Economic Analysis of Tomato (*Solanum Lycopersicum)* Marketing in Ondo State, Nigeria

Abstract
The study examines the economic analysis of tomato marketing in Ondo State, Nigeria. Primary data were used through a well-designed questionnaire. A multistage sampling was used to select 120 tomato marketers in the area. Descriptive statistics, budgetary techniques, and multiple regression were used for the analysis. The results revealed that married females dominate tomato marketers with an average age of 40 years.About 55.0% of them had household sizes that ranged from 4-6 persons with a mean marketing experience of 7.5 years. The products reach consumers through the channels from farmers through wholesalers to retailers.The results of regression showed that sex, purchase price, labour cost, and transport cost are the main determinants of profitability in the area. The significant challengesfaced are the high cost of transportation and the lack of storage facilities. Adequate road network and marketing infrastructure should be provided to increase the performance of the enterprise.
Keywords: Marketing margin, profitability, vegetables, retailers, wholesale

1. Introduction

Agriculture is an important sector in most developing countries [1]. It contributes more than 30% of the total annual GDP and provides over 80% of the food needs of the country [2]. An increase in agricultural productivity depends heavily on its marketability [1]. An efficient market does not only link sellers and buyers in reacting to current situations in supply and demand but rather has a dynamic role to play in stimulating the consumption of outputs which are essential elements of economic development [1].

Tomato is globally cultivated for its fleshy fruits and is known as a protective food because of its special nutritive value and its widespread production. It is the world's largest vegetable crop after potato and it tops the list of canned vegetables.Tomatoes are eaten directly as raw vegetables or consumed in a variety of processed products like ketchup, sauce, chutney, juice, diced, soup, paste, puree, etc. It is a rich source of vitamins A and C, also contains minerals like iron, and phosphorus, and is the richest source of nutrients, dietary fibers, and antioxidants like lycopene and beta-carotene, the compounds that protect cells from cancer (Hobson, 1993).

Tomato is cultivated almost throughout Nigeria with an estimated total annual production of 1.7 million tones cultivated on 1 million hectares of land and an average yield of 20 – 30 tons/hectare [3, 4] and it makes up about 18 percent of the average daily consumption of vegetables in Nigerian homes [5]. In fact, Nigeria is ranked as the second largest tomato producer in Africa and thirteenth in the world; yet, Nigeria continues to import tomato paste from China and Italy in large quantities making her the largest importer of these products [4].

The crop has a short generation time of about three to four months, well adapted to different cropping systems of cereal grains, pulses, and oilseeds. Hence, it is the most widely grown vegetable crop grown worldwide under outdoor and indoor conditions[6].

Tomato is the world's largest produced vegetable crop and is known as a protective food both because of its special nutritive value and itswidespread. Tomatoes and tomato-based foods are considered healthy for the reason that they are low in calories, but possess a remarkable combination of antioxidant micronutrients. It ranks third in priority after Potato and Onion in

India but ranks second after potatoes in the world. India ranks second in the area as well as in the production of Tomatoes according to [7]. It is one of the essential commodities of the Indian market. A number of tomato products e.g., ketchup, juice, puree, paste, sauce, and pickles are available in the market. These are items of common use in households, hotels, restaurants, and institutions. The recent scientific advances in tomato processing industries and emerging organized food retail stores have really helped in matching supply and demand for tomatoes in urban areas and protecting the interests of farmers during the crisis of overproduction. Due to increasing standards of living in the cities and the rapid urbanization taking place in the rural areas, consumption of tomato-based products is expected to go up steadily.

Marketing of tomatoes is a complex phenomenon due to their perishable nature, seasonality, and bulkiness, and as such, tomato production requires an efficient marketing system Tomato marketing is poorly developed in Nigeria. Worst still, in the past, the government paid more attention to production with little attention to the marketing of vegetables such as tomatoes, pepper, onions, garden eggs, okra, and leafy vegetables despite the fact that they need spatial marketing facilities [8]. Consequently, losses of 40-50 percent occur for many vegetables mainly due to spoilage, inadequate transportation, sorting, improper packaging and handling, and lack of storage facilities. Also, the problem with tomato marketing is in the area of standard weights and measurements. These leave the consumer to their luck and haggling abilities in securing a good deal. Thus, this study describes the marketing channels and structure, estimates the cost and returns to tomato marketing, and determines the factors influencing the net returns of tomato marketers. Given this background, it is expected that a lot of research efforts should be directed toward finding solutions to the problem of poor marketing in the tomato business in Nigeria. This study is therefore a response to filling this knowledge gap as well as providing some policy impetus to stakeholders in Nigerian agriculture, especially the vegetable industry in solving the challenges to tomatoes marketing activities in Nigeria. Therefore, the general objective of this study is to consider the economic analysis of tomatomarketing inAkure North Local Government Area of Ondo State, Nigeria.The specific objectives of this study are to:

