



Supply Chain Analysis of Raw and Value-added Products of Tomatoes in Telangana

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Authors' contributions

This work was carried out in collaboration among all authors. Author NB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors PR and KS managed the analyses of the study. Author S managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Tomato (*Solanum lycopersicum* L.) is one of the most widely consumed vegetable crops and the second-largest cultivated vegetable crop in the world after potato. Tomato is one of the most important protective foods because of its special nutritive value. Tomatoes grown in the country are consumed fresh in raw or cooked form or processed into tomato paste, juice, sauce, ketchup, soup and, pickles. Less than one percent of India's tomato production is processed. On the other hand, the demand in India for processed tomato products has been growing at an annual rate of about 30 per cent over the last few years. India is the World's largest producer of many fruits and vegetables but there still exists a huge gap between per capita demand and supply due to enormous wastage during post-harvest storage, handling, and the absence of an optimum supply chain. The price fluctuations in tomatoes are very high and often farmers are forced to sell at prices that will not cover even the labor cost of picking the tomatoes. A well-developed tomato processing industry will reduce wastages as well as secure better prices for tomatoes. The present study entitled "Supply chain analysis of raw and value-added products of tomatoes in Telangana" was intended to assess supply chain analysis for raw and processed tomato products along with the constraints faced by each stake holder in the supply chain. Vikarabad district was purposively selected for the study, two mandals four villages each were selected from each village, data was collected from 10 farmers.

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Hence the total data was collected from 80 farmers. The data was also collected from commission agents, wholesalers/ traders, and retailers. From the tomato processing firms operating in around Hyderabad, three firms were selected to collect data regarding their products and marketing supply chain. The collected data was analyzed.

The results of the study identified three channels of raw tomato marketing, namely: channel-I Farmer- Commission Agent-Trader-Retailer-consumer, Channel-II Farmer – Commission agent - Retailer-consumer and Channel-III Farmer- Retailer-consumer. Two channels of processed tomato products were identified, namely: Channel-I, Manufacturing unit- wholesalers-consumers and Channel-II, Manufacturing unit- consumers.

The producer share in the consumer rupee was highest in the Channel -III because of lesser number intermediaries. The marketing efficiency is highest for the channel – III followed by channel – II and channel -I. In case of processed industries are mostly preferring channel -II. The major constraints to the farmers identified were high price fluctuations, high cost of fertilizers and pesticides. The major constraints to the intermediaries identified were high price fluctuations and transportation costs and problems. The major problems identified were lack of quality raw materials suitable for processing, and price fluctuations of raw materials for the processing units, while the major problems faced by wholesalers identified were timely availability and quality related issues.

Keywords: Supply chain; value-added products; smallholder; tomatoes.

1. INTRODUCTION

Tomato is one of the most important protective foods because of its special nutritive value. Tomatoes are an important part of a well-balanced diet. Potassium, magnesium, phosphorus, and small amounts of calcium are all abundant in tomatoes. It is often referred to as the “poor man’s orange” because they are a good source of vitamins, especially vitamin A and C, and they have small amounts of vitamin B and vitamin E. It is one of the most versatile vegetables, with a long history of use in Indian cuisine.

Tomato cultivation has spread throughout the world and occupied an area of 128.00 million ha in 2017-18. Tomatoes are mainly grown in China, India, USA, Italy, Turkey, and Egypt, and the number of tomatoes produced worldwide stood at 188 MT in 2017-18, [1].

In India, tomato is the most cultivated vegetable and occupies a share of 7.79 per cent in the overall cultivated area under vegetables in India (Department of Agriculture, Cooperation and Farmers welfare, 2018-19). [2] With a 11 per cent share of global production, India produces more tomatoes than any other country, except China. Despite this, less than one percent of India’s tomato production is processed, on the other hand, the demand in India for processed tomato products has been growing at an annual rate of about 30 per cent over the last few years. Further, the range of processed tomato foods is also expanding with the introduction and demand

for several ready-to-eat meals, curries, and snack products finding favor with the Indian consumer [3].

The major districts for tomato cultivation in Telangana are Ranga Reddy, Siddipet, Adilabad, Nizamabad, and Vikarabad. These districts contribute 50.29 per cent of the total production of tomatoes in the state. (Horticulture department, Telangana state; 2018.) [4]. Tomato Varieties cultivated in the Vikarabad district are US440, PHS SWEAKAR-448, F1 Hybrid (LAXMI), and SAAHO (TO-3251) and tomatoes were cultivated in 5596 acres in Vikarabad district during 2018-19.

