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Marketing efficiency of vegetables in developing economies: Evidences for critical intervention from Rajasthan, India

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ABSTRACT

The purpose of the study is to identify the marketing channels, the relative profitability, and marketing efficiency of vegetables in a developing country, India, and identify points for critical intervention. The study uses field level data collected from farmers who cultivate carrot and tomato. Farm level data was collected from 240 farmers, 60 wholesalers (traders/contractors) and 60 retailers. Farmer's share in consumer's rupee is about 25% in carrot and 41% in tomato. The marketing efficiency index in prominent channels of 0.33 in carrot and 0.71 in tomato is quite low. The most common and important constraint is the non-adherence of traders with the prescribed auction system leading to lower price realisation to the farmers, followed by excessive deductions from value realised. Suggestions are provided to enhance marketing efficiency.

Key words: Group marketing, Infrastructure, Marketing cost, Marketing efficiency, Price spread

Marketing of fruits, vegetables and other horticultural crops in Rajasthan differs significantly from marketing of food grains. Vegetables are bulky, perishable and mostly seasonal in nature, and therefore needs infrastructure that addresses these concerns. The handling and transportation of the vegetables are difficult and warrants high costs of transportation, besides incurring heavy post-harvest losses. Vegetables, being seasonal, are subjected to high price variability, leading to income fluctuation of farmers. To overcome this, development of processing industries, cold storage facility and development of suitable crop varieties are attempted. The price spread along the marketing channel is directly proportional to the number of market intermediaries involved (Gupta and Rathore 1998).

The marketing channels have evolved over time in response to these concerns. For example, pre-harvest contracting is dominant method of marketing, mainly in fruits, wherein the prices are fixed in advance for a lot of crops, which includes coverage of risks (Sudha and Froukje 2006). The loss due to weather changes, pest and diseases and market price volatility are supposed to be factored in by the contractor at the time of entering into the contracts. Direct marketing of the produce from the farm to the consumer has emerged at many places. Rytu Bazars is one such concept which entails that the farm produces are directly sold by the farmers to the consumers, thereby avoiding the middlemen who apportion much of the benefits. Chengappa (2001) noted that to keep pace with the expanding and changing needs of agricultural marketing sector on one hand and to remove marketing imperfections on the other, series of reforms are carried out time to time. One of the major strategies is establishing orderly marketing systems. The establishment of regulated markets in many states is one such measure, where the government intervened in the market operations.

The regulated markets have made drastic impact on the marketing practices in India in terms of reducing multiple charges levied on producers, introducing system of price fixation and payment and providing market infrastructure. But lately it has acquired several disadvantages rendering it not in sync with the times, like being restrictive and imparting oligopolistic elements. There were several attempts to overcome these deficiencies by invoking direct marketing. *Apni Mandis* in Punjab and Haryana, *Rythu Bazars* in Andhra Pradesh (AP) and *Uzahvar Santhaigal* in Tamil Nadu (TN) are few examples in that direction. Kumari *et al*. (2008) noted that agricultural marketing through *Rytu Bazaars* needs further strengthening as it paves the way for 'inclusive growth'. Another noticeable change is the large presence of private companies in agribusiness, mostly in sourcing agricultural produces. Companies like Cargill India, Mahindra, ITC-e Choupal and Bharti also emerged

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with sophisticated supply chain management systems and vertical coordination. Contract farming also has emerged as an effective institutional mechanism to reduce risk of farmers and to ensure timely supply of raw inputs to industry. Among the success stories in many instances, the contract farming faces several lacunae also.

The vegetables are sold either in regulated market or special procurement stalls established by traders during peak production season. A vegetable farmer has to dispose the produce at the prevailing price in the market, due to the immediate cash requirement and lack of accessibility to cold storage facilities. The single most element of perishability of the produce leads the farmer to dispose the produce, often at a low price. On the other hand, the consumers who source the produce from the vendors, mainly in the cities, have to pay high prices, on account of existence of a multitude of intermediaries.