1. Examinethe socio-economic characteristics of the marketers in the study area;
2. Describe the marketing channels of tomato in the study area,
3. Estimate and compare the profitability of wholesalers and retailers of tomato;and
4. Identify the factors that affect the sales of tomatoes.

The rationale behind this study is that among different vegetables grown in Nigeria, tomato clarity stands out as the most important both in scale of production and level of consumption [9]. Tomato (*Solanum lycopersicum*) is grown by most dry-season market gardeners who regard it as the principal crop. Tomato is one of the most important vegetable crops both in scale of production and level of consumption. Most other vegetables have restricted demand in Nigeria, demand for tomatoes is universal. Tomato has a great poverty alleviation capacity. Its production, handling, transportation, distribution, and marketing will ~~definitely~~ employ a large number of people. Tomato can be processed and exported to other West African nations or sold within the country. An increase in agricultural productivity depends heavily on its marketability. An efficient market does not only link sellers and buyers in reacting to current situations in supply and demand but rather has a dynamic role to play in stimulating consumption of outputs which are essential elements of economic development [1]. Katharina

and Stefan [10] have reported that the concept of marketing subsumes a set of different innovative advertising instruments that aim at having a large effect with a small budget

2. Research Methodology

2.1 Description of study area

The study was carried out in three major markets within Akure North Local Government Area (LGA) of Ondo State,Nigeria namely: Ijapo market, Shasha market, and Sango market. The study area comprises the whole of Akure North Local Government Area in Ondo state of Nigeria. The Local Government Area comprises five major communities; Iju, ItaOgbolu, Oba Ile, Igoba, and Ogbese in Akure North LGA.These communities are located between latitudes 5˚45' and 7˚52'N and longitudes 4˚20' and6˚05'E.The population of the area is approximately 198,000. The vegetation type of the local government area is typically rainforest dominated by abundant trees and grasses. The economic activities in the area include fishing and the production of food and tree crops such as cocoa, rubber, oil palm, cashew, teak, gmeligna, and indigenous tree species. The predominant occupations in the communities are farming and trading. The area has a maze of numerous drainages (Ala, Oluwa, and Ogbese River).

2.2 Method of Data Collection

Primary data were used in this study. The data were obtained from a field survey through the use of a well-structured questionnaire, administered through personal interviews. The questionnaire was designed to elicit information on marketing activities, functions and structure of tomato marketers, cost and returns, factors determining the net return of tomato marketers, and the major constraints confronting marketers in the study area.

2.3 Sampling Technique

A multi-stage sampling technique was used in the study. The first stage involved a purposive selection of three (3) Major markets inAkureNorth LGA, while the second stage involved a stratified random selection of 40 respondents in each of the three markets, a totalof 120 marketers in the study area.

2.4 Analytical Techniques

Descriptive statistics, gross margin analysis, marketing margin, and multiple regression analysis were used to analyze the study's data.

2.4.1Descriptive Statistics

Descriptive statistics was used to achieve objectives i and iii. Descriptive statistics involving the use of measures of central tendency such as frequency, means, and percentages will be used to describe the socioeconomic characteristics of tomato marketers, marketing channels, and problems associated with the marketing.

2.4.2 Gross margin analysis

Gross margin analysis will be used to achieve objective ii. This was used to determine the profitability level of wholesale and retailers of tomato marketing. The Gross Margin model is specified from the point of view of estimation of total expenses (costs) as well as various returns or revenue within a marketing period.

Gross Margin (GM) = GR – TVC

Where, GR = Gross Revenue

TVC = Total Variable Cost……..……(2)

Gross Revenue (GR) = Q. Py ……..…….(3)

Where, Q = Quantities of tomatoes sold (Kg);

Py = Unit price of tomatoes (₦/kg).

