LITCHI PRODUCTION MARKETING AND PROCESSING IN BIHAR AND INDIA

Brajesh Jha

Ranjan Sinha

Research Assistance

Vivek Pal

Ghanshyam Pandey

Executive Summary

Study sponsored by

Ministry of Agriculture and Farmers Welfare
Agricultural Economics Research Unit

Institute of Economic Growth
University of Delhi Enclave (North)
Delhi- 110007

December 2017

Litchi Production, Marketing and Processing in Bihar and India

India home to wide variety of fruits holds a unique place in term of fresh fruit production. Among the tropical and sub-tropical fruits, litchi is one of the most delicate fruit with short duration. World litchi production is estimated to be around 2.11 million tons, with more than 95 per cent of the area and production in Asia. The top five world litchi producing countries are China, India, Taiwan, Thailand and Vietnam. In 2014, India's contribution in the world production of litchi was 24 per cent; it was preceded by China (57 per cent) and followed by Vietnam, Madagascar and Thailand. While the most of litchi produced in China and India is consumed domestically, Vietnam exports up to 40 per cent of its production. However India can offer market for a longer period as it matures in different producing states (Tripura, Assam, Bengal, Bihar, Jharkhand, Uttaranchal, and North Punjab) in different period. The gaps in infrastructure however cause huge loss and inefficiency in the post harvest operation of litchi. Processing often associated with perishable fruit with short duration is a labour intensive proposition that can generates huge employment opportunities, however processing facilities in litchi are grossly inadequate.

The assessment of gap in infrastructure requires analysis of supply chain of litchi production and processing. Therefore the present study coordinated with Agro-Economic Research Centre in Bhagalpur has following objectives:

i. To analyze temporal growth in area, production and productivity of litchi in important states of India
ii. To assess exports potential of litchi from India
iii. To understand efficiency in the post harvest operations of litchi in different marketing channels.
iv. To identify constraints in efficient production, marketing and processing of litchi

Findings on Production and Exports of Litchi

Area, production and productivity of litchi have increased during the reference period (1991-92 to 2013-14). The growth in litchi production during the period (1991-92 to 2013-14) has three distinct phases with break in the year 1997-98 and 2005-06 (Apdx. Table 1). In the Phase I (1991-92 to 1997-98) production and yield of litchi grew at a rate of 10.95 and 8.29 per cent respectively. In the subsequent period (1998-99 to 2004-05), production and yield of litchi declined; though area under litchi continues to increase (1.10 per cent). In the Phase III (2005-06 to 2013-14) the increasing trend in area under litchi continues to increase (3.65 per cent). The CAGR in yield and production were also positive during the period. Among different

litchi producing states, Bihar accounted for the largest share in area (37-53 percent) and production (40-78 percent) in all periods; though productivity has declined in the state during the same period. The productivity of litchi has increased significantly in the states of Assam, Punjab and West Bengal.

With the help of additive decomposition model the relative contribution of area, productivity and their interaction in the change in production between 1991-92 and 2013-14 have been estimated in major litchi producing states of india includinng the country. The same is presented below as equation 1 to 6.

India = 30.31 (Yield effect) + 50.07 (Area effect) + 21.46 (Intraction) ---------- (1)

Assam = 64.74 (Yield effect) + 11.71 (Area effect) + 23.04 (Intraction) --------- (2)

Bihar = -115.44 (Yield effect) + 287.22 (Area effect) - 74.68 (Intraction)-------- (3)

Punjab = 73.48(Yield effect) + 10.40 (Area effect) + 15.78 (Intraction) ---------- (4)

Tripura = 385.59 (Yield effect) – 26.40 (Area effect) – 259.55 (Intraction)------- (5)

West Bengal = 23.08 (Yield effect) + 33.98 (Area effect) + 42.97(Intraction)---- (6)

The equations shows that in the states like Assam, Punjab and Tripura yield has major contribution in the change in litchi production. However, area effect in litchi production is the highest in Bihar, followed by WB, Assam and Punjab. Whereas, at country level around 50 per cent of increase in total production has been due to change in area and 30 per cent due to change in the yield of litchi during the reference period (1991-2014).