Several studies have shown inefficiencies in marketing of perishables (Bansal 1994; Bhatia 1994; Sudha and Gajanana 2001). Raju and Rao (1993) and Kumar (2004) mainly focused on the issues faced by the traditional marketing channels, and identified several constraints. In the globalised world, remaining competitive is a daunting task for farming community. In the context, the farming as a profession has to shed its hue of backwardness and have to mainstream. The reforms in supply chain would form a major component of reform and agent of such a change. However, such an attempt is fraught several impediments. Galanopoulos *et al*. (2009) found that Mediterranean countries are traditional growers of fruit and vegetables, but are struggling to remain competitive in the global market. Linking the domestic market with the export sector has also been highlighted as a strategy to impart greater benefits to the farming community. In case of Kenya, Linne *et al* (2005) noticed the positive role of export system in improving the agricultural sector. In African context, the role of export sector is found to be positive in improving the efficiency, growth and economic value of domestic vegetable marketing systems (Lenné and Ward 2010). However, the export of vegetables from India is limited to a few crops. Development of modern sector like supermarkets and linking farmers with them are found to be one important step to revolutionise the agricultural marketing system in India and for other developing countries (Reardon and Hopkins 2006; Reardon and Mintern 2011).

In this background, the present paper analyses the financial profitability of vegetable production and the marketing channels in the supply chain. Also it estimates the marketing efficiency of different supply chains for important vegetable crops, viz. carrot and tomato in Rajasthan.

MATERIALS AND METHODS

The present study was conducted in Jaipur and Sriganganagar districts of Rajasthan. These districts were selected purposively based on large area under the selected vegetable crops. Multistage stratified random sampling technique was adopted for selection of tehsils, villages and farmers. For carrot, Sriganganagar tehsil in Sriganganagar district and for tomato, Chomu tehsil in Jaipur district was selected as both the districts had largest area as well as well-established market system for carrot and tomato, respectively. Sample size was 120 farmers for each crop. Information was also collected from 30 wholesalers (traders/ contractors) and 30 retailers for each of the crop studied. The total no. of carrot wholesalers in Sriganganagar and tomato wholesalers in Jaipur district were 48 and 80, respectively. The wholesale markets studied for tomato were Jaipur, Chomu while Sriganaganagr was selected for carrot marketing. The retail price data for tomato and carrot were collected from retailers operating at various locations in Jaipur and Sriganganagar district, respectively. The data related to production, constraints, sale, marketing system were collected during 2009-11. Information was also collected on price and marketing cost at different stages and marketing margin.

Analytical tools

Tabular analysis was used to measure the marketing margins, marketing cost, price spread and marketing efficiency. Estimates of producers' share in consumers rupee was worked out, using the formula suggested by Acharya and Agarwal (2005), as follows:

$$P_S = (P_F / P_C) * 100$$

where P_F = Price of produce received by farmer, Pc = Price of produce paid by consumer

Marketing efficiency

It was calculated using both Shepherd and Acharya's Modified Marketing Efficiency as follows:

Shepherd Formula

$$E = (O/I)*100$$

where, E is index of marketing efficiency, O is value added by the marketing system, I is 'cost + margin' of market intermediaries.

Acharya's Modified Marketing Efficiency (MME),

$$MME = FP/ (MC+MM)$$

where, MME is modified measure of marketing efficiency, FP is price received by farmers, MC is marketing cost, MM is marketing margin.

Factors affecting marketing efficiency

Multiple linear regression analysis with following variables was carried out to estimate marketing efficiency:

$$Y= f (x_1,\ldots\ldots\ldots x_n)$$

where, Y = Marketing efficiency (%), x_1= Marketing cost (₹), x_2= Marketing margin (₹), x_3= Open market price (₹), x_4= Volume of produce handled (kg), x_5= Length of the market channel (No. of market intermediaries).