2.4.3 Marketing Margin Analysis

Market marketing margin is a measure of market performance. It is the difference between the price paid by the consumer and that received by the producers. It can be expressed in cash or asa percentage of the retail cost [11,12]. The formula adopted for this study is that specified by Olukosi and Isitor[13] and as used by [14, 15] as follows:

$$Marketing\ margin = \frac{Selling\ \ Price - Purchase\ Price}{Selling\ \ Price}\ x\ 100 \ldots\ldots (4)$$

2.4.4 Ordinary Least Square (OLS) Regression Technique

Multiple regression using OLS was used to determine factors affecting the quantity of tomatoes purchased by the marketers for sale.

The model was specified as follows:

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b7X_7 + U_{ri}$…… (5)

Where:

Y= Quantity of tomatoes purchased for sale (₦)

X_1 = Sex

X_2 = Age (years)

X_3= Marketing experience (years)

X_4= Years spent in school

X_5= Purchase price (₦)

X_6= Labour cost (₦)

X_7= Transportation cost (₦)

b_0……b_7 = Coefficients to be estimated

X_1…..X_7 = Independent variables

µi =the error term (which is assumed to have zero mean and constant variance).The production function was estimated using the ordinary least square regression technique. The following functional forms were estimated for the production function and the one that best satisfies the theoretical, statistical, and econometric criteria for a production function were selected as lead equation.The functional forms to be estimated are Linear, semi-log, double log, and exponential.

Linear function:

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b5X5 + b6X6 + b7X7 + U_{ri}$ …….. (6)

Semi-Log:

$Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b5\log X5 + b6\log X6 + b7\log X7 + U_i$… (7)

Exponentials:

$\log Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b5X5 + b6X6 + b7X7 + U_i$……. (8)

Double log

$\log Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b5\log X4 + b6\log X6 + b7\log X7 + U_i$ (9)

3. Results and Discussion

3.1 Socio-economic Characteristics of Tomato Marketers in the Study Area

Results in Table 1 shows that the majority of female (53.3%) dominate tomato marketing while male consists of 46.7%. The analysis of results implies that tomato marketing is a female-dominated enterprise. This corroborates with the study by [9] who reported that tomato marketing is predominantly dominated by female marketers. The majority (33.3%) of the marketers are between the ages of 40 and 49 years old. The marketer's mean age of 40.0 years indicates that tomato marketers in the study area are in their economic active years.

This result was in line with the study of Obayelu et al.[16]who found the mean of tomato marketers to be 40.8. This result is also similar to the studies by [17, 1] who found out that vegetable marketers are relatively young and active to engage in marketing. About 47.5% of tomato marketers were married, while 34.2% were single. This corroborates the findings of [16] who also found that the majority of tomato marketers in their study are married. The results also indicate that tomato farmers had a mean of 5.5 household size with the majority falling between 7 and 9 members. These results collaborate with the findings of [17, 18] who reported 8 persons per household in their study. This implies that there will be availability of labour and the marketers can expand their tomato business which will in turn result inan increase in profit.About 77.5% of tomato marketers were literate, that is, respondents who can read and write. The majority of the respondents attained secondary school education as the highest level of education, while 7.5% of the respondents had no formal education. Given this level of literacy, it is expected that information can be disseminated with ease among the respondents. This result conforms to the study by [16 – 18] who also found that the majority of the marketers interviewed for their study were literate. This finding substantiated the findings of [19] observed that the level of education attended by marketers to a large extent determine the strategies, which he/she may use to solve his/her marketing problem and adopt new innovation without difficulties that will increase his/her profit as soon as they become available to him/her.The mean year of experience in marketing of the marketers was 7.5 years. This implies that the marketing of fresh tomatoes is done practically by well-experienced marketers which corroborates the findings of Emam[20]. Ali et al. [14] asserted that marketing experience is important in determining the level of profitability obtained by a marketer. The more years of marketing experience, the more knowledge and profits the marketers tend to get, as he/she will use his/her understanding of the marketing system, market condition, market trends, and price. About71.7% of the respondents do not belong to cooperative societies and 28.3% belong to cooperative associations. According to Katanga et al. [21] cooperatives are vehiclesfor development since they provide informal credit to farmers. Members of the cooperative, *ceteris paribus*, are likely to perform better than non-members because of possible economies of scale. Nearly 75% of tomato marketers had access to credit, while 25% of the population did not have access to credit. This implies that marketers as the tendency to pay back loans from formal or informal institutions because of the demand for tomato marketing.

