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Value Chain Dynamics and Determinants of Marketing Channel Preferences for Mango Processing Varieties in Andhra Pradesh

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ABSTRACT

The study conducted in the Chittoor district of Andhra Pradesh state focuses on mapping key actors and activities within the mango value chain, specifically for the Totapuri variety used in processing. It also analyzes factors influencing farmers' choice of marketing channels and marketing constraints faced in the process. Primary data was collected from 150 farmers and 30 intermediaries (Ramp traders, pre-harvest contractors and processors) using random and snowball sampling techniques, respectively, through structured interviews. Value chain mapping, percentage analysis and multinomial logistic regression were employed for the study. Findings showed that the mango value chain for processing varieties involved multiple actors, including growers, pre-harvest contractors, input suppliers, financial institutions, processing units and ramp traders. Three channels were identified: farmers selling to processors, ramp traders and pre-harvest contractors, with processors distributing mango based products to domestic and international markets. Among three channels, Channel I was the most efficient with the highest producer's share (95.95 %) and marketing efficiency (12.87), highlighting that direct marketing can significantly enhance farmer returns and overall value chain performance. Regression analysis revealed that family size, yield per acre, market distance, access to credit and finance, price realisation, timely payments, and pre-agreement contracts significantly influenced the farmers' marketing channel choices. The key market-related constraints faced by mango farmers include price fluctuations, unsupportive government policies, lack of market information and delayed payments. The study recommended for enhancing infrastructure, market intelligence and value chain financing solutions to improve the efficiency of the mango value chain for processing varieties. .

Keywords: Value chain mapping, marketing constraints, multinomial logistic regression, market intermediaries, value chain finance

JEL codes: L23, C25, Q13, Q12, Q18

I

INTRODUCTION

The Indian horticulture sector has been significantly impacting the national economy by contributing around 33 percent of the Gross Value Added (GVA) within agricultural sector (Department of Agriculture and Farmers Welfare, 2022). India ranks second in global fruit and vegetable production, following China. In 2023-24, India exported 489,216.32 MT of processed fruits, juices and nuts to the world valued at ₹ 5,659.47 crores. Grapes, pomegranates, mangoes, bananas and oranges account for the larger portion of fruits exported from the country. Major destinations for the Indian processed fruits are the USA, UAE, Bangladesh, United Kingdom, Saudi Arab, China and Netherland (APEDA, 2024).

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Among horticultural crops, mango, often referred to as the "king of fruits", holds cultural and commercial importance due to its exceptional taste and nutritional value. It is rich in vitamins (A, C, B6), potassium, beta-carotene and antioxidants, contributing to its health benefits. In India, Andhra Pradesh and Uttar Pradesh states lead in the area under mango cultivation, contributing 16.56 percent and 13.42 percent respectively. In terms of production, Uttar Pradesh ranks first with 25.76 percent share, followed by Andhra Pradesh with 22.10 percent (Department of Agriculture and Farmers Welfare, 2022). Despite India being the largest producer of mangoes, the country has been facing significant challenges in mango production and marketing. Some of these include lack of adoption of modern technologies by farmers, market price fluctuations, significant post-harvest losses due to inadequate storage and transportation facilities, exploitation by middlemen, lack of access to market information, raw material shortages for processors and many more (Ramu et al., 2024; Ravi et al., 2024). These necessities require the development of an integrated value chain to overcome these challenges and also enhance the overall efficiency and profitability across the entire mango supply chain.

The mango processing industry is predominantly concentrated in Krishnagiri district of Tamil Nadu state and erstwhile Chittoor district of Andhra Pradesh state, which together housing around 65 pulp processing units. Alphonso and Totapuri mangoes are the primary varieties used for processing in these facilities (APEDA, 2024). Erstwhile Chittoor district of Andhra Pradesh produces approximately 15.50 lakh tonnes of mangoes annually, predominantly of the Totapuri variety, which is widely used in pulp production. These processing units cater to both domestic and international markets, supplying products such as mango pulp, puree, and beverages. Despite growing demand for processed mango products, most processors operate at sub optimal capacity (ranging b/w 40 to 60 %). This underutilization is attributed to multiple constraints, including raw material shortages due to inconsistent supply, unsuitable processing varieties, poor quality of fruits due to inappropriate handling procedures, high working capital requirements, and competition from fresh produce buyers who often offer higher prices to farmers. Additionally, fragmented marketing channels inflate procurement costs. These challenges underscore the bottlenecks and complex interdependencies that characterize the mango processing value chain. For instance, many processors offer a flat transportation reimbursement rate regardless of the farmer’s distance from the processing facility, which may unintentionally influence farmers’ marketing channel choices and reduce the attractiveness of supplying to processors.