The marketing cost involves all the expenditure involved in getting the produce weighed, entry fee and charges for traders. The regulated markets usually have

higher marketing charges, which are generally used for developing the markets. Those markets which are regulated, have prescribed norms about the charges to be levied under various heads. However, the unregulated markets do have a different system, where market imperfections are rampant. Marketing cost as a share to consumers' price is high in unregulated markets. In that background a negative sign is hypothesised for the variable. The marketing margin increases the consumers' price and thereby reduces the marketing efficiency. Operation of a large number of intermediaries is one prime reason behind high marketing cost. On the above premise, a negative sign is anticipated for the variable. The impact of higher open market price on the marketing efficiency is rather relatively unexplored. It can be presumed that higher open market prices compel farmers to choose the channel with better marketing efficiency. In that backdrop, a positive sign is expected for this variable. The higher share of the produce being handled indicates the power the farmers hold over the trader in fixing the price, and serves an indicator of bargaining power. Larger farmer in general have higher bargaining power. Marketed surplus is generally higher with large holders and therefore, it is hypothesised that the higher the quantity supplied by a farmer, higher the marketing efficiency. The length of the marketing channel is hypothesised to have a negative sign on the marketing efficiency,

Constraint analysis

Constraints perceived by the farmers/wholesalers/ retailers were analysed using Garrett ranking technique-

$$\text{Percent position} = \frac{100\ (\text{Rij} - 0.50)}{\text{Nj}}$$

where, Rij is the rank given for i^{th} item by j^{th} individual, Nj is the number of items ranked by the j^{th} individual.

The percent position of each rank is converted into scores by referring tables given by Garrett and Woodworth (1969). Then for each factor, the scores of individual respondents are added together and divided by the number of respondents for whom scores are added. The mean scores for all the factors are ranked by arranging in descending order.

RESULTS AND DISCUSSION

Acreage and production

Carrot and tomato are important vegetable crops grown in Rajasthan. Sriganganagar district of the state had 17% of area under carrot and Jaipur had 38 % area under tomato. Further, Sriganganagar with annual production of 21,832 tonnes carrot and Jaipur with 67466 tonnes tomato accounted for 49 and 38 per cent, respectively of state's total production.

Economics

Cost and returns in vegetable cultivation

Cost and returns for both the carrot and tomato cultivation are worked out (Table 1). Tomato cultivating farmers received a net return of ₹ 276 per q of tomato while carrot farmers received only ₹ 80 per q. B: C ratio indicated that cultivation of both the crop was profitable for the farmers of Sriganganagar and Jaipur district. The profit and the B:C ratio was, however, higher in tomato. The net return from tomato is more than 5 times that of carrot. However, the cost of cultivation per ha is also higher for tomato, at about ₹ 147 thousands, which is almost 2.5 times that of carrot. It indicates that cultivation of tomato warrants more capital compared to carrot, although it yields higher net returns.

Marketing system

The marketing system involves various channels operating in the process of transfer of the produce from the farmers to consumers. An analysis of the marketing system for the two vegetable crops indicates existence of imperfections in market structure, conduct and performance.

Carrot

Marketing channels: There were two important marketing channels (Table 2).The passage of the commodity to the consumers passing through trader/wholesaler, commission agent and retailer is the most common one accounting for about 85% of total sale. Traders from Rajasthan and from adjoining states like Punjab, and Haryana participate in the auction. Being adjacent to Ganga canal systems in Sriganganagar, the farmers had the facility of canal water to wash and clean the produce. Open auction system is followed in this farmers market on the bank of gang canal which is transparent, even though no government agents are present during the auction process. Though it will not fall under the realm of a regulated market, as per the norms of the Government, but a system of community control is noticeable. During day time, the produce is filled in jute bags weighing 50 kg each, and the auction takes place in the evenings. One member of farmers' community acted as secretary and facilitates the auction on behalf of the community. After completion of auction, the produce is loaded in trucks and taken to different markets in Punjab, Haryana and Rajasthan and is sold in respective markets to retailers. The carrot produced in Ganganagar district is in high demand in other states because of its quality. Focused group discussion indicated that the farmers are satisfied with the existing marketing system, as they could dispose carrots quickly, without requiring storage facilities and relatively quicker payments within a week. The analysis has not taken into account the negative externalities in terms of usage of irrigation water. The channel II is relatively shorter, as the produce does not pass through trader/wholesaler. In channel II retailers from Ganganagar or adjoining towns buy the produce through commission agents at regulated market. This produce is sold in the district itself to consumers. The channel II gets only 15 percent share in the total carrot produce sold by farmers.