Table 1: Results of the Socioeconomic Profiles of the Tomato Marketers in the Area

Socio-economic variables	Frequency	Percentage	
Sex			
Male	56	46.7	
Female	64	53.3	
Age			**Mean**
20-29	30	25.0	40.0
30-39	30	25.0	
40-49	40	33.3	
50-59	16	13.3	
60-69	3	2.5	
70-79	1	0.8	
Marital status			
Married	57	47.5	

Single	41	34.2	
Divorce	14	11.7	
Widow	8	6.7	
Household size			**Mean**
1-3	20	16.7	
4-6	66	55.0	5.5
7-9	22	18.3	
10-12	11	9.2	
13-15	1	0.8	
Educational Level			
No Formal education	9	7.5	
Primary school education	18	15.0	
Secondary school education	33	27.5	
Tertiary education	60	50.0	
Marketing Experience			**Mean**
1-5	57	47.5	7.5
6-10	39	32.5	
11-15	12	10.0	
16-20	7	5.8	
21-25	2	1.7	
26-30	1	0.8	
≥ 31	2	1.7	
Membership of association			
Yes	34	28.3	
No	86	71.7	
Access to credit			
Yes	90	75.0	
No	30	25.0	
Total	120	100	

Source: Field Survey, 2023

3.2.1 Market Conduct for Tomato Marketing Channel

The marketconduct for tomato marketing in Figure 1 shows that all channels got their tomato from the farmers. The wholesale employed laborers to go to farms to harvest and in return, some farmers went to the market to supply tomatoes through the truck van to the wholesale. Local assemblers buy tomatoes in large quantities from the farmers and sell them to retailers. The retailers sometimes buy directly from the farmers and sell directly to the consumers.