Historically, India has been the biggest exporters of litchi. In the past two decades export of litchi increased (with some fluctuations) from 1993-94 and it reached maximum during 2006-07. Subsequently in the last phase (Phase III, 2005-06 to 2013-14) exports started decreasing. Exports basket of litchi has changed significantly from the high unit valued countries (Saudi Arabia, France, United States, Bahrain, Kuwait) to the low unit valued countries (Bangladesh, Nepal, Kuwait). Incidentally exports of litchi have been elastic (15 out of 19 yrs) to unit value of exports from India. Some desired analysis for litchi at international level could not be undertaken as separate trade statistics (litchi part of fresh fruit) for litchi is not available. Some reasons for present state of exports of litchi were increase in domestic demand, lack of initiative for export facilities, high perishability and non-acceptability of sulphitation (process for prolonging freshness of litchi) in international market.

Findings on Price, Perishability and Supply Chain of Litchi

There are different stages of litchi production: inflorescence, flowering, fruit bearing and maturity. In Bihar period between inflorescence and flowering usually comes during the month of February-March. Primary survey found that around 3-9 per cent of litchi is spoiled during the period and more of spoilage happens due to biotic stress. In the second period between flowering and fruit bearing stage, the larger volume of production is lost (2 to 11 per cent) due to abiotic stress like heat waves and winds (Easterly winds). In the third period between fruit bearing and maturity stage (in the month of May), abiotic factors like long stretch of westerly winds among others are the main factor for perishability (6 to 8.25 percent) of fruit. Thus abiotic stress like heat waves and winds are major reasons for spoilage of litchi on field. The wastage of litchi in the post harvest operation varies between 16.25 to 19.50 per cent as seen in sample districts. This was due to low shelf-life of fruits, inadequate post harvest infrastructure.

Unlike other agricultural produce marketed surplus of litchi is quite high (75 per cent of litchi produced). The marketing of litchi from producers to consumers takes different routes (Apdx. Box I). Farmer's share in consumer's expenditure for litchi depends on the length of route, market functionaries involved and similar other factors. The primary information shows that four of such routes (Channel I to IV) are for alternate domestic markets, one is for external market (Channel V) and two for processing of litchi (Channel VI and VII). In the marketing of litchi, pre-harvest contractors (PHCs) are very important and with alteration of market channels their role varies in production and marketing of litchi. Around 86 percent of litchi produced in sample districts is marketed through the PHCs.

The PHC is absent in one such marketing channel and interestingly growers' share in consumer's expenditure has been the maximum (50%) in this market channel. This requires high involvement of producers in marketing of litchi, but only around 10 percent of litchi is sold through this channel. The marketing of litchi is dominated (43 percent) by the channel wherein producer's share in consumer's rupees is minimal (around 25 percent). The dominance of PHC despite poor gain to growers, suggests about weak involvement of growers in litchi trade. This infact indicates presence of 'absent landlord' in litchi orchard.

Again producer's share in the consumer's rupee for litchi was good in the channel catering to exports, but exports are more about 'A' grade of litchi. The exports of litchi are also decreasing. The inferior quality (B and C grade) of litchi are generally processed, producers' share in the processors' expenditure for litchi was also good; however, less than 5 per cent of total marketable surplus in sample districts undertook this route. Nevertheless location of processing industry is highly skewed.

To measure market efficiency different ratios exist; these are about differential treatment of producer's price, marketing cost, marketing margin and consumer's price in the ratio. The method suggested by Acharya and Agarwal also considers loss of litchi in the process of marketing. Alternate methods of market efficiency were worked out for litchi.

Price of litchi in the wholesale market of Delhi is available in kilogram; whereas, it is the number of pieces in the growing region. The PHCs in the most cases purchase litchi on the basis of fruit laden trees in the orchard. Thus price of litchi for PHC is approximation of number of litchi in plants and the orchard. Litchi is available in Delhi's market from May to July as produce from Bihar, Uttarakhand and Punjab reaches to Delhi and harvesting period in each of these states graduates marginally. In the wholesale market (Azadpur) of Delhi, prices are determined by closed-auction The margin in the wholesale and retail market varies during the marketing period (May-July). The downward rigidity of retail price in season of abundance was observed in primary survey. The high margin at retail market is due to high waste of fruits at the level of vendors.

Constraints on Production, Marketing and Processing of Litchi

According to Garret the first rank constraint in production of litchi in sample households were wide fluctuation in temperature followed by lack of quality manure/fertilizer/bio-fertilizer, quality insecticide/pesticide, older litchi plants and complexities in availing government facilities including credit. The top constraint in marketing of litchi was dominance of middlemen PHCs and their 'far from perfect' behavior (ranging from monopoly to duopoly). This was accompanied with absence of big market, lack of transparency, high transportation cost, insufficient cold storage and pack houses, dearth of litchi producers' associations in Bihar (unlike Uttarakhand) and similar other factors.