Vikarabad district is selected as a study area as it has got the highest production of tomatoes in the state of Telangana. For collecting the data from farmers two mandals Nawabpet, Mominpet. The villages selected from Nawabpet mandal are Aknapur, Attapur, Chinchalpet, and Chittigidda and the villages selected from Mominpet mandal are Ramnathgudpalle, Govindapur, Mominpet, Morangapalle from the selected district are selected based upon the volume of production of tomatoes.

From each Mandal, four villages, based on tomato production were selected for the study. From each village, ten tomato cultivating farmers were selected, hence data was, collected from 80 farmers. Data was also collected from middlemen involved in the supply chain of raw tomatoes and processed tomatoes apart from tomato processing units. Thus, data was collected from five commission agents, five

wholesalers, five retailers, and two tomato processing units located in and around Hyderabad.

The study was taken up with the following objectives:

1. To map the supply chain of raw tomatoes and value-added products of tomatoes.
2. To examine constraints faced by various stake holders in supply of raw tomatoes and processed tomato products.

1.1 Review of Literature

Sharma [5] conducted a study that aims at analyzing the tomato value chain in the Jessore district in the Southeast region of Bangladesh. Identifying the main chain actors and map the tomato value chain, assessing their linkages and roles, calculating the marketing margins of each actor, and identifying the major constraints and opportunities in the value chain. Market margin analysis was carried out to estimate the value captured by each actor. The result revealed that the major actors in the value chain are input suppliers, tomato producers, collectors, small traders, big traders, processors, and consumers. The producer's market share shows that producers obtain the largest share when they sell out directly to roadside traders which is about 85.32%. The major problems confronting the tomato value chain were found to be low prices, high perishable nature, lack of access to credit, poor quality of tomatoes, inadequate storage and processing facilities, inadequate transportation facilities, dispersed nature of supply, high-interest rates, and lack of adequate information. While farmers ranked low price as their most worrying constraint, poor transportation facilities for tomatoes were ranked as the most pressing constraint of value chain actors.

Hanadi et al. [6] analysed the value chain of tomato production and its related activities, in Khartoum state, to perform financial analysis for the whole chain and to assess the value addition and profit margin distribution among the different actors. The degree of value addition at the farmer level was 53 per cent, 21.7 per cent at the middle man level, 10.2 per cent at wholesalers, and 15 per cent at retailers, according to the findings. The retailer received the highest percentage of total profit (52.1), while the farmer received the lowest (8.8); however, the middleman and wholesaler received almost equal percentages of total profits (19.2 and 19.9,

respectively). According to the report, an initiative must be taken to establish processing units in the production areas, as well as to provide financial assistance to these units.

Neupane et al. [7] have carried out a study to explore the value chain of tomato cultivation in the Chitwan district. The tomato production was found to be highly profitable after examine the variable cost of production, gross margin, and B: C ratio (1.609). According to the value chain diagram, 74.8 percent of total goods are distributed to wholesalers, 13.4% to suppliers, 4.4 percent to direct customers, 1.13 percent for home use, and 5.4 percent were lost during post-harvest handling. Post-harvest losses were higher at the producer level than at the wholesaler and retailer levels. Farmers score their produce based on size and colour 35% of the time, and all farmers store their produce in crates. Producer share for channel-producers to wholesalers to retailers to consumers was 70.71 percent, with a market margin of 24.51 percent for the wholesaler and 15.25 percent for the retailer, and 76.41 percent with a market margin of 14.8 percent for channel-producers to retailers to consumers. The key strengths were the availability of land, market access, and suitable agro-climatic conditions. The presence of agricultural stations such as line agencies and agro vets, as well as high demand for the commodity and the creation of jobs, were also major opportunities.

Arun [8] has conducted research work that deals with the supply chain management of tomato-based food processing industries in Noida. The emphasis is on existing problems faced by the food processing industries and how to address them by proposing cutting-edge technology for increasing production yields by using the least amount of hybrid seed and using the minimum acres of land Arrangements have been made to get the raw material at the right price at right time, in right place, in the right quantity, in the right quality. Since there is a lot of wastages during physical distribution in transportation, alternative suggestions have been made for minimizing such losses occurring during transit by suggesting suitable packaging material from farmers place to cold storage and from cold storage to the processing centre, and finally from the processing centre to the ultimate user. The important guidelines have been made for the development of prospective tomato entrepreneurs. Tomato-based food processing would be an attractive alternative source of income for the rural sector as it can generate employment and solve the problem of growers.

