

Original Research

Analysis of Tomato (*Solanum lycopersicum L*) Value Chain in Kebbi State, Nigeria

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Received 28 July 2023; Accepted 10 August 2023; Published 18 August 2023

ABSTRACT: The study analyzed Tomato value chain in Kebbi State, Nigeria. Primary data were collected using well-structured questionnaires. A multi-stage sampling procedure was used to collect data from 225 respondents for the study. The data collected were analyzed using Descriptive statistics, Net Farm Income, and Gross Margin Analysis. Results from the study revealed that input suppliers, producers, middlemen, traders, processors and consumers are the major actors in tomato value chain. In terms of profitability of the various actors, the study revealed that the actors realized a profit of ₦1, 630, ₦271, 821, ₦2, 190 and ₦1, 475 for input suppliers, farmers, wholesalers and retailers, respectively. The study further revealed that the marketing efficiency for seedling producers is ₦1.28, tomato farmers is ₦1.11, wholesalers is ₦0.22 and retailers is ₦0.12, implying that for every ₦1.00 invested ₦1.28 kobo for seedling producers, ₦1.11 kobo for tomato farmers, ₦0.22 kobo for wholesalers and ₦0.12 kobo for retailers was realized. These suggest that tomato value chain businesses are both profitable and viable. The constraints faced by the tomato value chain actors include; lack of storage facilities, perishability nature of the product, pest and diseases, lack of processing industries in the state, high cost of inputs, financial challenges, poor road network, price fluctuation and insecurity among others. It was recommended that, farmers should form cooperatives for better marketing and to also attract attention from government while government should provide incentives in the form of storage facilities and credit at low interest rate to value chain actors in order to boost their profit and also formulate and implement policies that are favourable and attractive to investors in the State.

Keywords: Tomato, cost and returns, profit, value chain

Citation: Norbert, S., Kaka, Y., and Gona, A. (2023). Analysis of Tomato (*Solanum lycopersicum L*) Value Chain in Kebbi State, Nigeria. Direct Res. J. Agric. Food Sci Vol. 11(8), Pp. 217-223. <https://doi.org/10.26765/DRJAFS99151604>. This article is published under the terms of the Creative Commons Attribution License 4.0.

INTRODUCTION

Tomato (*Solanum lycopersicum L*) is the third world's leading vegetable grown for fresh market and processing (Shiberu *et al.*, 2018). It is a versatile crop of high economic value and is considered as one of the main ingredients in hundreds of dishes and other products all over the world. Global tomato production is estimated at around 177 million metric tonnes, of which 120 million

metric tonnes are bound for the fresh markets and 57 million metric tonnes are processed (FAO, 2016). Nigeria is the second-largest producer of tomato after Egypt in Africa, with an estimated production of 3.91 million metric tonnes in 2019 (Food Loss in Nigeria, 2021). The bulk of tomato produced in Nigeria is grown mainly by smallholder farmers. These farmers cultivate between 0.5

and 4 hectares of land contributing about 90% of the total tomato production, with the balance supplied by commercial producers (Sahel Research, 2015). Despite the large area of about 541, 800 hectares harvested for tomato in Nigeria followed by Egypt with 214,016 Ha, Nigerian farmers on average generate the lowest yields for tomatoes in African at 4-7MT/Ha which is significantly lower than Egypt with 38.7MT/Ha and South Africa with yields of 78.7MT/Ha (FAOSTAT, 2014).

Yield is low because of the poor production practices including usage of old varieties, low soil fertility, inadequate pest and weed control and high post-harvest losses due to poor handling and distribution system, poor storage and lack of processing options with a lot of tomato produced in Nigeria wasted (Sahel Research, 2015 and Arah *et al.*, 2015).

According to Ugonna *et al.* (2015), tomato is grown in states like Kano, Kaduna, Sokoto, Taraba, Yobe Jigawa and others. However, despite Nigeria's strong potentials in tomato production, it still spends up to \$500 million - every year - to import tomato products (especially purees, pastes and canned tomatoes), making Nigeria one of the biggest importers of tomato paste in the world.

According to German Technical Cooperation (GTZ) (2007), value chain is a series of activities from the provision of specific inputs for a particular product to primary production, processing, marketing, and up to the final sale of the particular product to consumers. Improvement in its value chain may not only immediately contribute to the microeconomic advantage, particularly to considerable number of smallholder tomato producers in the country but could also enhance macroeconomic growth of the nation.

Thus, organization of agriculture along the value chain framework has been considered as one of the approaches to bring more competence in the sector (Addisu, 2016). There is, therefore, a need to understand the tomato value chain, its operational mechanism and various issues at grassroots level impeding its growth.

