

Effect of Post-Harvest Losses of Tomato Fruits on the Income of the Marketers in Federal Capital Territory, Abuja, Nigeria

(Research Article)

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Alaba Olanike OJO

Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria
(ojonikky@yahoo.com)

Orcid ID: <https://orcid.org/0000-0001-6155-3459>

Michael Akindele OJO

Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria
(akindele.ojo@futminna.edu.ng)

Orcid ID: <https://orcid.org/0000-0003-4011-4427>

Amina MUSTAPHA

Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria
(ojoolanike56@gmail.com)

Orcid ID: <https://orcid.org/0000-0002-9168-0640>

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ABSTRACT

Keywords

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Post-harvest losses of food crops, especially fruits and vegetables, are common phenomena in developing countries. Data were analysed with Ordinary Least Square technique and descriptive statistics. The results revealed that tomato marketing was male-dominated with a mean age of 36 years. The findings also revealed a gini-coefficient of 0.4 and that quantity of tomato fruits, time tomato fruits spent on farm after maturity and time taken before tomato is sold to consumers had significant effect on the income of the marketers. The major constraints faced by the marketers included bad road, inadequate storage facilities and, seasonality. It is therefore recommended that government should encourage the establishment of more tomato processing industries to purchase excess tomato fruits during the glut season.

1. INTRODUCTION

Agriculture is a very important sector in Nigeria economy. The inherent characteristics of farm products such as seasonality, bulkiness, perishability and their non-consumable nature make special demand on post harvest management of agricultural products most especially, fruits and vegetables which are usually harvested fresh. Postharvest handling refers to the stage in production process immediately after harvest which include storage, cleaning, packaging, transportation and sorting (Mbuk, 2011; Mrema and Rolle, 2002). It was reported that losses in agricultural production are estimated at 20 to 40% in developing countries, like Nigeria, depending on the crop and the season and that, as much as 40% vegetables are

wasted after harvest (Adenuga et al., 2013; Mrema and Rolle, 2002; Ogunleye and Adefemi, 2007). These post harvest losses occur, especially for tomato, if there is delay in harvesting after maturity; mechanical/physical injury during harvesting, sorting and packaging; poor methods of storage; excess supply over demand as a result of glut; bad road network or, as a result of physiological changes that occur during transit from the farm gate to the point of sale to the middlemen and/or to the final consumers.

Tomato is a major fruit vegetable crop that has achieved tremendous popularity over the last century. It is rich in minerals, vitamins, essential amino acids, sugars and dietary fibres. Aside these, researches have shown that it also contains much vitamin B and C, iron and phosphorus. Tomato fruits can also be consumed fresh in salads or cooked in sauces, soup and meat of fish dishes. They can be processed into purees, juice and ketchup (Ayandiji et al., 2011). In Nigeria, tomato is grown under irrigation in the north and thrives best in the dry season between December and April when the temperature is very high. The high temperature which is usually about 40°C or more during the day increases the rate of microbial activities and resultant rot/deterioration few days after harvest. The consequences of which are wastages, inadequate supply and accessibility to fresh tomato fruits, a reduction in its market value and income accrued to the marketers. It can also have negative impact on food security and livelihood of the marketers' in the area. It is against this backdrop that this research assessed the socio-economic characteristics of the farmers, effect of post-harvest losses of tomato fruits on the income of the marketers and, the constraints facing the marketers in the area with a view to providing appropriate recommendations to policy makers.