In this context, a comprehensive value chain analysis becomes essential to map key actors (farmers, pre-harvest contractors, traders, processors), understand the costs, margins and value addition at each stage. It also provides insights into farmers’ marketing preferences and the constraints faced by stakeholders, thereby enabling strategies to improve efficiency, productivity, and the competitiveness of the

industry. Value chain refers to a set of actors and the sequence of value-adding activities involved in bringing a product from production to the final consumer and its final disposal. The actors in the mango value chain in India include nursery producers, fresh mango producers, harvesters, assemblers, processors, traders and exporters. These actors engage in a series of activities in bringing the produce from the farm to the end consumer, and the performance of one actor affects the efficiency of the entire chain due to the interdependence of actors.

In light of these challenges, the present study aims to:

1. Map the actors and activities in mango value chain specific to processing varieties.
2. Assess the costs and efficiency across market channels for processing varieties
3. Examine the determinants influencing farmers' preferences for different marketing channels.
4. Identify the key constraints faced by each stakeholder in mango processing value chain.

II

MATERIALS AND METHODS

Andhra Pradesh occupies the first place in terms of area under mango cultivation and second in terms of production and productivity in India. In Andhra Pradesh erstwhile Chittoor district was purposively selected for this analysis due to its leading position in mango production. The district's top five mango-producing mandals were purposively selected. Within these mandals, the top three villages from each mandal were selected, resulting in a total of 15 villages. A random sample of 10 mango-growing farmers from each village was then selected, totaling 150 farmers as the sample. Additionally, 30 intermediaries, including 8 pre-harvest contractors, 10 ramp traders, and 12 processors, were selected using the snowball sampling technique. Thus, the study constituted a sample of 150 farmers and 30 intermediaries.

Primary data pertaining to socio-demographic features, farm size, membership in collective organisations, participation in the group meetings, information seeking sources and other details on marketing of mango were obtained from the sample respondents through a survey method in the study area employing a well-structured interview schedule. The marketing related challenges faced by sample farmers in the mango value chain of processing varieties were assessed through a survey method utilizing a well-structured schedule consisting of 10 constraint statements, each accompanied by a Likert scale with five levels of agreement: strongly disagree, disagree, neutral, agree, and strongly agree. These levels were assigned corresponding scores of one, two, three, four and five, respectively. The study pertains to the year 2024.

2.1 Likert's Scale Technique

The mean score was calculated by using the following formula.

$$\text{Mean score} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} x_i}$$

Where,

W_i = Weight of the variable

X_i = Variable

TABLE 1. DESCRIPTION OF INDEPENDENT VARIABLES

Independent variables	Variable description	Measurement
Age (X_1)	Age of the farmer in years	Categorical
Education (X_2)	Years of schooling in years	Categorical
Family size (X_3)	Number of members in house	Continuous
Membership (X_4)	Membership in farmer producer organizations	Dummy
Yield (X_5)	Yield per acre in tonnes	Continuous
Market Distance (X_6)	Distance to the market in kilometres	Continuous
Price Realization (X_7)	Better prices offered by channel partners	Agreements rated on a Five-Point Likert scale, with values ranging from 1 to 5, are treated as a continuous scale
Timely Payments (X_8)	Timely payments done by the channel partners	
Perishability (X_9)	Access to storage facilities	
Credit Facilities (X_{10})	Access to credit facilities	
Finance Facilities (X_{11})	Access to finance facilities	
Pre-Contracts (X_{12})	Pre-contract agreements with channel partners	
Trust (X_{13})	Long-term relationships with channel partners	