Ochilo et al. [9] published an article to describe production practices and challenges and opportunities for increased tomato productivity in smallholder production in Kenya. Smallholder tomato production in Kenya is characterized by a decline in the area under tomato cultivation. Furthermore, production is dominated by male farmers while participation by youth is minimal. In addition to these factors, a variety of biotic constraints obstruct tomato production, and farmers prefer to control them with conventional synthetic pesticides. With these, a diverse range of biotic constraints. The results of this study highlight the importance of increasing women's and youth's involvement in tomato production. Furthermore, initiatives that allow farmers to access available technologies, such as improved seed, must be investigated. Smallholder farmers should be encouraged to explore alternatives to over-reliance on synthetic pesticides for the management of biotic constraints.

Kumar et al. [10] conducted a study in eight villages of Almora and Nainital districts of Uttarakhand to analyse the marketing behavior of the vegetable growers and know the perception and constraints in the marketing of vegetable produce. Results obtained from the study revealed that most farmers use private mode of transportation and sell their produce preferably in distant mandi. The choice of market preference is based on the opinion of their relatives/friends and vegetable merchants. High commission charges, fluctuating market rate, non-availability of the nearby market, high transportation charges, and high cost of packaging material were the major constraints. The study suggested the creation of horticulture-based self-help groups at the village level, organization of weekly haat, strict compliance of rules and regulations of the regulated market, guidance on market avenues from time to time to the vegetable growers as the solutions to these problems.

Haruna [11] examined the constraints faced by various actors in the tomato value chain area in the Upper East Region of Ghana. Low prices, market instability, lack of access to credit, poor quality tomatoes, inadequate storage and warehousing facilities, inadequate transportation facilities, fragmented existence of the source of supply, high-interest rate, and lack of sufficient knowledge were found to be the major problems confronting the tomato value chain. Farmers cited low prices as their most pressing constraint, though wholesalers and retailers cited poor quality of Ghana-grown tomatoes as their most

pressing constraint. According to the report, value chain initiatives should consider the needs of all value chain players in order to boost the value chain's performance.

Baskaur [12] studied the problems of vegetable cultivation in rural areas of Haryana. For this purpose, four districts, namely, Sonapat, Gurgaon, Kurukshetra, and Hisar were selected based on the highest area under vegetable cultivation. Respondents were personally interviewed using a well-structured schedule. According to the report, the first constraint is a lack of labour availability during peak season, followed by labour costs and financial problems for vegetable growers. Inadequate and expensive transportation, as well as a lack of information about potential markets in large cities, were the two most significant marketing issues for vegetable cultivation.

2. MATERIALS AND METHODS

To fulfill the objectives of the study, Vikarabad was chosen as the study area and two markets in Hyderabad were also considered to collect data. Vikarabad district of Telangana state, was purposefully selected as tomato cultivation is highest in this district in Telangana. The data was collected through personal interviews from the selected tomato growers, traders, commission agents, and retailers with the help of pretested schedule designed separately for each category of respondents. Data on quantity purchased, price paid and received, costs incurred were collected from each stakeholder in supply chain of raw and value-added products of tomatoes. Data regarding the production and marketing costs was collected from the farmers and processing industries. The data collected was analysed using simple descriptive statistics and ranking techniques. The various problems associated with production and marketing were also analyzed.

3. RESULTS AND DISCUSSION

3.1 To Map the Supply Chain of Raw Tomatoes and Value-Added Products of Tomatoes

3.1.1 Mapping the supply chain of raw tomatoes

Three channels were identified in the marketing of raw tomatoes:

Channel I: Farmer – Commission agent –
Trader – Retailer – Consumer.
Channel II: Farmer – Commission agent –
Retailer – Consumer
Channel III: Farmer – Retailer – Consumer
Channel I: Farmer – Commission agent –
Trader – Retailer – Consumer.

It is observed that, the net share of producer in consumer rupee is 45.5 per cent in channel -I. The price received by the farmer is Rs. 1000/ q of the tomato from the commission agent, after taking 4- 10 per cent of commission, the commission agent sells that produce to the trader. The trader sells these tomatoes to the retailer at a price of Rs.1400/q, which is sold at Rs. 2100 to the customers. The price spread in channel -I is Rs. 1100/q and marketing efficiency is 0.90.0

Channel II: Farmer – Commission agent –
Retailer – Consumer

In supply chain of tomatoes through the channel -II, it is observed that the net share of producer share in consumer rupee is 55.5 per cent. The price received by the farmer is Rs. 1000/ q, from the commission agent, after taking 4- 10 per cent of commission, the commission agent sell that produce to the retailer. The retailer selling price to the customer is Rs.1700/q. The price spread for the marketing of tomato in supply chain -II is calculated to be Rs. 700/q and marketing efficiency is calculated to be 1.42.