Though litchi is highly perishable, it has limited processing capacity in Bihar and distribution of same is highly skewed. The constraints experienced by sample processors pertain to production, marketing and infrastructure aspects of litchi. These were lack of climate resistant varieties, inadequate knowledge for use of non-eatable parts of litchi, lack of cold-chains at major points (airport or railway stations)**,** absence of information network to keep track of raw material prices and its availability for processing.

The infrastructural bottleneck for limited processing units of litchi are many, some examples are low supply of electricity (average 10 hrs.), supply with low voltage, high hiring charge for reefer van, lack of temperature controlled pack houses, lack of trained labour, technicians and chemists, The other constraints are difficulties in assessing policy benefits due to procedural bottlenecks, reducing amount of subsidy on reefer van, non-availability of variety of horticultural produce in the region to run factories round the year.

In view of the above findings on dominance of PHCs in production and marketing of litchi, the low share of litchi growers in consumers' price, increase in area despite decrease in productivity of litchi in Bihar, low and skewed investment in processing of litchi and decreasing exports of litchi; there is sufficient scope of intervention in production, marketing and processing of litchi.

Suggestions and Policy Direction

The suggestions and policy recommendations pertain to removing the above constraints in production and marketing of litchi. It may ranges from commodity specific research institute in Ministry of Agriculture and Farmers Welfare to Division of MSME and APEDA in different Ministries of Government of India and other stakeholders of litchi in India and Bihar. The suggestions specific to litchi are in following sub-heads.

The 'absent landlord' and dominance of PHC

In many areas including Bihar farm land are too small to provide livelihood throughout the year, therefore farmers leave their land and move to urban places for better livelihood and facilities. The frequency of such 'absent landlord' is high. The land owner away to distant places has to depend on share croppers / tenant for cultivation of seasonal crops. Tenants / share croppers are often associated with dangers of loosing land therefore area under orchards is on rise. Litchi is increasingly preferred over mango and similar other fruits, since harvesting period of litchi is short and this perfectly coincide with the period of summer vacation in institutions of East India. On account of such conveniences area under litchi is on rise despite decrease in productivity of litchi. For 'absent landlords', security of land is more important than gain from litchi orchards.[1]

The arrangement of growers with PHC however does not require any written agreement and unlike tenancy system this has not yet attracted researchers and policy makers' attention[2]. However, any development policy for litchi must recognize presence of 'absent landlord' and importance of PHC in production and marketing of litchi in Bihar and India. One of the important externality of 'absent landlord' is old orchards and decrease in productivity of litchi. The PHCs should help orchard owners in adoption of many productivity enhancing practices in the litchi orchards. Some examples are trimming and pruning of plants, removal of weeds,

[1] Considering volatility in asset (gold) prices, land is increasingly considered as a mean of security for generations (present and future).

[2] Attention is in the sense of reports, laws and documents against the arrangement of tenancy. The present law in Bihar for land tenancy barred ordinary people to provide land on tenancy. This was upheld and even stringent rule for the use of land under tenancy was suggested by various experts and committees. Reference: Report of the Expert Committee on Land Leasing, Niti Ayog, GOI, March 2017.

treatment of orchard with compost, organic manures and bio-pesticides. They may help orchard owners in rejuvenation of old orchards.

Presence of Producers' Group

With the increased number of small holdings and relatively higher marketed surplus of production of litchi, one or other form of collectives becomes important. Limited number of producers' groups for litchi exists. The agricultural officials, extension service providers must encourage formation of producer's group or collective (as it is in Uttarakhand). The 'producers group' must campaign to make farmers aware of prices in distant market, specifications (as provided by APEDA) of products of different grade (A, B & C) of litchi. The producers group should also be aware of international quality specifications (HACCP) for litchi[3] and upgrade skill for better sorting, grading, packaging in post-harvest management.

The higher unit value for exports can be obtained by exporting organic litchi to niche markets (developed countries). Infact most of cultivation of litchi in Tripura and Assam is without fertilizers, farmers and producers group should be aware of its importance and certificate of an agency will facilitate its production and marketing. Union government in the recent budget (2018-19) has also announced multiple facilities for producers' organizations / companies. They can step in creating better market infrastructure for litchi.

