It is highly specific to climatic requirements and probably due to this reason its cultivation is restricted to few countries in the world. In India, litchi was introduced in the 18th century through Burma, and from there, it spread to many countries. India and China account for 91 percent of the world litchi production. Litchi is one of the important fruit crop commercially grown in Assam. Due to its perishable nature and having very short shelf life, Supply Chain Management (SCM) plays a vital role. Though India is an agrarian economy the business faces various challenges in terms of infrastructure facilities. The present article is an attempt to explain the production, distribution and Supply chain management of Litchi in Sonitpur District of Assam. Most of the litchi growers belong to marginal and small category. Hence, the involvement of marginal farmers is more in Litchi plantation as compared to other category of farmers. Major share of produce traded through market intermediaries. The linear trend model was used to check the dynamicity of the area and production data of Litchi in India. Due to perishable in nature, the litchi farmers are suffering severely due to wastage of litchi throughout the intermittent steps in existing supply chain of litchi.

Highlights

- Most of the litchi growers in Sonitpur District of Assam belong to marginal (83.10%) and small (16.90%) category and their shares in total number of plants were 73.82% and 26.17%, respectively.
- Major share (66.66%) of produce traded through market intermediaries. However, 33.34% of farmers were found to be direct selling in local market.
- The proposed model for supply chain may help in reducing wastages as well as better outcome to the stakeholders of Litchi supply chain in study area.

Keywords: Supply chain management, trend analysis, supply chain integration, market intermediaries.

Litchi (*Litchi chinensis* Sonn) is one of the important fruit crop commercially grown in Assam. The litchi mainly grown in Bihar, West Bengal, Assam and Jharkhand and to a smaller extent in Tripura, Punjab, Uttarakhand and Orissa. The varieties of Litchi which are grown in the Sonitpur District of Assam are (*Bombaya*, *Billati*, *Elachi*, *Local Sahi*, *Pyaji*, *Chinese*). The harvesting season of Litchi in the state of Assam takes place from the 1st week of May to the 3rd week of May. Due to its perishable nature

and having very short shelf life, Supply Chain Management (SCM) plays a vital role. Though India is an agrarian economy the business faces various challenges in terms of infrastructure facilities. Supply Chain Management is important to provide a systematic knowledge of the flow of the goods

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and services from their origins producer to the final destination consumer.

Supply Chain Management involves procuring the right inputs like raw materials, components and capital equipments etc. covering them efficiently into finished products and dispatching them to the final destination. The supply chain perspective can help the retailers to identify superior suppliers and distributors and which help them to improve productivity. At the same time Market logistics helps planning the infrastructure to meet demand, then implementing and controlling the physical flows of material and finished product from point of origin to point of use.

Supply Chain Management of Litchi is complex as compared to other fruits because of high fluctuation in supply because of climate conditions. Litchi grown in the farmers field reach the end consumer through a long chain of intermediaries. These intermediaries carry out various functions, such as transfer of ownership of commodities, its movement, quality & quantity maintenance, payment to the farmer and commodity delivery to the buyer.

Supply chain management of Fruits and Vegetables in India

Negi and Neeraj Anand (2015) found cold chain is weak link in the Supply Chain Management of fruits and vegetables. The Cold chain infrastructure facilities include grading, sorting, packing, storage, processing and transportation facilities in the supply chain network.. India, the world's second largest fruits and vegetables producer, is also one of the biggest wasters in the world, wasting 2 lakh cr worth of fruits and vegetables every year (ASSOCHAM, 2013). The SCM for Fruits &Vegetables in India is still in a very pathetic condition and fraught with various issues like inadequate cold chain storage and transportation facilities, fragmented and long supply chain, high cost of packaging, poor distribution, etc. (Dharni and Sharma, 2008). Kumar *et al.* (2015) found that the losses of litchi takes place during transportation at wholesale market level and retail market level. The losses of litchi happen mainly for sunburns, cracking and fruit borer infestation. Another reason of losses is for lack of efficient agricultural practices and the effect of climatic factors, and post harvest losses take place

for improper handling which results to moisture loss and browning. Hajoary (2016) highlighted the framework of Supply Chain Management in India. The people engaged in the Supply Chain benefited by efficient flow of information, by reducing the complexity in decision making and enhancing transparency of prices in product to farmers. The setting proper distribution infrastructures in each district to support farmers, government policy to encourage farmers, financial support are essential.