Table 1 Cost and returns in vegetable crops

Particulars	Tomato	Carrot
Cost of production (₹/q)	336	206
Cost of cultivation (₹/ha)	147197	59799
Yield (q/ha)	438	291
Price (₹/q)	612	285
Gross returns (₹/ha)	267885	82934
Net returns (₹/q)	276	80
Net returns (₹/ha)	120688	23135
B: C ratio	1.82	1.39

Table 2 Marketing channels in sale of carrot

Particulars	Supply chain	Quantity handled (Q)	Percent share
Channel I	Producer –Trader/ Wholesaler- Commission agent – Retailer – Consumer	36484	85.17
Channel II	Producer – Commission Agent- Retailer – Consumer	6355	14.83
Total		42839	100.00

Table 3 Marketing cost and marketing margin in carrot (₹/q)

Item	Channel I		Channel II	
	Cost	*% consumer price*	*Cost*	*% consumer price*
Farm gate price	202.63	25.08	214.77	33.04
Marketing cost				
Producer	82.68	10.23	83.43	12.84
Trader	33.70	4.17	0.00	0.00
Commission Agent Wholesaler	37.71	4.67	22.66	3.49
Retailers	38.57	4.77	38.57	5.93
Total marketing cost	192.66	23.84	144.66	22.26
Marketing margin				
Trader	100.00	12.38	0.00	0.00
Commission Agent Wholesaler	60.00	7.43	55.00	8.46
Retailer	252.71	31.28	235.57	36.24
Total marketing margin	412.71	51.08	290.57	44.70
Consumer price	808.00	100.00	650.00	100.00

Marketing cost: The marketing cost depends on kind of produce, distance of market from farmer's field and the kind of packaging material used during transportation. For channel 1, the total marketing cost accounted for about 24% of the value of final produce. The share of farmer, local trader, wholesaler and retailer in the consumer prices was 10.23%, 4.17%, 4.67% and 4.77% (Table 3). The channel II differed significantly from Channel I in lower marketing cost (only 60% of channel I). The absolute value of marketing cost for farmers was almost same in both channels. Farmers incurred expenditure for grading, washing, cleaning, packaging and transportation etc. Other market functionaries spent money on transportation of produce to different markets, paying of taxes and commission in the markets etc. The total marketing cost was lower in channel II compared to Channel I, because of complete avoidance of traders in the marketing channel, lower commission charges and not taking the produce to distant locations. However, the farm gate prices were higher in Channel II, accounting for about one-third of consumers' prices compared to about one fourth in Channel I. It may be due to lower marketing cost and transfer of this benefit to farmer.

Price spread: The structure of the price spread indicates that the out of the consumers' price, the total marketing cost was almost same for both the channels, but the marketing margin and prices farmers received varied considerably. For example, the total marketing margin is about 51% in Channel I, as against 45% in Channel II. The price received by the farmers in value terms and as a share of consumer prices is higher for Channel II (Table 3). Further, the retailers' margin was more than that realized by the farmers in both the channels. It ranges between 31-36% of the consumers' price. Despite realizing higher price, majority of farmers prefer channel I as they could dispose the produce by evening time due to daily auction of produce. The higher price paid by consumers in channel I is due to the fact that produce is taken to different states while in channel II it is sold in the district itself. Traders from other states also has the advantage of buying produce in channel I as they could get fresh produce which could be sold next day in the any market of Punjab and Haryana. Further traders save on account of market tax and commission charges in regulated market as market in channel I, was managed by farmers. The market in Channel I doesn't keep records of quantity sold and prices determined on a particular day. A consolidated and detailed analysis of the structure of price spread is provided in Table 4.