2.2 Multinomial Logit Regression

Multinomial logistic regression (MNL) was employed to analyze the factors influencing farmers' choices among different mango marketing channels, specifically for processing varieties. The dependent variable in the model represents three distinct marketing channels. MNL is particularly suited for this analysis because it allows for the modeling of outcomes where there are more than two possible choices, each of which can be influenced by multiple explanatory variables. The dependent variables in this analysis were categorical with three categories of market channels preferred by farmers in the study area. These include processing units, ramp traders and pre-harvest contractors. The MNL model assumes that the log-odds of the probability of choosing a particular channel are a linear combination of the independent variables. The general form of the model can be expressed as:

$$log\left[\frac{p(y=1)}{p(y=j)}\right] = \beta_{0j} + \beta_{1j}x_1 + \beta_{2j}x_2 + \ldots\ldots\ldots + \beta_{kj}x_k$$

Where, P (y = j), represents the probability of selecting the j^{th} market channel, and P (y = 1), represents the probability of selecting the reference channel (processing units). β_{0j} is the intercept, and β_{1j}, β_{2j}, …, β_{kj} are the coefficients corresponding to the independent variables X_1, X_2, …, X_k.

III

RESULTS AND DISCUSSION

3.1 Mapping of various value chains for processing varieties of mango in Chittoor district

The prominent mango variety cultivated for processing in the study area is Totapuri. The key actors involved in the mango value chain for this processing variety include mango growers, input suppliers, financial institutions, state departments, pre-harvest contractors, ramp traders and processing units. Input suppliers provide the essential inputs such as fertilizers, crop protection chemicals for undertaking cultivation practices, financial institutions extend credit facilities to assist farmers in managing their production costs, and state horticulture departments offer training programs focused on canopy management and orchard rejuvenation techniques. Pre-harvest contractors purchase the mango crop from mango growers before harvest based on pre-agreed terms and conditions. Ramp traders and processors acted as the main aggregators of mangoes. Processing units added value by converting raw mangoes into pulp, concentrates and mango-based beverages, which were then sold to domestic beverage companies or exported internationally, ensuring a smooth flow of mangoes across the value chain from cultivation to final product. Figure 1, illustrates the mango value chain, mapping the key actors, their interrelationships and the flow of mangoes from one entity to another.

Farmers cultivating processing varieties such as Totapuri primarily sold their produce through three main channels, which were selected for analysis in the Chittoor district. These value chains are detailed as follows:

In channel 1, once the orchards attain maturity, mango growers hire labour for harvesting and loading the produce. The harvested mangoes are then directly transported to nearby processing units, bearing the initial costs of loading and transportation. No intermediaries are involved in this channel. Upon receipt, processing units handle the unloading process and reimburse the farmers for the transportation expenses. These processing units subsequently undertake the value addition process by converting the raw fruit into pulp, concentrates and mango-based beverages. Then the finished products are sold to domestic beverage companies or exported to international buyers.