Operational research models used in fruits supply chain

Van Der Vorst *et al.* (2014) proposed an integrated approach towards logistics, sustainability and food quality analysis by introducing a new simulation environment. A case example of pineapple illustrates the benefits of its use relating to speed and quality of integrated decision making. Cittadini *et al.* (2008) discussed a multi-objective model to plan the production of fruit. The model optimizes manpower utilization and maximizes fruit production. Amorim *et al.* (2010) discussed about the production and distributions of perishable foods are integrated to optimize the freshness of fruit based on minimizing stocks of stored raw material. Blackburn and Scudder (2009) discussed the hybrid model to design a supply chain of perishable foods, based on optimizing the value of marginal product over time. The model considers the changing value of perishable foods over time that tends to decline according to quality deterioration.

The supply chain management for fruits and vegetable has been discussed by various authors but, the fruit specific to Litchi is concern the supply chain has not been discussed about the actors and aggregators involvement. The various optimization models have been well discussed for minimizing the overall loss. In this paper an attempt has been made to identify the factors affecting the actors and aggregators involving in the supply chain management of Litchi, the socio – economic variations related SCM of Litchi, type of market intermediaries involved in the supply chain management of litchi. The overall objective of the research article is to discuss present status of supply chain of Litchi in Sonitpur districts of Assam and the suitable strategies for the development of SCM.

MATERIALS AND METHODS

Sampling Technique

The Sonitpur district of Assam is purposively selected because of higher area and production of Litchi. Varieties such as Desi, Elachi, Rangiya and Chinese were used for plantation. A sample comprising 30 numbers of litchi growers and 22 number of market intermediaries including itinerant traders (12), wholesalers (2) and villages traders (8) were selected by using stratified random sampling method.

Data collection

Secondary data on land Utilization, Area of Study details has been collected from respective government department.

Primary data

Household particulars, operational holding, farm assets, livestock assets, cropping pattern, area or number of litchi trees, quantity of production, nature of wastage, type of sale, type of market intermediaries, type of litchi. The collected data were presented in frequency and percentages. The trend of litchi production over the years was analyzed by linear model and R² of the model was found out.

RESULTS AND DISCUSSION

The horticulture crop litchi has been found to be very much attractive for the both the socio economic group like marginal and small farmers. A comparison between area of plantation and number of trees has been elaborated in Table 1.

Table 1: Distributions of Litchi Plantation

Sl. No.	Socio-economic Category	Area (ha)	Total Plants (Nos)
1	Marginal	4.72 (83.10)	268 (73.82)
2	Small	0.96 (16.90)	95 (26.17)
	Total	5.68 (100.00)	363 (100.00)

Figures in parentheses indicates percentage to total.

The data reveals that farmers belong to marginal and small category did plantation (83.10%) and (16.90%). Whereas, the number of trees found to be (73.82%) and (26.17%) respectively. The sum total

in both the socio-economic group has been 5.68 ha. Moreover the average canopy area for the litchi trees is found to be same and total plantation has been recorded as 363 trees.

Table 2: Area and Production of Litchi in India during 2006-2018

Year	Area (000' ha)	Production (000'tons)
2006-07	65.00	403.00
2007-08	69.00	418.00
2008-09	72.00	423.00
2009-10	74.40	483.30
2010-11	78.00	497.00
2011-12	80.4	538.10
2012-13	82.7	580.00
2013-14	84.2	558.30
2014-15	85.0	528.3
2015-16	90.1	558.8
2016-17	93.3	568.2
2017-18	92.3	586.4

Source: Indian Horticulture Database.

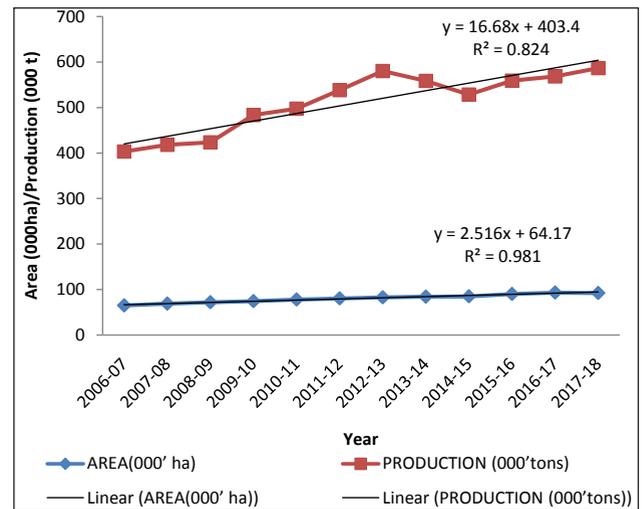


Fig. 1: Trends in Area and production of Litchi in India

Litchi production and utilization

The production of any fruits or horticultural crops goes through various steps before it reaches to the end users, litchi is one of them. The analysis of data in Table 3 revealed that, in case of marginal farmers, out of the total production of litchi, 90.20% has been marketed directly to the customer or to the market intermediaries, 3.16% were retained for home consumption, and a significant proportion