Acharya's modified measure of marketing efficiency was 0.33 and 0.49 in channel I and II, respectively (Table 5). It was higher in channel II as compared to channel I, but the market share of channel II was much smaller because farmer could sell more conveniently in channel I in the evening of the day. On the other hand, the time of operation under Channel II is during early morning till noon. Farmers prefer to dispose it off the same day, without storing it. This helps to avoid the requirements for storage and incurring weight loss.

Factors affecting marketing efficiency: Multiple regression analysis was carried out to know the impact of variables on the marketing efficiency (Table 6). The analysis showed negative and significant relationship between marketing efficiency, marketing costs and marketing margins (Table 6). In tune with the hypothesis, it has emerged that the volume of produce had positive and significant relationship

Table 4 Price spread in carrot

Particulars	Channel I		Channel II	
	Amount (₹)	Percent	Amount (₹)	Percent
Price received by the farmer	202.63	25.08	214.77	33.04
Cost incurred	82.68	10.23	83.43	12.84
Contractor's purchase price	285.31	35.31	0	0
Cost incurred	33.70	4.17	0	0
Margin	100	12.38	0	0
CA/ Wholesaler's purchase price	419.01	51.86	298.20	45.88
Cost incurred	37.71	4.67	22.66	3.49
Margin	60.00	7.43	55.00	8.46
Retailer's purchase price	516.72	63.95	375.86	57.82
Cost incurred	38.57	4.77	38.57	5.93
Margin	252.71	31.28	235.57	36.24
Price paid by the consumer	808.00	100.00	650.00	100.00

which shows that large carrot growers could bargain and fetch better prices in the market. The number of market intermediaries did not turn out to be a significant factor. Rather than the number of intermediaries, it could be the efficiency of the price determination mechanism in the market that could influence the marketing efficiency. Open market prices did not have a significant influence on the efficiency, contrary to the expectations. One probable reason for this could be the weak price transmission mechanism from the markets to the farmers. It has been shown that the price transmission mechanism is not faster, while it passes from the consumers to the farmers.

Constraints in production and marketing: Constraints faced by the farmers in carrot production and marketing are explained in Table 7. Carrot crop, after harvesting, is to be disposed at the earliest to maintain its quality. The price of carrot depends heavily on the quality and freshness. The most important constraint was about price of the produce as farmer is not sure about price that could be realised. The demand of carrot at various consuming centres and competition with producer from other regions also played a major role in deciding the price. Sometime small size carrot has no buyer in the market and it is used to feed their animals. Though, auction of produce takes place daily in both channels, the farmers generally believed about existence of strong cartel among traders who wields significant power in transferring the value to the farmers. Procurement of quality seed materials at affordable prices turned out to be another constraint. Quality seed bears significant influence in raising yields of the crops. The problem of poor quality seed is rampant, one reason being the poor enforceability of norms of ensuring quality of the seed material. Further, facility of cold storage also lack for this crop, which causes sale of produce at lower prices during peak season.

Table 5 Measurement of marketing efficiency of carrot

Particulars	Unit	Channel I	Channel II
Retailer's sale price (RP)	₹/q	808.00	650.00
Total marketing costs (MC)	₹/q	192.66	144.66
Total margins of intermediaries (MM)	₹/q	412.71	290.57
Price received by farmer (FP)	₹/q	202.63	214.77
Value added by the marketing system (1-4)	₹/q	605.37	435.23
Conventional method (E) (5/2)	Ratio	3.14	3.01
Shepherd's method (ME) (1 / 2)	Ratio	4.19	4.49
Acharya's method (MME) [4/ (2+3)]	Ratio	0.33	0.49