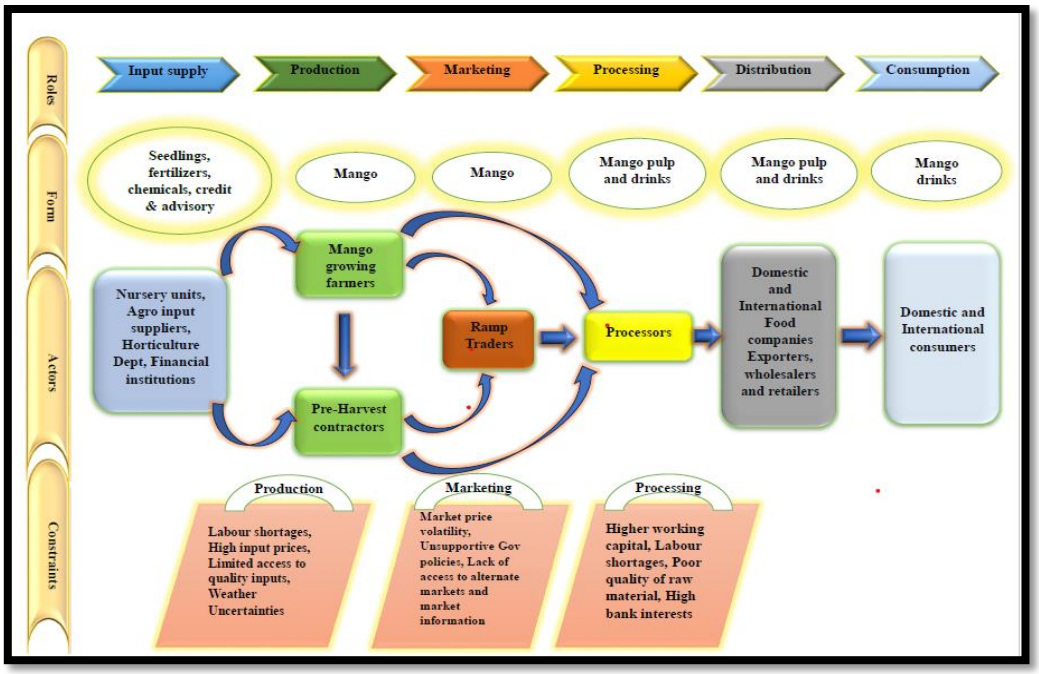

FIGURE 1. MAPPING OF ACTORS AND ACTIVITIES INVOLVED IN MANGO VALUE CHAINS FOR PROCESSING VARIETIES

CHANNEL 1. DIRECT SUPPLY TO PROCESSORS

In value chain 2, farmers transport the harvested mangoes to the nearest market yard, incurring all costs of loading, unloading and transportation costs. Ramp traders at the market purchase the mangoes from farmers. Traders are named as ramp traders due to their swift loading of produce using ramps. These traders then transport the produce to and sell it to processing units, typically located within the Chittoor district, bearing the transportation costs themselves. The processing units carry out value addition, transforming the mangoes into pulp, concentrates and beverages, which are subsequently marketed to domestic buyers or exported internationally.

CHANNEL 2. INDIRECT SUPPLY VIA RAMP TRADERS

In channel 3, farmers sell their mango orchards to pre-harvest contractors (PHCs) at a mutually agreed price based on pre-defined terms and conditions. Upon the sale, farmers relinquish all further responsibilities related to orchard management, and PHCs assumes full responsibility of the orchard's maintenance. After harvest, PHCs sold the produce directly to processing units, covering the transportation and loading costs by themselves. The processing units converted the mangoes into pulp and beverages, which are subsequently sold to domestic or international markets. The results are consistent with findings of (Sowmya et al., 2022; Kalidas et al., 2024), who reported in their studies that pre-harvest contractors as a marketing channel.

CHANNEL 3. PRE-HARVEST CONTRACTOR (PHC) MODEL

3.2 Assessment of Marketing Costs and Efficiency in Mango Channels for Processing Varieties

To analyse the efficiency of each mango marketing channel, costs incurred at various stages were examined. The findings presented in Table 2, indicated that Channel 1 found to be most efficient with the highest producer's share (95.95%) and marketing efficiency (12.87) while Channel 2 (via traders) was moderately efficient and Channel 3 (through post-harvest contractors) was the least efficient, with a low producer's share (49.22%) and efficiency (2.52). In Channel 1, farmers directly sold their produce to processors, with transportation costs reimbursed by the processors to encourage direct transactions. This arrangement is mutually beneficial, as processors procure produce at a lower cost compared to other channels. In Channel 2, farmers preferred selling to traders due to established relationships and reliance on them for credit support. Consequently, processors incurred higher procurement costs, driven by the traders' bargaining power owing to their ability to aggregate large quantities. Channel 3 involves farmers selling to post-harvest contractors (PHCs), often to mitigate price risks or fulfil their immediate financial needs. These contractors typically manage the orchards and later sell the produce directly to processors. Thus,

the results highlight the advantage of farmers adopting direct marketing in improving their returns and value chain performance as well.

These findings align with earlier studies, which have shown that direct marketing channels tend to be more efficient over intermediary-driven ones (Sowmya et al., 2022; Ravi et al., 2023; Kalidas et al., 2024).