Table 3: Litchi production, utilization & wastage (kg)

Sl. No.	Farm Category	Marketed	Household consumption	Waste	Production
1	Marginal	8570.2 (90.20)	300.1 (3.16)	630.7 (6.64)	9501 (100.00)
2	Small	2370 (91.86)	60 (2.33)	150 (5.81)	2580 (100.00)
	Total	10940.2 (90.49)	360.1 (2.98)	780.7 (6.46)	12090 (100.00)

Figures in parentheses indicates percentage of production.

Table 4: Farmers approach for litchi marketing

Sl. No.	Socio-economic category	Directly selling at local market	Selling to market intermediaries	Total
1	Marginal Farmers	10 (37.04)	17 (62.96)	27.00 (100)
2	Small Farmers	—	3 (100.00)	3.00 (100)
	Total	10 (33.34)	20 (66.66)	30.00 (100.00)

Figures in parentheses indicates percentage to total.

6.64% of litchi got wasted. Whereas in case of small farmers 91.86% were marketed, 2.33% retained for home consumption and 5.81% litchi wasted waste due to sunburn, rotten, rainfall, packaging etc..

Approach for litchi marketing

Farmers generally adopt two possible ways a) directly selling at local market b) selling to market intermediaries for selling their produce (Table 4).

The data reveals that (62.96%) of marginal farmers are mostly associated with intermediaries for selling out their produce. Whereas (100.00%) of small farmers shows their presence to market intermediaries. Moreover (37.04%) of marginal farmers sell their produce in local market and small farmers does not show any presence in local market. The total among the all farm categories it has been found that (33.34%) of farmers are relying on direct selling to local market and major (66.66%) of farmers are dependent on market intermediaries.

Market intermediaries: Market Intermediaries also known as middlemen involved between the supply chain of any product. Role of marketing intermediaries also have huge responsibility for proper market allocation of litchi, the details has been elaborated in Table 5.

The table depicts that out of three marketing intermediaries itinerant merchant is having the highest share of (61.11%), whole sellers (11.11%) and village traders (27.78%) for marginal farmers. However for small farmers it has been found to be (25.00%) of itinerant merchants and (75.00%)

for village traders. In overall situation (54.54%) of itinerant merchant, (9.09%) of whole seller and (36.66%) of village traders found to be dominating.

Table 5: Socio economic Category of Market Intermediaries

Sl. No.	Socio economic Category	Itinerant merchants	Whole sellers	Village traders	Total
1	Marginal	11 (61.11)	2 (11.11)	5 (27.78)	18 (100.00)
2	Small	1 (25.00)	—	3 (75.00)	4 (100.00)
	Total	12 (54.54)	2 (9.09)	8 (36.66)	22 (100.00)

Figures in parentheses indicates percentage to total.

Marketing Channel for litchi in Sonitpur District

As litchi is a horticulture crop which is perishable in nature, it needs to be consume within very less time from the day of its plucking. The litchi growers get very less time for marketing or for selling the produce. So, they take the assistance of the marketing channel in which it helps them to sell their produce. The existing marketing channel has been figured in Fig. 2.

In the Fig. 2 it is shown about the existing marketing channel of litchi which is adopted in the Sonitpur district of Assam. The farmers engaged in litchi production sometimes do not takes the help of the intermediaries in which they sell the produces directly to the consumers. But usually as self

markets and self selling is difficult for the farmers, so they take the assistance of the intermediaries. As an intermediary the village trader and itinerant merchant role comes into play.