Channel III: Farmer – Retailer – Consumer

It is observed that in the supply chain of tomatoes through channel -III, the net share of producer in consumers rupee is 61.5 per cent. The price received by the farmer is Rs. 800/ q by selling produce to the retailer. The retailer selling price to the customer is Rs.1300/q. The price spread for the marketing of tomato in supply chain -II is calculated to be Rs. 500/q and marketing efficiency is calculated to be 1.6.

Channel- III is having the highest marketing efficiency among all the channels but mostly preferred channel is channel – II in the study area.

3.2 Mapping the Supply Chain of Value-added Products of Tomatoes (Tomato Sauce and Pickle)

Two channels were identified in the marketing of value-added products of tomatoes and are they are.

Channel – I Manufacturing unit - Wholesalers - Consumer (i.e.: Restaurants, bakeries, institutional mess, canteens, catering firms and fast-food centers).

Channel – II Manufacturing unit - Consumer (i.e.: Restaurants, bakeries, institutional mess, canteens, catering firms and fast-food centers).

Channel – I Manufacturing unit - Wholesalers - Consumer (i.e.: Restaurants, bakeries, institutional mess, canteens, catering firms and fast-food centers).

With regard to the supply chain of Tomato sauce in channel -I, the manufacturing cost of 4.5 kg SKU of tomato sauce is Rs. 100, and the selling price to the wholesaler is Rs. 130 with a margin of Rs.30 per 4.5 kg SKU. Wholesalers selling price to the customers is Rs.170 with the margin of Rs. 50 per 4.5 kg SKU. In case of tomato pickle in channel -I the manufacturing cost of one kg SKU of tomato pickle is Rs. 120, and the selling price to the wholesaler is Rs. 200 with a margin of Rs.80 per one kg SKU. Wholesalers selling price to the customers is Rs.260 with a margin of Rs. 60 per one kg SKU.

Channel – II Manufacturing unit - Consumer (i.e.: Restaurants, bakeries, institutional mess, canteens, catering firms and fast-food centers).

With regard to the supply chain of Tomato sauce in channel -II, the manufacturing cost of 4.5 kg SKU of tomato sauce is Rs. 100, and the selling price to customer is Rs. 150 with a margin of Rs.50 per 4.5 kg SKU. In case of tomato pickle in channel -II the manufacturing cost of one kg SKU of tomato pickle is Rs. 120, and the selling price to the customer is Rs. 240 with a margin of Rs.120 per one kg SKU.

3.3 Production and Marketing Constraints of Raw Tomatoes

The constraints faced by the farmers and other stakeholders were analysed in the study. The major production and marketing constraints faced by the tomato cultivating farmers were price fluctuations, high cost of fertilizers and pesticides, high labour charges, lack of timely financial availability, high marketing cost. Marketing constraints faced by the traders/wholesalers are price fluctuations, transportation problems, delay in payments by retailers, losses/wastage. Marketing constraints faced by the retailers are transportation costs and problems, losses/wastage, price fluctuations. Constraints faced by processing industries in supply chain of processed tomato products are

the lack of quality raw materials suitable for processing, price fluctuations of raw materials, non-availability of finances, lack of skilled labour and high wages, machinery maintenance problems, marketing problems. Constraints faced by wholesalers of processed tomato products are non-availability of product when it is required, quality related issues, expiry date of the product, storage related issues, transportation problems.

4. CONCLUSIONS

Tomato is a highly perishable commodity and farmers had no contract with the processing firms to supply tomatoes for processing, Hence it can be concluded that there is enough production in the study area for the processing firms to explore. Farmers in the study area are also not aware about the suitable varieties for processing. The processing firms in Hyderabad are unregistered and, they supply tomato sauce and tomato pickle to local customers (i.e.: Restaurants, bakeries, institutional mess, canteens, catering firms and fast-food centers). They do not brand their products and the major brands like MAGGI, KISSAN, DEL MONTE, PRIYA, and SWASTHIKS have their manufacturing operations in and around Hyderabad, hence there is immense potential which can be explored with regard to tomato processing in Telangana.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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