TABLE 2. ASSESSMENT OF MARKETING COSTS AND EFFICIENCY IN MANGO CHANNELS FOR PROCESSING VARIETIES

Particulars	Mango processing variety		
	Channel 1 Cost per Kg (₹)	Channel 2 Cost per Kg (₹)	Channel 3 Cost per Kg (₹)
Farmer Level			
Farmer Selling Price	24.52	23.75	12.61
Loading & Other Misc	0.84	0.84	
Transportation	0	0.88	
Total Marketing Costs	0.84	1.72	0
Farmers Net Selling Price	23.68	22.03	12.61
Pre-Harvest Contractor			
PHC Purchasing Price			12.61
Orchard Maintenance Cost			8
Loading & Other Misc			0.84
Transportation			0.65
Total Marketing Costs*			1.49
Margin			3.52
PHC Selling Price			25.62
Trader Level			
Trader Purchasing Price		23.75	
Loading & Other Misc		0.64	
Transportation		0.8	
Total Marketing Costs		1.44	
Margin		0.96	
Trader Selling Price		26.15	
Processor Level			
Processor Purchasing Price	23.68	26.15	25.62
Transportation Reimbursement	1	0	0
Total Marketing Costs	1	0	0
Processor Net Purchase Price	24.68	26.15	25.62
Ps (Price Spread)	1	4.12	13.01
P’s S (Producer's Share) (%)	95.95	84.24	49.22
Me (Marketing Efficiency)	12.87	5.35	2.52
Domestic Sale Price of Pulp		44.01	
International Selling Price Of Pulp		57.21	

3.3 Determinants Influencing Farmers' Choice of Marketing Channel

A multinomial logistic regression was conducted to identify the factors influencing farmers' choice of market channel. The analysis used processors as the reference category, comparing the likelihood of choosing ramp traders and pre-harvest contractors as the market channels against this reference. The Chi-square value of 228.8 showed that the likelihood ratio statistic is highly significant ($p<0.001$), suggesting that the model possesses strong explanatory power. The McFadden pseudo-R^2 value of 0.738 indicated that the explanatory variables account for 73.8 percent of the variation in the choice of market outlets, as shown in Table 3a.

TABLE 3A. MODEL FITTING INFORMATION

Model fit summary	
Pseudo R-Square (McFadden)	0.738
Chi-Square	228.8***

3.4 Determinants Influencing Farmers' Choice for Processing Units vs Ramp Traders

Table 3b infers that the key factors influencing farmers' choice for ramp traders as a marketing channel over the reference category (processors). The multinomial logit model identified six significant factors, namely yield per acre, distance to the market, price realization, timely payments, access to credit and access to finance. Among these factors, distance to the market and timely payments emerged as highly significant factors, positively influencing the choice of ramp traders by farmers at 1 percent significance level. Farmers who prioritize timely payments are approximately 32.69 times more likely to select ramp traders over processors. This indicates that spot cash payments by traders highly motivated the farmers to prefer traders over processors and highlights the critical role of timely payments in the farmers' decision-making process. Further, as distance increases, the odds of choosing ramp traders increase by 1.52 times, implying that farmers farther from processing units preferred ramp traders.

Access to credit and access to finance were found to be positively and significantly increased the likelihood of choosing ramp traders over processors, with farmers who have better access to credit and access to finance being about 3.2 times and 9.2 times more likely to choose ramp traders as their marketing channel, respectively. This highlights that, higher the farmers depend on traders for credit and finance, the higher will be their probability of choosing the traders as their preferred market channel over others. On the other hand, price realization and yield per acre were found to be highly significant but negatively associated with the choice of ramp traders. A higher emphasis on better prices by sample farmers significantly decreased the likelihood of choosing ramp traders over processors. This suggests that farmers who seek better price realization are found to be less inclined to opt for ramp traders.

Additionally, farmers with higher yield per acre over their peer group preferred to choose processors as their marketing channel over ramp traders. This could be because these farmers aim to leverage larger output volumes for better price realization. Furthermore, these farmers likely invested more capital to attain higher yields, aiming to maximize their returns by opting for processors to enhance price realization.

TABLE 3B. FACTORS INFLUENCING FARMER'S CHOICE OF MARKETING CHANNELS (MULTINOMINAL LOGISTIC REGRESSION)