Tomato

Marketing channels: For tomato there are two important marketing channels (Table 8). Produce procured in channel I, is sold in different markets of Rajasthan, viz. Jaipur, Sikar, Ganganagar, Hanumangarh, Sardarshahar, Churu and various cities in Punjab and Haryana while in Channel II produce is directly procured by retailers through commission agents and sold in and around Jaipur city. About 40% of tomato produced in Jaipur district is consumed in the district itself. To procure tomato either trader of other cities directly come to the market or local commission agents buy the produce for outside traders and transport the produce by trucks to distant places as per order. The quantity of produce handled in channel I and II was about 80% and 20%, respectively. The channel-I was most popular and traders from adjoining states like Punjab, Haryana and other parts of Rajasthan procured tomato either from the market at Jaipur (or *Chomu,* the nearby market) or from major production regions in Jaipur district. During peak

Table 6 Linear estimates of determinants of marketing efficiency of carrot

Factor	Coefficient	't' value
Constant	1.044271***	2.412
Marketing cost (x1)	-0.00228**	-1.70
Marketing margin (x2)	-0.00188***	-4.48
Open market prices (x3)	0.000005^{NS}	0.08
Volume of the produce handled (x4)	0.001428***	3.56
Length of the market channel (No. of market intermediaries) (x5)	-0.00081^{NS}	-0.117
R^2	0.81	
Adjusted R^2	0.79	
No. of observation (N)	120	

***, **, * indicate significance at 1 %, 5 % and 10% level, respectively

Table 7 Constraints perceived by farmers in carrot production and marketing

Constraint	Score	Garret ranking
Highly variable market price (high risk)	96.70	I
Vegetable purchasers make a cartel in mandi and offer less price	89.16	II
Problem in getting quality seed material	86.85	III
Delay in payment by traders	85.12	IV
No facility of cold storage in the area	83.06	V
Increased cost of hired labour	82.01	VI
No facility of refrigerated containers (Cold chain)	80.14	VII

season sometime there is no space left in the market to keep large quantity of produce, hence traders procure it from production centers directly. The Channel II is mostly used by the retailers who are operating in nearby areas, like those from Jaipur (or *Chomu*). The quality of tomatoes produced in Jaipur district, is popular for its quality, and enjoys niche market outside the state. There exists consumer preference for this produce.

Marketing cost: The consumer price of tomato in Channel I is almost 24% higher than that of Channel II, amounting to ₹ 244 (Table 9). The major factor that contributed to this is the differences in the marketing cost, which is almost 114% higher compared to that in Channel II, mainly accrued by the trader. The traders accounted for almost 15% of the consumer's price. Both farmers and retailers had almost equal share in marketing cost in channel II. Farmers incurred expenditure on grading, transportation and packaging etc. The Channel II doesn't involve marketing the produce to distant places which effectively reduces the marketing cost. However, Channel I is preferred over Channel II, as there was high demand for tomato throughout the year from other regions and neighboring states, and traders procure it directly from production centers during peak season. The absence of traders during peak production season dips the prices to the disadvantages of the farmers. The poor development of processing facilities in the vicinity renders farmers vulnerable to the demand by the traders. In channel I, produce is not auctioned and prices are determined by selected commission agents daily, and the price reflects the demand supply position at local city (Jaipur market). The commission agents facilitate sale of produce in channel II by helping in prices discovery process (issuing rate slips to farmers), and weighing the produce and making payments to the farmers. In channel I, money is not paid immediately post-sale, and farmers have to wait till commission agents receive money from outside traders.

Table 8 Marketing channels in sale of tomato

Particulars	Supply chain	Quantity handled (q)	Percent share
Channel I	Producer – Commission agent-Wholesaler/ Trader – Retailer – Consumer	38999.68	80.00
Channel II	Producer – Commission agent- Retailer – Consumer	9749.92	20.00
Total		48749.60	100.00

The price the farmers receive is about 41% of the consumer price in Channel I and 52% in Channel II. The price received by farmer for a quintal of tomato is higher in Channel II, but farmers prefer channel I, which provide more stable market, and absorb large quantity of produce (Table 10).The outside demand is critical in stabilizing price as local demand is much smaller. Traders from other states also have the advantage of buying produce in channel I as they could get fresh produce which could be sold next day in any market of Punjab and Haryana state. However, the marketing cost is higher in Channel I, accounting for about 30%, far higher than that in Channel II. The total marketing margin accounts for about 28-30%, and slightly higher (₹ 50/q) in Channel I. The retailer margin accounts for about 21% of consumer's price in Channel I and 30% in Channel II, which constitutes almost 75 and 100% of total marketing margin in Channel I and Channel II, respectively. In this context, many researchers have highlighted the monopoly power wielded by the traders in price determination at consumer level. However, the retailer's role in price determination is less attended. The study points to existence of margin to the tune of 20-30% of consumer's price, which in effect reduces the producers' share considerably.