Despite the fact that Nigeria is a major producer of tomato in Africa, second to Egypt, yield is low and prices are fluctuating up to ridiculous level at certain seasons, and become very scarce at some season leading to non-availability especially at off season. For tomato to be produced and made available at all seasons there is a need to look in the direction of the value chain study.

The present study is an attempt to examine the role played by different value chain actors such as input suppliers, producers, traders, processors and opportunities to strengthen the value chain, especially from the perspective of institutional enhancement in the study area. It is against this backdrop that this study hopes to provide answers to the following research questions;

1. Who are the actors in the tomato value chain,

existing linkages and functions?

2. What is the cost and returns of the different actors (seedling producers, tomato farmers, wholesalers and retailers)?

3. What are the constraints encountered in tomato production?

MATERIALS AND METHODS

The study was conducted in Kebbi State which is located in the north-western part of Nigeria. Kebbi State is situated between latitudes $10^{\circ} 8^{\prime} N$ and $13^{\circ} 15^{\prime} N$ and longitudes $3^{\circ} 30^{\prime} E$ and $6^{\circ} 02^{\prime} E$. The State is bordered by Sokoto and Zamfara States to the East, Niger State to the South, Benin Republic to the West and Niger Republic to the North. Kebbi State occupies an area of about 37,699 square kilometers out of which 36.46% is made up of farmland (Kebbi State Government, 2018). The State has a projected population of about 5,563,900 people (NPC, 2022)

Kebbi State has tropical weather conditions with three seasons: rainy, dry and hot. The annual rainfall is variable between 600mm to 850mm and on average 650mm. The monthly temperature in the region ranges from $25^{\circ}C$ to $45^{\circ}C$. The State possessed two important agricultural lands namely: dryland (arid-prolonged dryness) and Fadama (floodplain-significant alluvial clay particles). These two lands remained the key source of income to millions of people in the State (Usman *et al.*, 2016).

Agriculture is the most important economic activity, with riverine floodplains producing crops like groundnuts, cotton, rice, millet, sorghum and vegetables such as tomato, onions etc. most of the land in the State is used for grazing cattle, goat and sheep. The State is divided into 4 Agricultural Zones which consist of 21 Local Government Areas out of which 8 Local Government Areas were selected, 2 from each zone based on predominant history of tomato production using multi-stage sampling technique. From these Local Government Areas, 16 villages were randomly selected. The next stage involved a random selection of 15 respondents each from the 16 selected villages giving a total sample size of 240 respondents who supplied information with structured questionnaire. However, a total of 225 respondents were found useful for data analyses (15 seedling producers as input suppliers, 160 tomato farmers, 15 wholesalers and 35 retailers). Data were analyzed using Descriptive Statistic, Value Chain Mapping and Net Farm Income and Gross Margin

Net Farm Income (NFI) Model

$$NFI = TR - TC \dots\dots\dots (1)$$

Where;

NFI = Net Farm Income
 TR = Total Revenue
 TC = TVC – TFC

Gross Margin (GM)

$GM=TR-TVC$ (2)

Where;
 GM = Gross Margin
 TR = Total Revenue
 TVC = Total Variable Cost

RESULTS AND DISCUSSION

Tomato value chain actors, linkages and function

Input suppliers

Input suppliers are the manufacturers of agricultural inputs such as seeds/seedling, fertilizers, agrochemicals, etc. required for the production of raw tomatoes. Through company owned, and other company dealers they sell their products to the farmers. Moreover, they also provide technical guidance on inputs usage and timely supply of inputs to the tomato farmers. They maintain good relationship with farmers and act as one of the informal sources of finance. Regarding the delivery of inputs like improved seed, pesticides, and credit among others, public and private extension service providers usually provide extension services to the farmers. Banks and microfinance institutions provide credit and information about schemes for tomato production. Figure 1 shows the tomato value chain actors and their linkages in Kebbi State, Nigeria.