2. MATERIALS and METHODS

2.1. Study Area

The study was conducted in Federal Capital Territory (FCT) of Nigeria. It has inter-state boundaries with Nasarawa State to the east and southeast, Niger State to the northwest, Kaduna State to the northeast and Kogi State to the southwest (Wikipedia, 2015). It covers an area of 7,753.9 square kilometres and lies between latitude 09°05'N and longitude 07°32' East. FCT had a population of 1,406,239 persons (National Population Commission (NPC), 2006) which was projected to 3,324,000 at 2.5% growth rate (World Bank, 2013 and United Nations Funds for Population Activities (UNFPA), 2015). It has a population density of 192 people per square kilometre. It falls within the Guinean forest-savanna mosaic zone and experiences three weather conditions annually. These include a warm, humid rainy season and a blistering dry season. In between the two, there is a brief interlude of harmattan occasioned by the northeast trade wind, with the main feature of dust haze and dryness. The rainy season begins from March to November every year. It is administered through six area councils which include Bwari, Kwali, Gwagwalada, Abaji, Kuje and AMAC (Wikipedia, 2015). Most people in the study area engage in farming at all level while few of them engage in white collar jobs. The major crops grown include millet, corn, sorghum, rice, yams, cassava, plantains, groundnuts, cowpeas and tomatoes and pepper while commercial rearing livestock such as cattle, sheep, and goats also occurs.

2.2. Data Collection

Primary data were collected through the use of well-structured interview-schedule to elicit relevant information from the tomato marketers. Multistage sampling technique was used to select the respondents due to the diversity of the area. The first stage involved a random selection of Abuja Municipal Area Council (AMAC) while the second stage involved a

random selection of Dei-dei and Gwagwa tomato markets. In the third stage as shown in Table1, 90% of the total sample frame (That is, the total number of registered tomato marketers in the area) was selected for each of the markets, which correspond to 69 and 32 sample size respectively thus making a total of 101 respondents.

Table 1. Selection procedure of the sampled markets in the study area

LGA	Markets	TSF(N)	TNRS (n=90% of TSF)
AMAC	Dei – dei	77	69
	Gwagwa	35	32
TOTAL		112	101

Source: Author's computation AMAC = Abuja Municipal Area Council; TSF = Total Sampling Frame; TNRS = Total Number of Respondents Sampled

2.3. Analytical Techniques

Descriptive statistics such as frequency, tables and mean were used to identify the socio-economic characteristics of the marketers. The income distribution of the marketers was accessed with the aid of Lorenz curve. When the Gini Coefficient is close to 1, the income distribution is more uneven (unequal) because most income is earned by the richest marketer, whereas the lowest-income group earns much less. When the Gini Coefficient is close to 0, the income distribution is more even (equal) because the highest-income marketer does not earn much more than the lowest-income marketer. When the gini index expands, the Gini Coefficient will be nearer to 1; and the income distribution will be more unequal but when it diminishes, the gini coefficient will be nearer to 0 and, the income distribution will be more equal. When the Lorenz Curve is closer to the line of equality, the gini coefficient is smaller and closes to zero, representing a smaller income inequality.

Ordinary Least Square (OLS) technique was used to determine the effect of tomato fruit losses on the income of the marketers, the model is implicitly expressed as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e_1)$$

Where,

Y = Income (₦)

X₁ = Age (Years)

X₂ = Year of experience (Years)

X₃ = Distance from farm to market (km)

X₄ = Time spent on the farm after maturity (Days)

X₅ = Quantity of tomato fruits loses (kg)

X₆ = Time taken to be sold in the market (Days)

X₇ = Years spent in formal education (Years)

e = Error term which is used to captured the influence of variables not included in the model.

Four functional forms (i.e. Linear function, Power, Semi-log and Exponential functions) were used for the analysis. The best fitted was chosen based on the magnitude of coefficient of the multiple determination, R² and the number of significant variables. The explicit forms of the model were stated as follows:

Linear

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e_i$$

Power

$$\ln Y = a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + e_i$$

Semi-log

$$Y = a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + e_i$$

Exponential

$$\ln Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + e_i$$

Where Y, X₁, X₂, X₃, X₄, X₅, X₆ and X₇ are as defined in the implicit form

b₁ – b₇ = regression coefficients

a = constant term

e_i = error term

3. RESULTS and DISCUSSIONS

3.1. Socio-economic characteristics of tomato marketers

Table 2 shows the distribution of marketers according to their socio-economic characteristics such as sex, age, marital status, level of education, household size and marketing experience. The sex distribution of marketers showed that 51.5% of the marketers in the study area were males while 48.5% of them were females. The age distribution of the marketers also revealed that 22.8% of them were within the age bracket of 26-30 years with mean age of 36 years. Furthermore, the marital status of the marketers revealed that 73.7%, 19.6%, 3% and 2% of the marketers were married, single, divorcee and widow(er), respectively. In addition, education is very important in the adoption of innovation by marketers. As revealed in Table 1, 65.3% of the marketers had secondary education while 19.8%, 11.9% and 3.0% had primary, tertiary and qur'anic education, respectively and that over one-half of the marketers (52.4%) had formal education. The analysis of household distribution of the marketers revealed that 55.4%, 38.6% and 5.0% of the marketers had 1-5, 6-10 and 11-15 persons, respectively while the mean household size was 5. Moreover, the marketing experience of the marketers as presented revealed that 37.7%, 15.8% and 10.9% of the marketers had between 5-10, 10-15 and 15-20 years of marketing experience, respectively. Gender analysis indicated male dominance in tomato marketing in the study area. This agrees with the findings of Usman and Bakari (2013) in a research conducted on the profitability of small-scale dry season tomato production in Adamawa State, Nigeria. It was reported that gender was an important determinant of farmers' participation in tomato marketing but at variance with the findings of Adenuga et al., (2013) and Achoja and Okoh (2014). The age distribution of the marketers also implied that majority of tomato marketers in the study area were active and energetic adults who could be proactive in taking decisions that could improve their marketing strategies and thus could contribute positively to improving their marketing performance and overall efficiency of tomato marketing in the area. This assertion is in line with the findings of Haruna et al., (2012) in the study on the economic analysis of fresh tomato marketers in Bauchi State of Nigeria. Since most of the marketers were married, it may increase their market participation so as to meet the household food security needs of their families thereby improving their living standards. This result is at variance with Ayandiji et al., (2011), who reported that although married farmers are likely to have access to more family labour yet it could have serious implications on post harvest losses in tomato production due to poor handling skills when compared with hired labourers. In addition, the result on education analysis implied that all the marketers had formal education and thus, allowed for easier dissemination and adoption of innovations that could improve better handling, marketing and preservation of tomato fruits in the area. This corroborates the findings of Olaleye et al., (2009) in their study on the demographic and socio-economic characteristics of the women marketers of dry season tomato in Niger State. The analysis of

household distribution of the marketers also indicated that the marketers had enough family labour to undertake marketing activities though this depends on the willingness of the marketers and/or the household members to engage in tomato marketing in the area. Where there is that willingness, it will save cost of hiring labour, reduce unemployment and increase the accrued family income. The marketing experience of the marketers indicated that marketers with many years of experience would be able to make sound decision as well as increase efficiency in marketing activities. This result was corroborated with the findings of Adekunle and Adewumi (2015) who reported that the marketers had 5-15 years of marketing experience and also revealed marketing experience as one of the important determinants of marketing efficiency. However, Ayandiji et al. (2011) carried out a research on the determinant of post harvest losses among tomato farmers in Imeko-afon Local Government Area of Ogun State, Nigeria and found that majority (68.17%) of the farmers had below 16 years of marketing experience in tomato production. They believed the low years of experience in tomato production might be responsible for the farmers' lack of knowledge and, the unavailability of technology of tomato processing and preservation in the study area.