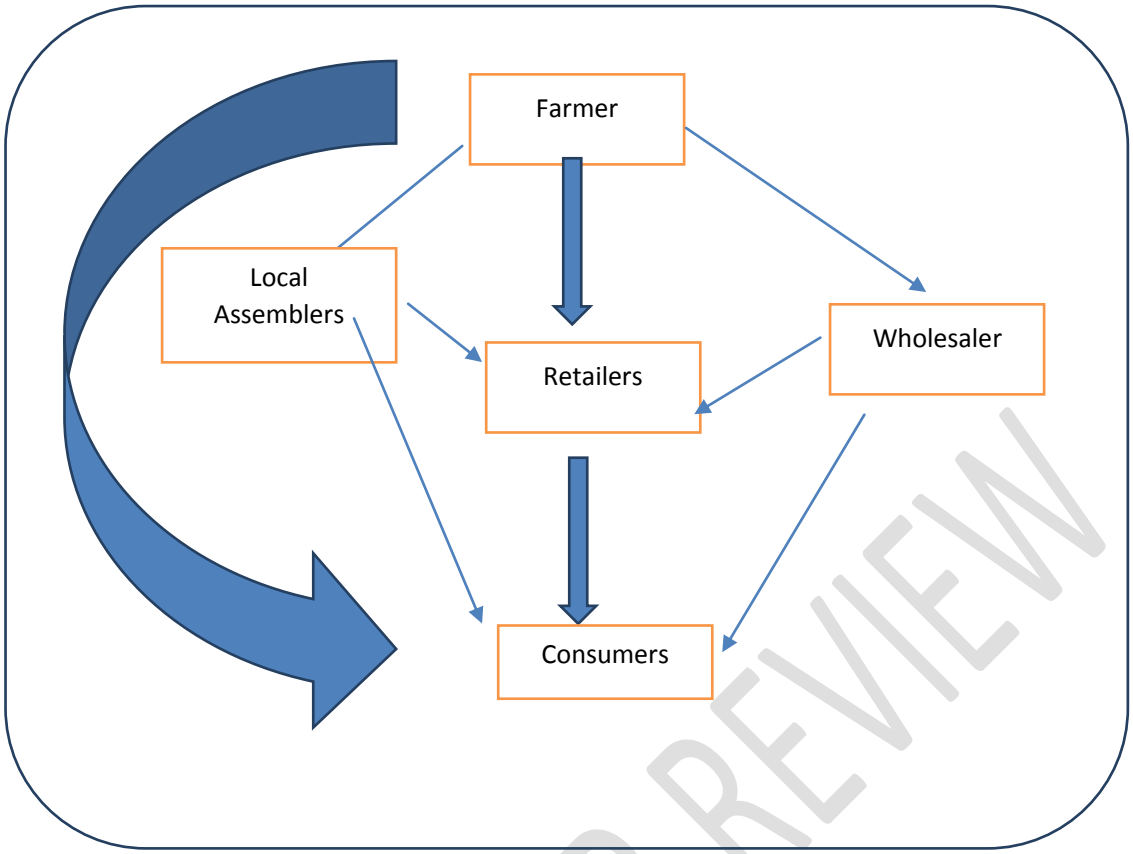

Figure 1: Marketing channel for tomato marketing.
Source: Field survey, 2023

3.2.2 Buying and SellingPoint of the Respondents

Results in Table 2 show the distribution of the buying and selling points of tomato marketers. Results show that the majority (35.0%) of tomato marketers got their buying and selling from farmers associations, 30.0% got their buying and selling from family, 22.5% got their buying and selling from friends, 9.2% of the marketers got their buying and selling from social media and 7.5% got their buying and selling from newspaper. This implies that association is a powerful tool. Belonging to farmers and market-based community associations will increase the marketing of tomato production**.**

Table 2: Distribution of Respondents buying and selling points

Buying and selling point	Frequency	Percentage
Farmers associations	42	35.0
Social media	11	9.2
Newspaper	9	7.5
Family	31	30.0
Friends	27	22.5
Total	120	100

Source: Field Survey, 2023

3.3.1 Profitability of Tomato Marketers.

In order to determine the profitability and performance status of the tomato marketers, a cost and returns analysis as well as a profitability analysis were carried out in this study. The results are presented in Table 3. Results of percentage of the variable cost for wholesaler and retailer accounted for 94.3% and 94.2% respectively of which the purchasing cost of tomato was 72.3% out of the total cost of production for wholesaler and 79.2% out of the total cost of production for tomato retailer. The net farm income was computed by subtracting total revenue fromthe total cost incurred for marketers.net farm income for wholesalers was accounted for ₦ 394,122 and retailers ₦383,184

Table 3: Costs and Return Analysis of Tomato Marketing

Items	Wholesalers		Retailers	
	Value in (₦)	Percentage	Value in (₦)	Percentage
Shop rent /Market space	10,484	3.5	4,986	3.4
Tray	1,500	0.5	740	0.5
Basket	2,834	1.0	952	1.0
Scale	1,700	0.6	1,200	0.8
Fixed cost (FC)	**16,518**	**5.6**	**7,878**	**5.7**
Price of tomato purchase in naira	212,509	72.3	114,192	79.2
Labour	10,867	3.7	3,524	2.4
Transport	11,854	4.0	5,288	3.6
Packing	7,381	2.5	994	0.6
Loading and offloading	9,281	3.2	1,752	1.2
Storage	15,423	5.2	3,537	2.4
Association	10,000	3.4	7,000	4.8
Variable cost (VC)	**277,315**	**94.3**	**136,287**	**94.2**
Marketing cost=Fixed cost Variable cost (MC=FC+VC)	**293,833**	**100**	**144,105**	**100**
Revenue=price* quantity(basket)	**687, 955**		**383,184**	
NFI=TR-TC	**394,122**		**239,079**	
ROI=TR/TCM	**2.34**		**2.6**	

Source: Field Survey, 2023

3.3.2 Profitability Index between Wholesalers and Retailers

Results presented in Table 4 show the purchasing cost, tomato sales revenue marketing cost, net margin, and profitability index for the main channels of marketing in the study area. The wholesaler purchasing was the amount they buy tomatoes from the farmer. The results below showed that the profitability index for wholesalers and retailers are 61.0 and 86.0 respectively. Thus, both types of marketers are making very handsome profits, but retailers tend to make more profit per naira invested compared with wholesalers. The average wholesaler and retailer makes a profit of ₦61.0 and ₦86.0 respectively for every ₦100 invested in the tomato marketing business.