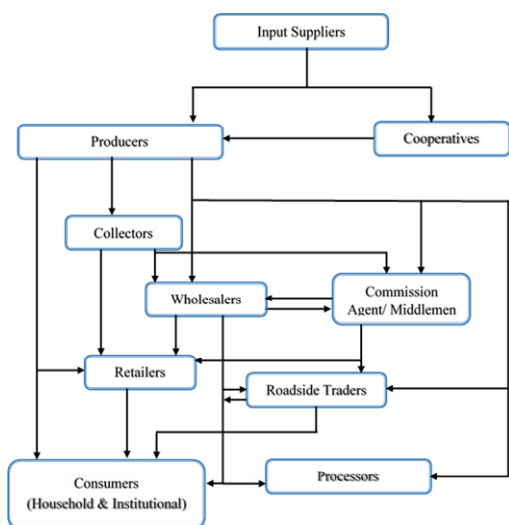


Figure 1: Map of tomato value chain actors and their linkages in Kebbi State

Source: Field survey, 2021

Supporting actors

These are actors who provide supportive services including training and extension services, information, transportation, financial and research services. According to Martin *et al.*, (2007) access to information or knowledge, technology and finance determine the state of the success of value chain actors, Federal and State Ministry of Agriculture, ADPs, Donor Agencies, IFAD, Fadama, Private Organization, NGOs, Cooperatives, Microfinance, Transport service providers among others, are the main supporting actors who play a central role in the provision of services.

Producers

Kebbi State tomato producers are the main actors who perform most of the value chain functions right from farm inputs, preparation of their farms or procurement of the inputs from other sources to post-harvest handling and marketing. The major farming and value addition activities that tomato producers perform include ploughing, ridging, sowing, fertilizing, weeding, pest/disease controlling, harvesting and post-harvest handling.

Collectors

These are producer traders or part-time traders who collect tomatoes for the purpose of reselling it to processors, wholesalers, roadside traders, retailers, consumers etc. They know areas of surplus; they speak the local language of the community well and usually use their financial resources. The value adding activities of collectors include buying, assembling and selling.

Commission agents

These are persons who on behalf of a principal and in consideration of the amount of commission involved in each transaction, keep in his/her custody the goods of his/her principal and sells them, holding himself liable to deliver to the buyer and to make payment of its price to his principal. Hence, they broadcast price and other information to the wholesalers and play the leading role in influencing price formation in the market.

Wholesalers

These are market participants who buy large quantities of tomato and resell to other traders. They purchase tomato at the farm gate and from collectors and producers in a larger volume than any other marketing actor does. They relatively spend their full time in wholesale buying throughout the year in and out of the State.

Each wholesaler uses vehicle as a means of transportation when the amount of tomato supplied to the market is large. Otherwise, they purchase other vegetable crops together with tomato to fill the vehicle sometimes.

Roadside traders

These are traders who collect tomato from farmers at the farm gate for the purpose of reselling to retailers and consumers. Farmers sell directly to roadside traders and road side traders re-sell it to retailer and consumers in the study area. They play an important role and they know areas of surplus very well. There are few roadside traders who compete with wholesalers. When it is impossible for them to meet required quantities of their demand, they employ brokers to collect tomato by paying a commission.

Retailers

Retailers are market actors operating at the last stage of the marketing channels selling to the final consumers. They buy from wholesalers and farmers in their surroundings in small quantities and directly sell tomatoes to consumers. They perform several value addition activities such as buying, sorting, transporting, storing and selling to end users in smaller quantities with a profit margin. Tomato retailers in the study area purchase tomato directly from producers at farm gate, wholesalers or roadside traders and sell to consumers. This is one of the final links in the chain that delivers tomato to consumers. They are very numerous as compared to others and the basic function they provide is bulk breaking; selling tomato to consumers in small volumes after receiving large volumes from roadside traders, wholesalers and producers.

Processors

This entail, the transformation of tomatoes into a variety of value-added products including tomato paste, sauce, ketchup and local/traditional value-added products such as dried tomato. There is a large automatic tomato processing company established recently at Ngaski Local Government. But over the years it was the traditional dried tomato type that was prominent in the villages within the study area.

Consumers

It is the last link in the tomato market chain, they are categorized into two; household and institutional consumers e.g., restaurant, hotel, food vendors etc. From the consumer point of view, the shorter the market chain,

the more likely is the retail price going to be low.