Table 2. Distribution of marketers according to their socio economic characteristics

Characteristics	Frequency	Percentage	Mean
Gender			
Male	52	51.5	
Female	49	48.5	
Total	101	100.0	
Age			
> 25	6	5.9	
26-30	23	22.8	
31-35	20	19.8	36
36-40	18	17.8	
41-45	15	14.9	
< 45	19	18.8	
Total	101	100.0	
Marital Status			
Single	26	22.8	
Married	84	73.7	
Divorcee	3	2.6	
Widower	1	0.9	
Total	101	100.0	
Level of Education			
Quranic	3	3.0	
Primary	20	19.8	
Secondary	66	65.3	
Tertiary	12	11.9	

Total	101	100.0	
Household size			
1-5	56	55.4	5
6-10	39	38.6	
11-15	5	5.0	
>15	1	1.0	
Total	101	100.0	
Marketing Experience			
< 5	11	10.9	15
5 – 10	35	37.7	
10 -15	16	15.8	
15 -20	11	10.9	
>20	29	28.7	
Total	101	100.0	

Source: Authors' computation

3.2. Mode of transportation adopted by the tomato fruits marketers

The results in Table 3 shows the distribution of the marketers based on the mode of transportation adopted in conveying the tomato fruits to their various places of sales. The result showed that majority of the marketers used keke (Tricycle) (30.7%) while 25.7% and 14% of the marketers used buses and trucks, respectively. Although few marketers conveyed their tomato fruits via trucks and buses, yet these means of transportation aided easy movement of large quantities of tomato fruits in a single trip by the wholesalers. This ensures economy of scale and increased revenue of the marketers. Use of keke and wheel barrows (22.8%) were however cheaper and easier to move baskets of tomato fruits within the markets and, to the points of sale to the final consumers by retailers. This is acceptable because the point of purchase by the retailers is always not too far away from the point of sale to the final consumers.

Table 3. The distribution of marketers based on the mode of transportation adopted

Mode Of Transport	Frequency	Percentage (%)
Car	1	1.0
Truck	14	13.9
Bus	26	25.7
Pickup	3	3.0
Keke	31	30.7
Motorcycle	3	3.0
Wheelbarrow	23	22.8
Total	101	100.0

Source: Authors' computation

3.3. Source of finance of the tomato fruits marketers

The result in Table 4 shows that majority (82%) of marketers in the area sourced for finance from personal savings. Only 11%, 6% and 1% of the marketers sourced for finance in

cooperative societies, money lenders and commercial banks, respectively. Sourcing of finance from commercial banks was lowest during the period. Sourcing of finance from commercial banks was lowest because most commercial banks' unwillingness to disburse loans to marketers because of the high risk and uncertainties embedded in agricultural related businesses. Aside this, even where there is that willingness, high interest rate, hidden charges, too much bureaucracy and use of assets as collateral security among others, tend to discourage the marketers from sourcing for finance in commercial banks. This result is in corroboration with Usman and Bakari (2013) on the analysis of the profitability of small scale dry season tomato production in Adamawa state. Result from their findings showed that (80%) of the respondents sourced for funds from their own personal savings.

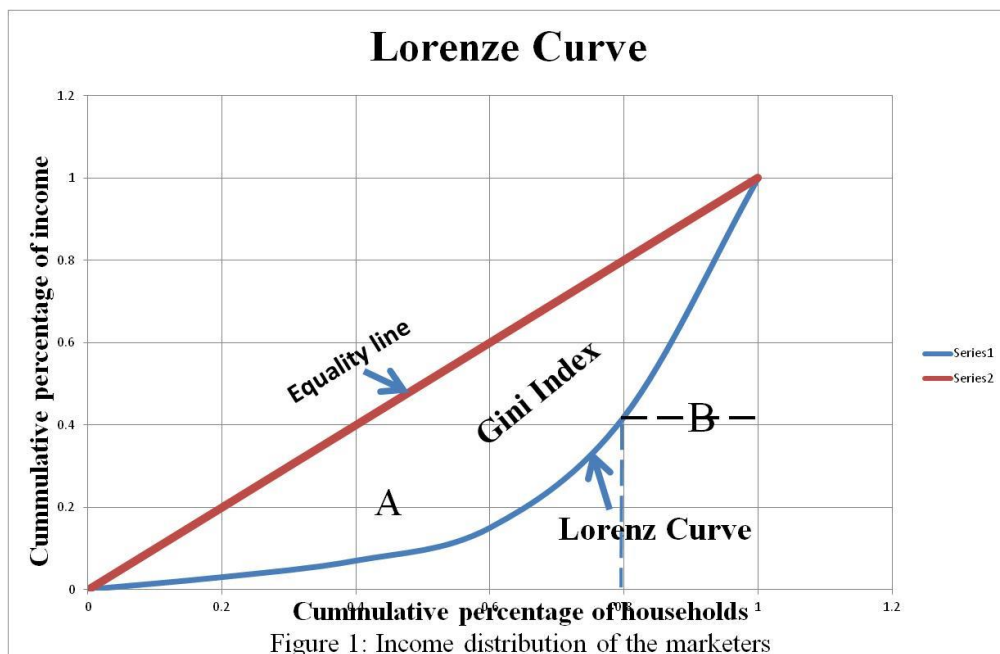
Table 4. Source of finance of tomato marketers in the study area