Infrastructure for Marketing and Processing of Litchi

The market infrastructure for litchi consist of pack houses with pre-cooling chambers at production clusters (ensures cooling within 5-6 hours of harvest), cold chain, reefer vans, specialized fumigation chamber in producing areas. Since litchi occupies an important place in some districts, a collective like 'Litchi Hub' is suggested for creation of suitable infrastructure facilities. Incidentally there are Agri Export Zones in litchi growing areas (including Bihar) but there is deficiency of infrastructure facilities as that of a Common Facility Centre (CFC).

A profitable post harvest infrastructure also requires availability of adequate electricity in the concerned hub. To promote domestic trade of litchi, one or two bogies from certain litchi growing railway stations may be attached to train destined towards major consumer centres like Delhi, Mumbai. To harness higher unit value of litchi exports to Europe and similar developed country, air transport of good quality of litchi (organic) may be subsidized.

Litchi is highly perishable but this does not attract investment since invested capital remains useless for the large part of year (litchi processing is for few months only), supply of electricity is often discontinuous. Investment of processing in organized sector are generally compatible

[3] Farmers group should be aware of the process of extending life of litchi harvested; for example sulphitation is not accepted at international levels.

to Hazard Analysis and Critical Control System (HACCP), Sanitary and Phytosanitary Standards (SPS) and TQM norms; however this is not the case of processing facilities in unorganized sector and their activity shatters confidence of produce in national and international markets. Technical efficiency of these units needs to be improved.[4] These units may be encouraged to follow the HACCP, SPS and TQM standards. The processing activity at village level should be recorded, monitored and certified by a designated body (semi-government with producer group), so that it can be part of the larger value chain.

Considering perishability of litchi and poor economics of processing the litchi processing needs incentives. The incentive to litchi processing can be in the form of tax holidays for investment in litchi processing and creation of post harvest infrastructures (like reefer vans, pack houses). The Union budget 2018-19 has provided some benefit to MSME sector, hope this includes processing and post harvest infrastructure for litchi. The investment for tetra pack units (TPUs) may be promoted by subsidizing it around litchi growing areas like Muzaffarpur and Vaishali for supply of litchi concentrates to distant regions like Jaipur, Pune and Mumbai.

Institutions and Facilities related to Litchi

One of the important reason for decreasing productivity of litchi is the climate sensitivity of crop, deterioration in quality i.e., size of seed versus pulp in fruit. Nevertheless certain varieties of litchi continue to dominate over generations (more than 70 yrs) and we know dangers of growing old varieties.[5] Inspite of these challenges there is hardly any improvement in varieties and planting materials, though large germplasm of litchi are reported to exist in the country. The study advocates for increase in productivity of litchi with improvement of cultivars through traditional and modern tools (bio-tech, bio-informatics, genetic engineering).

The institutes concerned with litchi may look into use of parts other than pulp. Infact, there is evidence of use of seeds of litchi. The commodity specific institutes may organize periodical training for skill upgradation of local technicians/chemists in litchi producing and processing areas. The commodity specific institute of ICAR, Plant Genetic Resource Institute, and similar other institute/ organizations (APEDA) must address concerns related to litchi. They may take lead role in increasing productivity and developing domestic and external market of litchi.

There are institutions responsible for marketing, logistics and processing of litchi. They should provide extension services so that people dealing with post harvest operation of litchi know the best way to handle it. On a similar line technology for alternate storage (CA and MA) must be

[4] The technology for litchi processing may be developed to the extent of increasing its possible use for processing other fruits grown in the region.

[5] The old varieties often attract disease (like rust for litchi) and pest.

standardized. The facilitative institutions related to litchi (AEZs / CFCs) may be provided with a laboratory for residue analysis.

Production marketing and processing of litchi involves some government facilities. Transaction costs in availing some of these facilities are often high. The success stories at various levels (farmers, PHCs, traders, processors) should be documented to evoke a sense of pride within the stakeholders. Adoption of suggestions mentioned above may reverse the existing trend in litchi. There are some public sector institutions to promote production and marketing of litchi but the quality of their functioning is an important question to investigate?