Cost and returns analysis

Table 1 presents the average cost and returns for tomato seedlings production in the study area. Results revealed that the average cost value of Tomato seedlings produced was ₦2, 900.00 per 1x2m². Comparing this value with the total cost of production (₦1, 270.00) shows that the production of Tomato seedlings in the study area has a Net income of ₦1, 630.00, suggesting that seedling production is profitable. The return on naira invested (ROI) of ₦2.28 suggests that for every one naira invested, two-naira twenty-eight kobo was realized as revenue. This reveals that tomato seedling production is not only profitable but also efficient. Table 2 presents the average cost and returns of tomato production in the study area. The average revenue of Tomato produced was ₦516, 050.00 per hectare. Comparing this value with the total cost of production (₦ 244, 229.00), shows that the production of Tomato in the study area has a net return of ₦271, 821.00, suggesting that tomato production is profitable. The Return on Investment (ROI) of ₦2.11 suggests that for every one naira invested, two naira eleven kobo was realized as revenue. This finding is similar to that of Gona *et al.* (2020) on profit efficiency among smallholder irrigated tomato farmers in Kebbi State, Nigeria which shows that tomato production is profitable, viable, and efficient and a lucrative business. The result also agrees with the findings of Danmaigoro and Gona (2020) on tomato production under irrigation in some selected districts of Zuru Local Government Area of Kebbi State, Nigeria which revealed that the average revenue for a typical farmer is ₦54, 050.00 and profit of ₦44, 657.80 was realized.

Table 3 present the average cost and returns for wholesalers in the study area. The results showed that, the average cost of marketing a basket (65kg) of Tomatoes was ₦12, 290.00. Comparing this value with the total cost of marketing operations ₦10, 100.00, shows that marketing of tomato in the study area has a Gross income of ₦2, 190.00, suggesting that tomato is quite profitable. The Return on Investment (ROI) of ₦1.22 suggests that for every one naira invested, one naira twenty-two kobo was realized as revenue. This also reveals that tomato wholesaling is also efficient.

Table 4 presents the average cost and returns for tomato retailers in the study area. The results showed that the average cost of marketing a basket (65kg) of Tomatoes was ₦13, 480.00. Comparing this value with the total cost of marketing operations ₦12, 005.00 shows that marketing of tomato in the study area has a Net income of ₦1,475.00, suggesting that tomato marketing is quite profitable. The Return on Investment of ₦1.12

Table 1: Average cost and returns for Tomato seedling producers per 1x2 m²plot

Variable	Average (₦)	Percentage
Average size of plot = 1x2m²		
Average Price of Seedling/plot	2,900.00	
A. Total Revenue (1x2,900)	2,900.00	
Cost of Production		
Cost of Planting Material (seed)	200.00	15.75
Cost of Labour	550.00	43.31
Cost of Fertilizer	150.00	11.81
Cost of Manure	70.00	5.51
Cost of Herbicides	125.00	9.84
Cost of Pesticides	175.00	13.78
B. Total Cost (TC)	1,270.00	100.00
Gross Margin (A - B)	1,630.00	
Return on Investment (ROI)	2.28	

Source: Field survey, 2021

Table 2: Average cost and returns for Tomato production per 1 hectare.

Variable	Average (₦)	Percentage
Average Quantity of tomato produced in baskets (65kg)	55.80	???
Average Price per basket	9,248.21	???
A. Total Revenue	516,050.00	100
Cost of Planting Material (seed)	8,054.00	3.30
Cost of Labour	99,778.00	40.85
Cost of Fertilizer	48,276.00	19.77
Cost of Manure	35,785.00	14.65
Cost of Herbicides	6,247.00	2.56
Cost of Pesticides	5,061.00	2.07
Cost of Transportation	16,649.00	6.82
Cost of Land (rent)	13,650.00	5.59
Depreciation on Equipment	664.00	0.27
Cost of Uploading/Downloading	5,258.00	2.15
Others/Tax	4,806.00	1.97
B. Total Cost (TC)	244,229.00	100.00
Net Income (A-B)	271,821.00	
Return on Investment (ROI)	2.11	

Source: Field survey, 2021

Table 3: Average cost and returns for Tomato wholesale per basket (65kg).

Variable	Average (₦)	Percentage
A. Total Revenue	12,290.00	
Cost of Marketing		
Cost of Storage	15.00	0.15
Tax/Market Levy	20.00	0.20
Cost of Transportation	195.00	1.93
Cost of Basket	450.00	4.46
Cost of Uploading/Downloading	35.00	0.35
Cost of Purchase	9,385.00	92.92
B. Total Cost (TC)	10,100.00	100.00
Gross Margin (A - B)	2,190.00	
Return on Investment (ROI)	1.22	

Source: Field survey, 2021

suggests that for every one naira invested, one naira twelve kobo was realized as revenue. This reveals that

tomato marketing is also efficient. Comparing the profitability of wholesalers (₦2,190.00) and retailers (₦1,

Table 4: Average cost and returns for Tomato retailers per basket (65kg) in Kebbi State.