Reference category = Processing units	Ramp traders			Pre-harvest contractors		
Factors	Coefficient (B)	Std. Error	Exp(B) or (odds ratio)	Coefficient (B)	Std. Error	Exp(B) or (odds ratio)
Family Size	0.403	0.358	1.496	-1.549***	0.579	0.213
Yield Per Acre	-1.514***	0.584	0.220	0.568	0.302	1.764
Distance To The Market	0.421***	0.163	1.523	-0.193**	0.095	0.825
Price Realization	-3.145***	1.015	0.043	-4.632***	1.530	0.010
Timely Payments	3.487***	1.022	32.698	0.034	0.783	1.035
Access to Storage	1.730	1.016	5.641	-1.082	0.981	0.339
Access to Credit	1.185**	0.573	3.271	-0.314	0.859	0.730
Access to Finance	2.225**	1.143	9.256	0.432	1.125	1.541
Pre-Contract Agreements	-1.326	0.968	0.266	3.726***	1.035	41.497
Long-Term Relationships	-0.169	0.678	0.844	-0.215	0.584	0.807
Education [0]	1.847	2.119	6.339	0.007	2.771	1.007
Education [1]	3.672	1.963	39.349	2.614	1.844	13.658
Education [2]	3.826	2.138	45.857	2.202	1.747	9.040
Age [0]	-3.659	2.320	0.026	-1.584	2.654	0.205
Age [1]	-1.155	1.528	0.315	-3.627	1.974	0.027
Member Of FPO [0]	-1.521	1.350	0.219	-0.515	1.449	0.598

****, **, Significance at 1 per cent and 5 per cent level*
FPO – Farmer Producer Organization

3.5 Determinants Influencing Farmers' Choice for Processing Units vs Pre-harvest Contractors

The results of Table 3 indicate that the key factors influencing farmers' choice for pre-harvest contractors as a marketing channel over the reference category (processors). The multinomial logit model identified four significant factors: family size, distance to the market, price realization and pre-contract agreements. Among

these factors, pre-contract agreements emerged as a highly significant factor, positively influencing the choice of pre-harvest contractors at the 1 per cent significance level. In this case, pre-agreements with pre-harvest contractors strongly motivated farmers, as they received payment months before harvesting and were relieved of maintenance and risk responsibilities, leading them to prefer pre-harvest contractors over processors. This highlights the critical role of pre-agreement contracts in farmers' decision-making.

On the other hand, price realization and family size were highly significant but negatively associated with the choice of pre-harvest contractors at the 1 percent significance level. A higher emphasis on better prices by sample farmers significantly decreased the likelihood of choosing pre-harvest contractors over processors. Additionally, farmers having larger families decrease the likelihood of choosing pre-harvest contractors, indicating that families with fewer members are more inclined toward this channel. Larger families may possess more resources and networking opportunities, allowing them to effectively manage farm activities through the distribution of labour and to prefer channels that offer better prices. Distance to the market significantly reduces the likelihood of farmers choosing pre-harvest contractors over processors. This might be in areas with longer market distances, pre-harvest contractors may be less accessible, leading farmers to prefer processors who offer the advantage of reimbursing transportation costs.

The results are consistent with the findings of (Honja et al., 2017; Musara et al., 2018; Monika et al., 2022 and Gachoka et al., 2023) who reported in their studies that family size, yield, distance to the market, price realization, timely payments and access to credit were the factors influencing the farmer’s choice of market channel.

3.6 Market related constraints faced by mango growing farmers in the mango value chains for processing varieties

Results in Table 4 indicate the marketing constraints faced by the sample farmers in the mango value chain of processing varieties. The means obtained were arranged in descending order, and accordingly, the constraints were ranked based on their severity. The first major marketing constraint faced by the sample farmers was high market price fluctuations, with a mean score of 4.34. This is a major constraint prevalent among perishable commodities, largely driven by demand-supply dynamics and limited access to market information.

The second major constraint identified was unsupportive government policies, with a mean score of 4.13. Mango crop lacks effective price support mechanisms, unlike MSP available for various agricultural commodities. Additionally, due to a large number of processing units, some of them appear to be forming cartels in the study area, procuring raw materials at lower prices, which further undermines farmers' incomes. This situation underscores the urgent need for robust government intervention to ensure fair and remunerative prices for farmers and to protect them

from exploitation. The third, fourth, fifth, sixth and seventh constraints faced by the sample farmers were lack of access to market information (3.91), lack of timely payments (3.41), exploitation by market intermediaries (3.19), lack of adequate storage facilities (3.09) and high market commissions (3.06). As stated earlier, due to a lack of access to timely market information, farmers have been facing the problem of price volatility, leaving farmers vulnerable to fluctuating prices. Many farmers also reported delays in receiving payments from processing units and other market players. Furthermore, due to limited market knowledge, cartel networks, and lower output volumes, farmers are often exploited by intermediaries, including traders and processors. The lack of adequate storage facilities in the study area forces farmers to sell their perishable produce immediately, increasing market arrivals and consequently driving down prices. Although high market commissions (3.06) were not a primary concern for most farmers, some still faced this issue in certain markets. Thus, the study highlights the pressing need for improved market information, timely payments, supportive government policies and infrastructure development to address the key constraints faced by mango farmers and enhances their market participation.