Source	Frequency	Percentage (%)
personal savings	83	82.2
Bank loan	1	1.0
Cooperative society	11	10.9
Money lenders	6	5.9
Total	101	100.0

Source: Authors' computation

3.4. Analysis of income distribution among the marketers

The Lorenz curve (Figure 1) is a graphical representation of the cumulative income distribution of the marketers. It shows the percentage of the total income that was accrued to the marketers. The straight line represents perfect equality but any departure from this 45° line represents inequality and the larger that 'deficit', the larger the inequality of income and vice versa. From the Figure, the value of gini-index was 0.4 which revealed that income distribution was closer to 0 than 1. The result indicated low level of disparities in the income of the marketers. It was also an indication that richest among them did not have the power over the gross income of all the marketers, that is, the highest-income marketer did not likely earn much more than the lowest-income marketer.



Effect of post-harvest losses of tomato fruit on the income of the marketers: Table 5 shows the results of the regression analysis of the effect of tomato fruit losses on the income of the marketers in the study area. Based on a priori economic and statistical criteria for selecting the 'lead' equation, exponential function out of the four functional forms was chosen as the 'best fit' because it has the highest number of significant variables and highest coefficient of determination, R^2 . The F-ratio showed the significance of the whole model. Therefore, the F-ratio of 27.41 showed that the whole model was significant at $p < 0.01$ which implied that the model was of good fit. The estimated R^2 showed that 67% of the variability observed in the income of the marketers was explained by the included explanatory variables. Only five out of the included explanatory variables conformed to the a priori expectation. For instance, years of marketing experience (X2) and distance from farm to market (X3) were significant at $p < 0.01$ while time tomato fruits spent on farm after maturity (X4), quantity of tomato fruits losses (X5) and, time taken before tomato is sold to interested buyer (X6) were significant at $p < 0.05$. The positive coefficients of years of marketing experience (X2), distance from farm to market (X3), time tomato fruits spent on farm after maturity (X4), quantity of tomato fruits losses (X5) and, time taken before tomato is sold to interested buyer (X6) showed that 1% increase in any of these variables led to a 0.019%, 0.0015%, 0.0807% and 9.1200% increase in income of the marketers, respectively. However, the negative sign of X6 implied that an increase in time taken before tomato fruits were sold led to decrease in the income of tomato marketers due to high rate of deterioration and hence, decrease in the market value of the tomato fruits and marketers' income. This finding corroborates the findings of Ayandiji et al., 2011 in the analysis of the determinants of post harvest losses among tomato farmers in Imeko-Afon Local Government Area of Ogun State, Nigeria. Their findings revealed that distance from farm to market, days fruits spent in the market before getting to the consumer, age of fruits at harvest among others were significant determinants of post harvest losses of tomato in the area.