Variable	Average (₦)	Percentage
A. Total Revenue	13,480.00	
Cost of Marketing		
Cost of Storage	15.00	0.12
Tax/Market Levy	30.00	0.25
Cost of Transportation	250.00	2.08
Cost of Basket	430.00	3.58
Cost of Uploading/Downloading	40.00	0.33
Cost of Purchase	11,240.00	93.63
B. Total Cost (TC)	12,005.00	100.00
Gross Margin (A - B)	1,475.00	
Return on Investment (ROI)	1.12	

Source: Field survey, 2021

Table 5: Constraints encountered in Tomato Production.

Parameters	Frequency	Percentage
Lack of storage facilities	158	98.75
Perishable nature of the product	145	90.63
Pests and diseases	133	83.13
Lack of processing industries in the state	127	79.38
High cost of inputs	125	78.13
Financial challenges	123	76.88
Poor road network in rural communities	118	73.75
Price fluctuation (Unstable prices) of the products	113	70.63
Insecurity and banditry	87	54.38

Source: Field survey, 2021

*Multiple responses were recorded

475.00) revealed that wholesalers were realizing more profit than retailers. This finding is similar to that of Sanusi and Dada (2016) on profit analysis of marketing of tomato in Odeda Local Government Area of Ogun State, Nigeria which shows that for every one naira invested by wholesalers and retailers in marketing tomato in Olodo and Kila yielded ₦1.35 kobo and ₦1.21 kobo returns, respectively. The result is also in consonance with that of (Camillus *et al.*, 2014; Obasi, 2008; and Echebiri and Mejeha, 2004) who reported higher gross margin for wholesalers than the retailers.

Result in Table 5 revealed that lack of storage facilities is the major constraint encountered in tomato production. Due to the perishable nature of tomato, lack of storage facilities and processing industries in the state led farmers into panic disposal of their tomatoes at ridiculous prices especially during the glut season. This is because tomato cannot be kept for a long period while storage facilities and processing industries are inadequate.

Pests and diseases were also regarded as one of the constraints affecting tomato production in the study area. White fly, green aphid root-knot of nematodes are among the insects that affect the production of tomatoes in the study area while diseases such as bacterial wilt, leaf curl are among the prominent diseases affecting tomato

production, high rural-urban migration due to insecurity treat faced by the state most especially in the west and southern parts of the state that is yet to be fully curtailed. Lack of processing industries in the state was also reported as one of the constraints affecting tomato production in the study area. If processing industries are available within the state, it will serve as a market for tomato produced by the farmers, thus ensuring that the farmers do not need to keep their produce in their custody for a long period of time. These industries could serve as market for tomato produced.

Conclusion and recommendation

Based on the revealed results of the study, the main tomato value chain actors are input suppliers, producers, middlemen, traders, processors and consumers. It can be concluded that seedling producers (₦1, 630), tomato farmers (₦271, 821), wholesalers (₦2,190) and retailers (₦1,475) are making profit, based on return per naira invested, seedling producers has the highest returns follows by tomato farmers, wholesalers and retailers. For every one naira invested the following returns were realized; ₦2.28 for seedling producers, ₦2.11 for farmers, ₦1.22 Wholesalers and ₦1.12 for retailers.

Seedling producers realized more profit based on return per naira invested. It was recommended that, farmers should form cooperatives to attract attention from government while government should provide incentives in the form of storage facilities and credit at low interest to value chain actors in order to boost their profit and also formulate and implement policies that are favourable and attractive to investors in the state.

Highlights of the paper

Based on the study conducted in Kebbi State, Nigeria, the tomato value chain has been analyzed. The study found that input suppliers, producers, middlemen, traders, processors and consumers are the major actors in the value chain. The profitability of these actors was also analyzed, with input suppliers realizing a profit of ₦1,630, farmers earning ₦271,821, wholesalers earning ₦2,190 and retailers earning ₦1,475.

Marketing efficiency was also analyzed and it was found that for every N1.00 invested, seedling producers realized ₦1.28 kobo, tomato farmers earned ₦1.11 kobo, wholesalers earned N0.22 kobo and retailers earned N0.12 kobo. These findings suggest that the tomato value chain is a profitable and viable business.

However, there are several constraints faced by the actors in the value chain, including lack of storage facilities, perishability of the product, pest and diseases, lack of processing industries in the state, high cost of inputs, financial challenges, poor road network, price fluctuation and insecurity.

To address these challenges, it is recommended that farmers form cooperatives for better marketing and to attract attention from the government. The government should provide incentives in the form of storage facilities and credit at low interest rates to value chain actors in order to boost their profits. Additionally, policies that are favorable and attractive to investors should be formulated and implemented in the state.

Authors' Declaration

We declare that this study is an original research by our research team and we agree to publish it in the journal.

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