Marketing efficiency: Acharya's modified measure of marketing efficiency is 0.71 and 1.09 in channel I and II, respectively (Table 11). Though marketing efficiency in channel II is higher, its markets share is quite low, due to

Table 9 Marketing cost and marketing margin of tomato (₹/q)

Particulars	Channel I		Channel II	
	Cost	% consumer Price	Cost	% consumer Price
Farm gate price	522.32	41.45	530.71	52.24
Marketing cost				
Producer	89.29	7.09	89.29	8.79
Trader	192.19	15.25	0.00	0.00
Commission Agent Wholesaler	0	0.00	0	0.00
Retailers	101.14	8.03	89.12	8.77
Total marketing cost	382.62	30.37	178.41	17.56
Marketing margin				
Trader	86.20	6.84	0.00	0.00
Commission Agent/ Wholesaler	0.00	0.00	0.00	0.00
Retailer	268.86	21.34	306.88	30.20
Total marketing margin	355.06	28.18	306.88	30.20
Consumer price	1260.00	100.00	1016.00	100.00

the inability of the channel to source the production, and failure to adjust with the time of farm operation.

Factors affecting marketing efficiency: The analysis indicated negative and significant relationship between marketing efficiency and marketing cost and marketing margin (Table 12). The marketing cost and marketing margin significantly reduced the marketing efficiency. The open market prices did not have significant influence, as in case of carrot. One prime reason for this could be the weak price transmission mechanism from the consumer to the producer level, as the consumer level is constituted by the marketing margins, particularly at the retail level, which is quite flexible. But, unlike carrot, the volume of trade by the farmers also did not have statistically significant influence, probably because the number of cultivators and traders are higher in case of tomato. Also, the volume demanded is higher, which buffers the fluctuations. The length of the market channel also did not have influence, mainly because at retail level, the benefit of smaller number of intermediaries is negated to a large extent by charging higher marketing margins.

Constraints in production and marketing: The most important constraint was price risk. The demand of tomato in different cities and competition with produce of other regions also plays major role in deciding the price. Moreover the auctioning system is not followed at the regulated market yard and traders have a cartel and offer lower prices to farmers. Farmers, after bringing the produce to market yard, find it uneconomical to transport back. His role as a price determinant is ceased and he offers to sell the produce at the given price. During peak season market space is insufficient (at *Chomu*), to keep the produce, and cold storage facility is lacking. The constraints perceive, by the farmers in order of their ranks are given in Table 13.

Table 10 Price spread in tomato

Particulars	Channel I		Channel II	
	Amount (₹)	Percent	Amount (₹)	Percent
Price received by the farmer	522.32	41.45	530.71	52.24
Cost incurred	89.29	7.09	89.29	8.79
Traders's purchase price	611.61	48.54	0	0
Cost incurred	192.19	15.25	0	0
Margin	86.20	6.84	0	0
CA/Wholesaler's purchase price	0	0	0	0
Cost incurred	0	0	0	0
Margin	0	0	0	0
Retailer's purchase price	890.00	70.63	620.00	61.02
Cost incurred	101.14	8.03	89.12	8.77
Margin	268.86	21.34	306.88	30.20
Price paid by the consumer	1260.00	100.00	1016.00	100.00