Apdx. Table 1. Major Litchi Producing States and Districts in India

State	Districts
Assam	Dibrugarh, Goalpara, Sonitpur, Lakhimpur, Jorhat, Golaghat, Kamrup, Nalbari, Barpeta, Bongaigaon, Nagaon
West Bengal	Mushirdabad, 24- Parganas, Nadia, 24- Parganas South Malda, Uttar Dinajpur, Dakshin Dinajpur, Hoogli
Uttarakhand	Udham Singh Nagar, Champawat, Nainital, Dehradun, Tehri Garhwal, Pauri Garhwal, Haridwar
Bihar	Muzaffarpur, Vaishali, East Champaran, West Champaran, Sitamarhi, Sheohar, Samastipur, Bhagalpur
Chhattisgarh	Korba, Raigarh, Surguja, Jashpur, Surajpur, Balrampur, Koriya, Narayanpur
Tripura	West Tripura, North Tripura, South Tripura, Dhalai Tripura
Himachal Pradesh	Kangra (Palampur, Panchrukhi, Dharmshala), Sirmour (Paonta Sahib, Dhaula kuan)
Jharkhand	Ramgarh, Ranchi, Hazaribagh, Gumla
Odisha	Sambalpur, Debagarh (Deogarh), Sundergarh, Rayagada, Koraput
Punjab	Pathankot, Gurudaspur, Hoshiarpur

Source: Directorate of Horticulture of different states and APEDA, Ministry of Commerce & Industry, Govt. of India

Apdx. Table 2. Litchi Producing Districts in Bihar according to Groups of Area and Production

SN	Area (ha)	Production (MT)	Districts
1.	More than 1,300	More than 10,000	Muzaffarpur, Vaishali, Sitamarhi, East Champaran, West Champaran, Katihar
2.	600 - 1,300	5,000 – 10,000	Samastipur, Purnea, Siwan, Gopalganj, Saran, Sheohar, Darbhanga, Madhubani
3.	100 – 600	1,000 – 5,000	Begusarai, Bhagalpur, Saharsa, Araria, Kishanganj, Khagaria, Munger, Jamui, Madhepur, Supaul
4.	Less than 100	Less than 1,000	Sheikhpura, Lakhisarai, Banka

Source: AERC, Bhagalpur * 1 Ton = 1 MT = 1000 kg

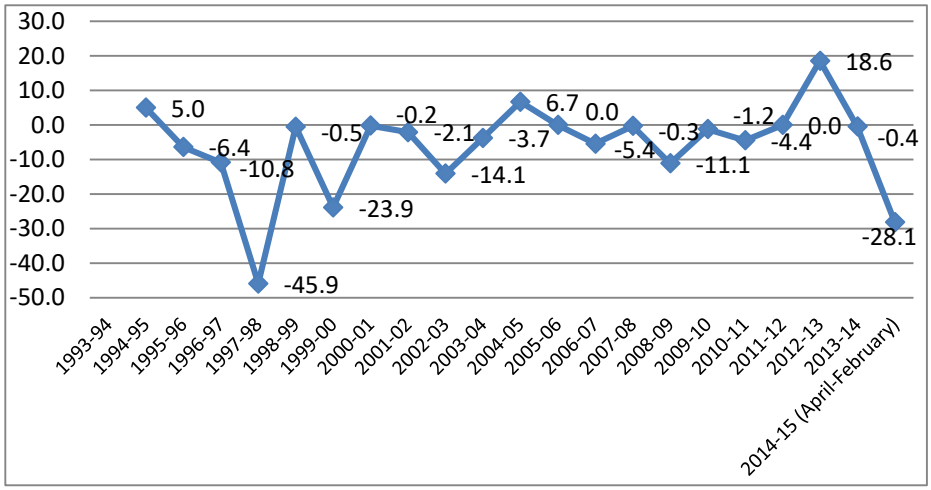
Apdx. Table 3. Phase-wise Growth and Instability of Litchi at the National Level

(Area '000 ha; production '000 tons; Yield ton/ha)

Phase		Mean	SD	CV	CAGR	Instability Indices (%)	
						Ratio method	CDV index
Phase I 1991-92 to 1997-98	**Area**	53.20	3.60	6.77	2.69	9.41	6.46
	Production	335.46	72.22	21.53	10.95	6.49	4.29
	Yield	6.30	1.28	20.27	8.29	9.44	5.62
Phase II 1998-99 to 2004-05	**Area**	56.01	2.42	4.33	1.10	7.19	4.23
	Production	421.93	47.69	11.30	-2.49	18.62	11.29
	Yield	7.56	1.13	14.93	-3.60	25.44	14.89
Phase III 2005-06 to 2013-14	**Area**	74.32	7.60	10.23	3.65	1.32	0.93
	Production	479.99	75.44	15.72	5.14	4.27	3.20
	Yield	6.44	0.39	6.07	1.53	4.34	3.17
All phases 1991-92 to 2013-14	**Area**	62.32	11.15	17.88	2.46	6.05	7.78
	Production	418.33	88.64	21.19	4.06	11.30	11.74
	Yield	6.74	1.08	15.96	1.63	14.23	15.80