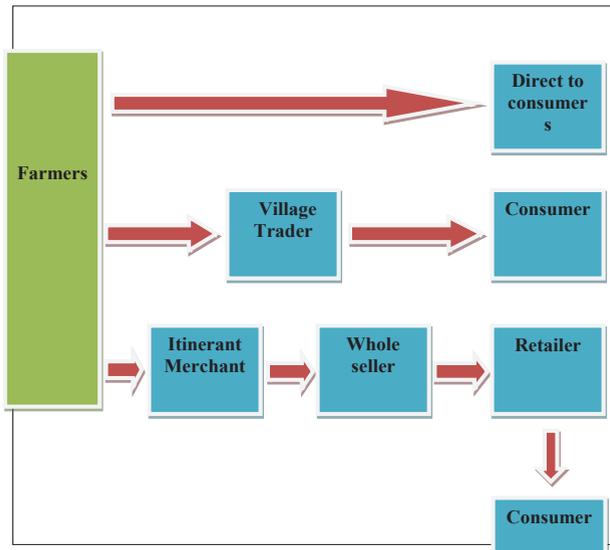


Fig. 2: Litchi Market channel of Sonitpur District

Sometimes, the farmers sell their produce to the village trader who procures the produce and sell it to the nearby village market. But most of the time as the produces has to be sold in distance market, so the itinerant merchant takes the responsibility to sell it. The itinerant merchant takes the produces from the farmers and sells it to the whole sellers. The whole sellers sell it to the retailers and from the retailers the ultimate consumer buys it for consumption.

Analysis of the respondents

Respondents basically farmers of two socio economic groups has been interviewed with a set of five questions for responses on five point likert scale. Following questions related to supply chain of litchi were asked during interviewed.

- Q1. The level of integration with growers and the company (Food processing)
- Q2. Growers integration with intermediaries
- Q3. The information exchange and the participation of the growers in the firm’s business?
- Q4. Level of partnership and the procurement process is just above the middle point?
- Q5. Level of loss of litchi due to delay of supply.

The responses of the litchi farmers were sought on five point scale that is 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. The association of responses on above statements with holding size an and independent variable were analysed using scattered plot and the results obtained is present in Fig. 3.

The Fig. 3 explains the mean of responses given by the farmers respective to operational holding. Out of 5 responses, the concentration of observation lies between 4 & 5. Further it is observed that the small farmers were more consistent in opinion on the statements as compared to marginal farmers. Further, most of the farmers were strongly agreed upon the level of loss of litchi due to delay of supply. Hence, proper development of supply chain is essential for avoiding physical and monitory of litchi.

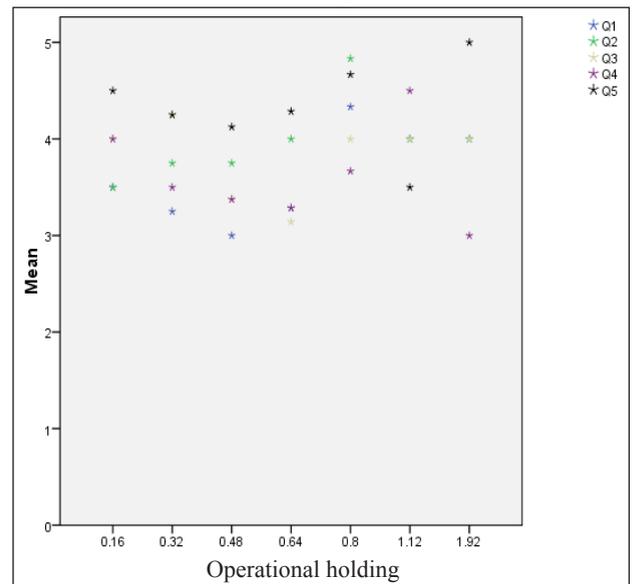


Fig. 3: Analysis of the respondents

Based on the observation and discussion among farmers, Itinerant Merchant, Whole seller Retailer, consumer and findings of the study a conceptual supply chain model can be proposed which may help in development of supply chain in the study area is proposed in Fig. 4.

It is clearly understood that the supply chain management of litchi starts from the litchi growers. In the process the litchi growers sell the produce to the village level big growers, cooperatives or to the SHGs in which the concerned parties purchase the litchi from the farmers and store the