Table 5. Regression analysis on the effect of tomato fruit losses on the income of the marketers

Variables	Coefficient	T – ratio	P – Value
Age	-0.0035	-0.58	0.563
Years of experience (X ₂)	0.0190	2.81***	0.006
Distance from farm to market (X ₃)	0.0015	4.06***	0.000
Time spent on farm after maturity (X ₄)	0.0807	2.42**	0.017
Quantity of tomato fruit loses (X ₅)	9.1200	2.43**	0.017
Time taken before tomato fruit is sold (X ₆)	-0.1364	- 2.02**	0.046

Source: Authors' computation $R^2 = 0.6736$, $F = 27.41$ ***

*** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Constraints faced by tomato fruits marketers in the area: The constraints faced by the marketers were as depicted in Table 6. From the Table, bad road (85%), inadequate storage facilities (79%), problem of seasonality (75%) and price fluctuation (72%) ranked 1st, 2nd, 3rd, and 4th, respectively, while inadequate capital and lack of customers were the least constraints which ranked 3% and 2%, respectively. The result implied that poor transportation network constituted a major hindrance limiting the ease of movement of tomato fruits from the point of production to the point of sale to final consumers in the study area. In addition, the result revealed that tomato marketing required little capital to start up the business and therefore can be a source of income to interested members of the society and invariably help reduce unemployment in the study area in particular and, Nigeria at large. Moreover, there was probably a consistent market for tomato fruits in the area despite the price fluctuations due to seasonality in production and marketing. This is supported by the findings of Haruna et al., (2012) on the economic analysis of fresh tomato marketers in Bauchi Metropolis of Bauchi State, Nigeria who reported that the main constraints facing the marketers were high cost of purchasing from farm gate during lean season production, lack of storage facilities (30%) and production fluctuation (10%).

Table 6. Distribution of marketers according to tomato fruits marketing constraints

Constraints	*Frequency	Percentage (%)	Rank
Bad road	86	85.1	1 st
Inadequate storage facilities	80	79.2	2 nd
Seasonality	76	75.2	3 rd
Price fluctuation	73	72.3	4 th
High tax	53	52.5	5 th
Small market	37	36.6	6 th
Exploitation by middlemen	32	31.7	7 th
Infestation by rodents and insects	29	28.7	8 th
Inadequate market	8	7.9	9 th
Infrastructure	5	5.0	10 th
Inadequate capital	3	3.0	11 th
Lack of customers	2	2.0	12 th
Total			

Source Authors' computation

* Multiple responses

4. CONCLUSION AND RECOMMENDATIONS

The study examined the effect of post-harvest losses of tomato fruits on the income of the marketers in Abuja municipal area council, Federal Capital Territory (FCT), Nigeria. The study revealed that tomato marketing was a male-dominated business with a mean age of 36 years. The gini coefficient of 0.4 showed that there was less inequality in the income of the marketers thus the highest-income marketer did not earn much more than the lowest-income marketer in the area. Also, the regression analysis of the effect of tomato fruit loses on the

income of the marketers in the study area showed R^2 of 0.6736 while the F-value was significant at $p < 0.01$. Out of the included variables, years of marketing experience (X2), distance from farm to market (X3), time spent on farm after maturity (X4), effect of tomato fruits loses (X5) and time taken to be sold (X6) were significant at different levels of probability. The most critical problems facing the tomato marketers were inadequate good road (85.1%), lack of storage facilities (79.2%), price fluctuation (72.3%) and seasonality.

Based on the findings, the following recommendations were made:

1. Local Government Authorities should rehabilitate bad roads and construct new roads to aid ease of transportation of tomato fruits to the desired destination.
2. Central Bank of Nigeria should formulate policies that will among other things, reduce the lending rate for agricultural purposes so as to encourage patronage by the marketers
3. Government should intensify efforts in providing modern storage facilities that will reduce rate of deterioration of tomato fruits after harvesting.
4. Extension agents' contacts should not be limited to the production aspects of tomato but should be extended to the marketing so as to train the marketers on the improved method of storage and processing so as to reduce post-harvest losses.
5. Government should encourage the establishment of more tomato processing industries to purchase excess tomato fruits during the glut season.
6. To overcome the problem of price fluctuations, the private sector should be encouraged to establish tomato dehydration plants to process tomato into more durable products in the area. This may help to enhance all-year round availability of tomato fruits.

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