TABLE 4. MARKET RELATED CONSTRAINTS FACED BY THE FARMERS IN MANGO VALUE CHAIN

S. No.	Constraints Statements	Mean	Rank
1	High market price fluctuations	4.34	I
2	Unsupportive government policies	4.13	II
3	Lack of access to market information	3.91	III
4	Lack of timely payments	3.41	IV
5	Exploitation by market intermediaries	3.19	V
6	Lack of adequate storage facilities	3.09	VI
7	High market commissions	3.06	VII
8	Insufficient transport facilities	2.54	VIII
9	Longer distances to markets	2.15	IX
10	Lack of support from procurement companies	2.00	X

The above findings are consistent with the results of (Sowmya et al.,2022; Shrestha et al., 2020; Badar et al., 2021 and Saripalle, 2019) who in their studies also identified that lack of access to market information, high market price fluctuations, unsupportive government policies, lack of timely payments, high market commissions were the major marketing constraints faced by the mango farmers.

IV

CONCLUSIONS AND RECOMMENDATIONS

The study conducted in Chittoor district of Andhra Pradesh on mango processing varieties, particularly the Totapuri variety, reveals a complex value chain involving multiple actors such as growers, pre-harvest contractors, input suppliers,

financial institutions, processing units and ramp traders. These actors play a key role in facilitating the flow of mangoes from production to value addition and final markets. The study identified three distinct value chains for marketing processing varieties: Value Chain I, where farmers sell directly to nearby processing units; Value Chain II, where farmers sell to ramp traders, who then supply to the processors; and Value Chain III, where pre-harvest contractors purchase entire orchards from growers and sell to processing units. In all cases, processing units sell the processed products, such as pulp and juice, to domestic and international buyers. Of the three channels identified, channel I was found to be most efficient with the highest producer's share (95.95%) and marketing efficiency (12.87), while channel II (via traders) was moderately efficient and channel III (through post-harvest contractors) was the least efficient, with a low producer's share (49.22%)and efficiency (2.52). This highlights that the overall performance of the value chain can be increased if farmers opt the direct marketing over others, which in turn is beneficial to them as well.

The study also highlights the significant role of processing units, ramp traders and pre-harvest contractors in shaping farmers' market choices, which are primarily influenced by factors like price realization, timely payments, market distance, and access to credit and finance, pre contract agreements. The results of multinomial logistic regression indicated that farmers who prioritise on timely payments, need access to credit and finance found to be more likely to choose ramp traders, while pre-contract agreements strongly motivate farmers to choose pre-harvest contractors over processors. On the contrary, farmers seeking better price realization and those with higher yields per acre tend to opt for processors as their preferred marketing channel. Additionally, larger families and those farther from market hubs were found to be less inclined to engage with pre-harvest contractors, preferring processors for better price realization and risk mitigation. Coming to the marketing constraints faced by mango growers, high market price fluctuations, unsupportive government policies, lack of access to market information and delayed payments are identified as critical issues impacting farmers' profitability and market participation.

Enhancing the mango value chain for processing varieties demands a comprehensive and consolidated approach, particularly in light of the growing demand for mango-based value-added products and their widespread use in the food and beverage industries. Based on the study outcomes, the following recommendations are proposed to enhance the mango value chain for processing varieties:

- Farmers need to be encouraged to adopt direct marketing of their produce to processors, the channel that showed the highest efficiency over others. This can be supported through value-added services such as transport reimbursements based on actual costs, formal procurement contracts and a prompt payment mechanism.