Source: Calculated from Horticulture Crops Estimates, NHB, MoA&FW, Government of India

Apdx. Figure 1. Elasticity of Exports to unit Price of Litchi from India



Apdx. Box I. Some Marketing Channels for litchi in Bihar

Channel I: Growers—Preharvest Contractor (PHC)--Wholesale Buyers--Retail Traders--Consumers (G-PHC-WB-RT-C)

Channel II: Growers--Wholesale Buyers--Retail Traders--Consumer (G-WB-RT-C)

Channel III: Growers--PHC--Wholesale Buyers (Through commission agent, CA)--Retail Traders--Consumer (G-PHC-WB-RT-C)

Channel IV: Growers--PHC--Commission Agents--Retail Traders--Consumer (G-PHC-CA-RT-C)

Channel V: Growers--PHC--Middlemen--Export Merchants (G-PHC-MM-EM)

Channel VI: Growers---PHC---Processing Industry (G-PHC-PI)

Channel VII: Growers---Processing Industry (G-PI)

Table 4a. Efficiency of different Marketing Channels in Litchi

(In Rs. per '000 pieces of Litchi)

SN	**Particulars**	**Channel - I**	**Channel - II**	**Channel - III**	**Channel - IV**
1.	Retailer's sale price or consumer's purchase price (Pc)	900.00	886.00	756.80	829.00
2.	Total marketing costs (MC)	159.00 (17.67)	160.60 (18.13)	175.00 (23.12)	178.00 (21.48)
3.	Total margins of intermediaries (MM)	503.50 (55.94)	277.65 (31.34)	316.80 (41.87)	289.25 (34.89)
4.	Net price received by producers (FP)	237.50 (26.39)	447.75 (50.54)	265.00 (35.02)	361.75 (43.64)
5	Total loss in value of litchi (TL)	100.45	117.77	90.21	105.14
6.	Value added, VA (1-4)	662.50	438.25	491.80	467.25
7	Producers share in consumer INR in percent, (4/1)	26.38	50.54	35.02	43.64
8.	Index of Marketing Efficiency				
a.	Traditional method, (TMEI) (3/2)	3.17	1.73	1.81	1.63
b.	Shepherd's method (SMEI) (1/2)	5.66	5.52	4.32	4.66
c.	Modified Marketing Efficiency (MMEI) , (6/2)	4.17	2.73	2.81	2.63
d.	Acharya's method (4/{2+3+5}) (AMEI)	0.35	0.81	0.46	0.63

Note: Figures in parentheses are percent of items in the retail price of litchi. Value of loss is part of retailers' price and marketing cost of litchi. Source: Calculated from primary data.

Table 4b. Efficiency of different Marketing channels in Litchi

(In Rs. per '000 pieces of Litchi)

SN	**Particulars**	**Channel - V**	**Channel - VI**	**Channel - VII**
1.	Retailer's sale price or consumer's purchase price (Pc)	638	322	239
2.	Total marketing costs (MC)	115 (18.01)	165 (51.34)	148 (61.92)
3.	Total margins of intermediaries (MM)	302 (47.33)	168 (52.17)	0
4.	Net price received by producers (FP)	448	232	239
5	Total loss in value of litchi (TL)	95.5	48.9	42.2
6.	Value added, VA (1-4)	190	90	0
7	Producers share in consumer INR in percent, (4/1)	70.2	72.1	100
8.	Index of Marketing Efficiency			
a.	Traditional method, (TME) (3/2)	2.62	1.02	0
b.	Shepherd's method (SME) (1/2)	5.55	1.95	1.62
c.	Modified Marketing Efficiency (MME) , (6/2)	1.65	0.54	0
d.	Acharya's method (4/{2+3+5}) (AME)	0.87	0.61	1.25

Note: Figures in parentheses are percent of items in retail price of litchi. Value of loss is the part of retailers' price and marketing cost. Source: Calculated from primary data.