Table 4: Marketing Margin and Profitability Index for tomato marketers in Akure North Local Government Area

	Wholesaler	**Retailer**
Items	**Value (₦)**	**Value (₦)**
Tomato sale revenue	687, 955	383,184

Tomato purchasing cost	212,509	114,192
Marketing cost	81,324	29,913
Total cost	293,833	144,105
Net marketing margin	394,122	239,079
Margin	181,613	124,887
Profitability index	0.61	0.86

Source: Field Survey, 2

Notes:

Marketing Cost = Variable cost + fixed Cost

- Total Cost = Purchase cost + Marketing Cost
- Net Marketing margin = Revenue –Total Cost
- Profitability index = Net marketing margin/Total Cost

3.4 Determinant of Factors that Affect the Sales of Tomatoes

The summary of the parameter estimates for the factors that affect the quantity of fresh tomatoes purchased for sale by the marketers is presented in Table 5, Based on the R-squared value, F-ratio, and the number and signs of significant variables, the double-log functional form was chosen as the lead equation. The model shows that the independent variables accounted for 67.2 percent of the variation in the number of fresh tomatoes the marketers purchase for sale. Four variables out of seven were found to be significant. This implies that four variables had a significant influence on the quantity of tomatoes purchased for sale by the marketers in the study area. The variables were purchasing price, transportation cost and labour cost these results were in line with *apriori* expectation and also in line with [22, 16]. Gender was included in the variables which was significant.The purchase price of tomatoes showed a negative relationship with the quantity purchased for sale at a one percent significant level (P>0.01) This is however expected If the purchase price per unit increases, the quantity that will be demanded by the marketers for sale is bound to decrease by 25.6%, ceteris paribus. Conversely, if the price of purchase per unit decreases, the quantity that will be purchased by the marketers for sale will increase, *ceteris paribus*.This is in line with the study of [23]. The labour cost showed a negative relationship with the quantity purchased for sale at one percent significant level (P>0.01). This is however expected a unit increase in labour cost will decrease the sales of tomato marketing by 12.0%.On the other hand, transport cost was positive and significant at 1% levels. This suggests that the more the commodity for sale, the higher the transport cost incurred. Thus, the effect of higher transport costs paid was compensated for by better profits made in returns.

Table 5: Results of Regression Models

Independent Variables	**Semi-log**		**Exponential**		**Double log**	
	coefficient	**P-value**	**coefficient**	**P-value**	**coefficient**	**P-value**
Constant	-116.087	0.000	2.733	0.000	-.295	0.518
Sex	4.586 *	0.072	O.057	0.140	0.120 **	0.046
Age	-0.361	0.919	-0.001	0.747	-0.013	0.881
Year of Experience	1.365	0.257	0.005*	0.092	0.033	0.246
Level of education	2.115	0.534	-0.067	0.358	-0.058	0.473
Purchase	10.175***	0.000	8.390E-5***	0.000	-0.256***	0.000

price(kg)						
Labour cost	4.841***	0.001	7.881E-6*	0.008	-0.120***	0.000
Transportation cost	2.944***	0.007	-1.052E-6	0.179	0.077***	0.003
R square	0.642		0.736		0.672	
Adj R^2	0.620		0.720		0.652	
F- ratio	28.748		44.647		32.798	

Source: Field Survey, 2023

Figure in first line= estimated coefficient

Figures in parenthesis = t value

Figure in third line= p value

***< 0.01-1%, ** 0.01-0.05= 5%, *0.051-0.099=10%

4. Conclusion and Recommendations

The best marketing channel routes chosen by the respondents were (Farmers -Wholesalers—retailers). The profitability index for wholesalers and retailers are 61.0 and 86.0 respectively. Thus, both types of marketers are making very handsome profits, but retailer tends to make more profit per naira invested compared with wholesaler. The average wholesaler and retailer makes a profit of ₦61.0 and ₦86.0 respectively for every ₦100 invested in the tomato marketing business.Four variables out of the seven independent variables which are sex, the purchase price of tomato in (kg), labour cost, and transportation cost were significant from 1-10 percent alpha level. This implies that these variables were the factors that would affect the sales of tomato marketing in the study area.

Based on the findings, the following recommendations were made:

1. Marketers should join cooperative societies to improve means of credit and aid business expansion
2. Markers should also be encouraged to acquire formal education as this will contribute to efficient marketing.
3. Adequate transportation should be provided by the government and the existing roads should be refurbished to minimize transportation costs.
4. Also, since the selling price is one of the determinants of gross margin, there is a need for the policymakers to make necessary pricing policies; this is because the selling prices have an effect on the price that will be paid by consumers as well as those that will be received by the sellers.

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