- Integrated value chain finance needs to be facilitated among farmers/FPOs, processors and financial institutions through formal contract agreements. This reduces farmers' reliance on intermediaries for credit and ensures a consistent raw material supply to processors.
- Development of mandal-level digital kiosks and mobile-based applications to provide real-time market information. This will enhance farmers' bargaining power and support better price realization.
- State departments, horticultural universities, processors, along with locals NGOs should collaborate to provide capacity building programmes on post-harvest management, orchard practices and collective marketing. This will help farmers improve product quality and gain better returns while meeting processor requirements.
- FPO-led investment should be facilitated in infrastructure such as cold storage units, collection centres, ripening chambers, and first-mile logistics. This necessitates the need to ensure easy access to grants and credit under relevant agricultural and rural development schemes by the government.

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REFERENCES

Agricultural and Processed Food Products Export Development Authority. (2024a). *Fresh fruits and vegetables*. Ministry of Commerce and Industry, Government of India. https://apeda.gov.in

Agricultural and Processed Food Products Export Development Authority. (2024b). *Fresh mangoes*. Ministry of Commerce and Industry, Government of India. https://apeda.gov.in

Agricultural and Processed Food Products Export Development Authority. (2024c). *Mango pulp*. Ministry of Commerce and Industry, Government of India. https://apeda.gov.in

Badar, H., & Ahmad, B. (2021). Smallholders' constraints and options for participation in mango value chains in Punjab, Pakistan. *Journal of Agricultural Research, 59*(2), 187–195.

Department of Agriculture and Farmers Welfare. (2022). *Ministry of Agriculture and Farmers Welfare*. Government of India. https://agriwelfare.gov.in/

Gachoka, W. M., Kingori, G. G., & Wanja, M. S. (2023). Determinants of market outlet choices among smallholder mango and passion fruit farmers in Kenya. *Journal of Economics, Management and Trade, 29*(11), 12–23.

Honja, T., Geta, E., & Mitiku, A. (2017). Determinants of market outlet choice of smallholder mango producers: The case of Boloso Bombe Woreda, Wolaita Zone, Southern Ethiopia—A multivariate probit approach. *Global Journal of Science Frontier Research, 17*(2), 22–30.

Kalidas, K., & Ravikumar, R. (2024). Assessing marketing efficiency in the coconut value chain: A case study of Western Tamil Nadu's coconut landscape. *Journal of Scientific Research and Reports, 30*(5), 625–632.

Monika, K. R., Balaji, R., Prahadeeswaran, M., & Sridevy, S. (2022). Marketing channels, efficiency, and factors influencing channel selection by pomegranate growers in Karnataka. *Asian Journal of Agricultural Extension, Economics & Sociology, 40*(10), 603–615.

Musara, J. P., Musemwa, L., Mutenje, M., Mushunje, A., & Pfukwa, C. (2018). Market participation and marketing channel preferences by small-scale sorghum farmers in semi-arid Zimbabwe. *Agrekon, 57*(1), 64–77.

Ramu, M. S., Gaddi, G. M., Sadhana, H. S., Umesh, K. B., & Nayana, H. N. (2024). Cultivation challenges: Farmers' realities in mango production and marketing with an agro-eco-tourism twist. *International Journal of Statistics and Applied Mathematics, 8*(Special Issue 6), 1347–1351.

Ravi, S. C., Kumar, B., Gupta, A. K., Amrutha, T., Maneesha, M., Rohit, J., & Damodaran. (2023). A comprehensive analysis of the value chain dynamics of Dashehari mango in Uttar Pradesh, India. *Journal of Applied Horticulture, 25*(3), 297–303.

Saripalle, M. (2019). Market awareness and profitability: A case study of mango production in Karnataka, India. *Economic and Political Weekly, 54*(4), 52–59.

Shrestha, S., Joshi, N. R., & Pandey, S. (2020). Value chain analysis of mango (*Mangifera indica* L.) in Saptari District, Nepal. *Malaysian E-Commerce Journal, 5*(1), 7–19.

Sowmya, R. B., Kishore, N. K., Lakshmi, T., & Umar, S. N. (2022a). A study on export growth of Chittoor mango and constraints faced by different actors in the mango value chain. *Andhra Pradesh Journal of Agricultural Sciences, 8*(4), 223–228.

Sowmya, R. B., Kishore, N. K., Lakshmi, T., & Umar, S. N. (2022b). Critical analysis of the value chain: A case of mango processing varieties in Chittoor District of Andhra Pradesh. *The Journal of Research ANGRAU, 50*(3), 139–143.