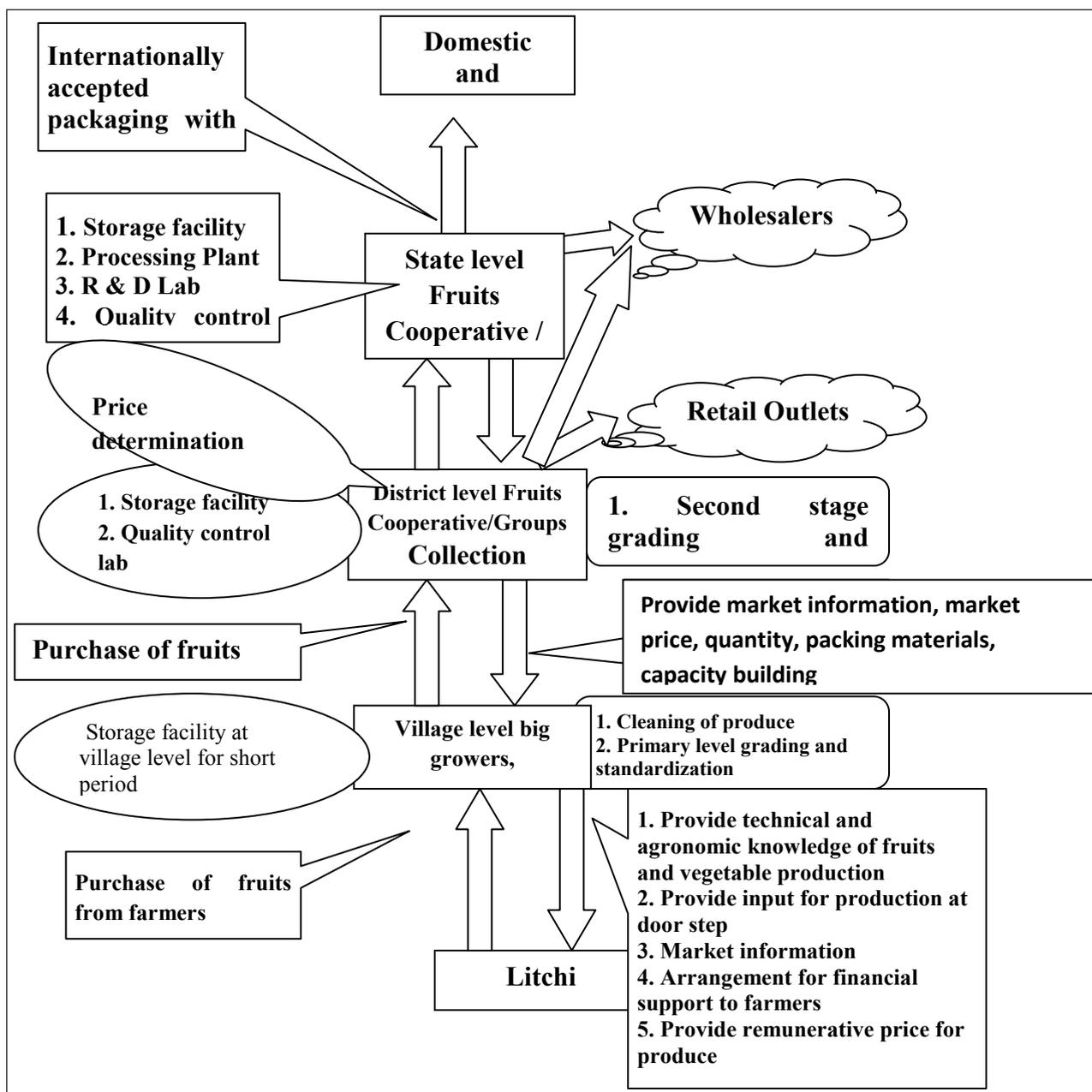


Fig. 4: Proposed Conceptual framework of supply chain model for Litchi

produce at village level for shorter period. After that the products are sold to the district level fruits cooperative or to the group collection centre where determination of price and testing of quality is done. After village level the produces goes to the state level fruits cooperative where the produces are dispatch for processing to the processing plant and coordination with other department takes place. From district level onwards the produces goes to the whole sellers and retailers to sell it to the ultimate consumer. In the state level itself the certification, specification or final grading of the produces is

done as a process of exporting the produces to other countries. Most of the time from the state level, after processing of the fruits the processed products comes back to the district level and also to the growers as finished products.

CONCLUSION

This research article focused on production and distribution of Litchi in Sonitpur District of Assam. Most of the litchi growers belong to marginal (83.10%) and small (16.90%) category and their shares in total number of plants were 73.82%

and 26.17%, respectively. Hence involvements of marginal farmers are more in Litchi plantation as compared to other category of farmers. It may be because manpower availability for the management of litchi orchard. Major share (66.66%) of produce traded through market intermediaries. However, 33.34% of farmers were found to be direct selling in local market. Through data analysis it is evident that farmers are very much suffering due to wastage of litchi throughout the intermittent steps in existing supply chain of litchi. The development of appropriate model for supply chain may help in reducing wastages as well as better outcome to the stakeholders of Litchi supply chain in study area.

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