Table 11 Measurement of marketing efficiency of tomato

Particulars	Unit	Channel I	Channel II
Retailer's sale price (RP)	₹/q	1260.00	1016.00
Total marketing costs (MC)	₹/q	382.62	178.41
Total margins of intermediaries (MM)	₹/q	355.06	306.88
Price received by farmer (FP)	₹/q	522.32	530.71
Value added by the marketing system (1-4)	₹/q	737.68	485.29
Conventional method (E) (5 / 2)	Ratio	1.93	2.72
Shephered's method (ME) (1 / 2)	Ratio	3.29	5.69
Acharya's method (MME) [4 / (2+3)]	Ratio	0.71	1.09

Conclusion and strategies for increasing agribusiness and marketing efficiency

The study points to the existence of large inefficiencies in the marketing of vegetables in Rajasthan. The inefficiencies originate from existence of higher marketing cost and marketing margins at trader and retail level. The margins accrued by the traders and retailers together pushes up the consumer's price. The large scale benefit appropriation by these business intermediaries renders transmissions of lower consumer price to farmers. Farmers face high price volatility, especially when there is price crash, which is quickly transmitted. Inadequate storage and processing facilities enhances their vulnerability. Strategies to enhance marketing efficiency of vegetables would vary according to nature of produce and kind of marketing facilities in a particular region. To enhance marketing efficiency following suggestions and strategies emerged from the primary survey and focussed discussion with different stakeholders.

- Some studies have suggested that the group marketing is a determinant of profits. Encouraging formation of cooperatives/producer groups for small farmers for easy disposal of produce and better bargaining
- Ensure market regulations so as to streamline the price determination process, so as to avoid monopsony ele-

Table 12 Linear estimates of determinants of marketing efficiency of tomato

Factor	Coefficient	't' value
Constant	1.914389***	11.52208
Marketing cost (x1)	-0.00159***	-3.0663
Marketing margin (x2)	-0.0017***	-2.92864
Open market prices (x3)	0.000003^{NS}	0.063176
Volume of the produce handled (x4)	0.000002^{NS}	0.044185
Length of the market channel (No. of market intermediaries) (x5)	-0.00193^{NS}	-0.49432
R2	0.6844	
Adjusted R 2	0.6705	
No. of observation (N)	120	

***, **, * indicate significance at 1%, 5% and 10% level, respectively

Table 13 Constraints perceived by farmers in tomato production and marketing

Constraint	Score	Garret ranking
Highly variable market price (high risk)	96.27	1
Contractor make cartel and offer lower price	92.33	2
Traders avoid auction system	89.43	3
Estimating whole produce weight based on weight of randomly selected box	86.57	4
Lack of space in the market yard to keep produce specially during peak season	85.20	5
Encroachment on farmers platform by traders	83.23	6
Poor access to quality seed material	81.78	7
Increased cost of hired labour	80.22	8

ments from operating in the market. Communication of information of market prices at wholesale and retail markets in different geographical locations would help to solve the information asymmetry issue. Digital display of current market rates in different markets need to be ensured.

- Lack of cold storage facility is a serious limitation that enhances the vulnerability of farmers to price risk. Promote crop specific cold storage facilities and provision of using cold storage receipt for bank loan.
- Enhance conduct of markets by ensuring proper measurement/weight of farm produce and auction system.
- Regulations are needed to streamline the extent of deductions possible at market level.

The smallholder value chains are complex and dynamic. In such a situation, designing interventions to link smallholders with value chains will benefit from greater attention to the contextual factors that shape value chain performance over time (Orr *et al*. 2018). Though there are number of constraints in production and marketing of vegetable crops in the state, better coordination among different development departments and implementation of strategies with active involvement of stakeholders will enhance the marketing efficiency along with supplying quality vegetables. Development of infrastructure at production centres has critical role in ensuring both producers' and consumers' interest. Establishment of cold storage facility has critical role in it. IFPRI's (2003), Sankerlal Guru (2001) and Chengappa (2001) have indicated the need to identify role of government in providing or facilitating the development of those institutions that are necessary to promote agricultural markets and rural income growth. Agro-processing is a key component of rural non-farm economy (Devaux *et al*. 2018). In order to harness the potential of agro-processing sector, the constraints faced by various organizations including private sector involved in agri-marketing need to be addressed.

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