Determinants of post harvest losses in tomato production: a case study of Imeko – Afon local government area of Ogun state.

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ABSTRACT
This study analyzed the determinants of post harvest losses among tomato producers in Imeko – Afon local government area of Ogun State. Eighty eight tomato farmers were interviewed using the purposive sampling technique. Data collected were analyzed using descriptive statistics, regression analysis and gross margin analysis. The regression result showed that 94.8 percent in the variation in the quantity of fruit loss from harvesting to marketing stage were explained by the specified variables and only 5.2 percent of the variation in the quantity of fruit loss was explained by other variables not specified. The gross margin analysis showed that losses had a significant effect on the income of the farmers. The main determinants of the losses from this study were the distance from the farm to the market, age of fruit at harvest, the size of farm put to cultivation of tomato and the number of the baskets that were harvested. In order for post harvest losses to be reduced, there should be intensification and follow up training to facilitate adoption of the newly introduced post harvest technology initiative by the government. Cooperative marketing and organization of farmers markets should also be encouraged among farmers to ameliorate losses related to marketing.

Keywords: *Post-harvest losses, Gross margin, tomato, cooperative marketing.*

INTRODUCTION

Tomato (*Lycopersicum esculentum*) is a staple fruit vegetable. Fresh fruits and vegetables are very important sources of vitamins and minerals that are essential for healthy human diet. Tomato has become an important cash and industrial crop in many parts of the world (IAR&T, 1991). In Nigeria alone, annual total area of one million hectares is reportedly used for its cultivation (Anon, 1989; Bodunde *et al*, 1993). The use of tomato is about 18 percent of the average daily consumption of vegetables in Nigeria (Olayide *et al*, 1972). Tomato may be eaten fresh as salad or they may be pressed into pastes or purees, which are used for cooking in soups or stews and producing fruit drinks. The quality and nutritional value of fresh produce like tomato, is affected by post harvest handling and storage condition. (Sablani *et al*, 2006). Vegetables are usually harvested when the plant is fresh and high in moisture and are thus distinguished from field crops, which are harvested at the mature

stage for grains, pulses, oil seeds, or fibre. This high moisture content of vegetable makes their handling, transportation and marketing a special problem particularly in the tropics.

In developing countries like Nigeria, storage, packaging, transport and handling techniques are practically non-existent with perishable crops and so, this allows for considerable losses of produce. Thus as more fresh fruits are needed to supply the growing population in developing countries, as more produce is transported to non producing areas and as more commodities are stored longer to obtain a year round supply, post harvest loss prevention technology measures become paramount (Oyekanmi, 2007). Post harvest losses have been highlighted as one of the determinants of the food problem in most developing countries like Nigeria (Ojo, 1991; Babalola *et al*, 2008).

Despite the remarkable progress made in increasing world food production at the global level,

approximately half of the population in the third world does not have access to adequate food supplies. There are many reasons for this, one of which is food loss occurring in the post harvest and marketing systems. Evidence suggests that these losses tend to be highest in countries where the need for food is greatest (FAO, 1989; Oyewole and Oloko, 2006; Babalola *et al,* 2008). Unfortunately, in many countries experiencing serious food problems, there seems to be no consistent food policy framework which should form the foundation of effective implementation of programmes (Ojo, 1991).

Food supply can be improved either by increase in production or reduction in loss. Since many researches show that great effort is being made in the area of food production especially in the developing countries, the decline in food production therefore can be traced to food losses. Thus, reduction in post harvest losses increases food availability, hence alleviation of food problems. The effect of post harvest losses reduces the effect of the efforts put into production and lowers marketing efficiency (Bautista, 1990; Okunmadewa, 1999). It is against this background that this paper examines the determinants of post harvest losses in tomato production and how it affects the income of tomato farmers in Imeko Afon Local Government Area of Ogun State.

METHODOLOGY
Imeko Afon Local Government Area of Ogun State has a total land area of 1,711.43 km^2. The local government is predominantly rural and agrarian with a population of 82,217 people (NBS, 2007). Significant volume of tomato production takes place in this locality. This study employed the use of structured questionnaire designed in line with the objectives of the study. A purposive sampling technique was used in administering questionnaire because the research is targeted at Tomato Producers. 88 farmers were interviewed to elicit the data used in the analysis for this study. The data were analyzed using descriptive statistics, gross margin and regression analyses

Model Specification
Q = f (PHWD, HWD, DIST, DFT, AFH, ALC, DFM, NBH, U)
Where
Q = Quantity of fruit loss (baskets)
PHWD = Pre harvest working days (man days)
HWD = Harvest working days (man days)
DIST = Distance from the farm to the market (km)
DFT = Days fruit spend on the farm (days)

AFH = Age of fruit at harvest (months)
ALC = Area of land cultivated (hectare)
DFM = Days fruit spend in the market before getting to the consumer (days)
QFH = quantity of fruits harvested (baskets)
U = error term
For the above estimation, four functional forms were fitted in the regression analysis to obtain the best fit.
Linear: $Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + U$
Double log: $InY = b_0 + b_1logx_1 + b_2logx_2 + b_3logx_3 + b_4logx_4 + b_5logx_5 + logU$. Semi log: $Y = logb_0 + b_1logx_1 + b_2logx_2 + b_3logx_3 + b_4logx_4 + b_5logx_5 + log U$
Exponential: $log Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + U$
The lead equation was chosen by using the value of coefficient of variation (R^{-2}) and F-statistics, number of significant variables as judged by t-value, appropriate sign of the coefficient, low standard error, less/zero multicollinearity of the variables and *a priori* expectation.
Gross margin is expressed as:
GM = TR – TVC
Where:
GM = Gross Margin
TR = Total Revenue
TVC = Total Variable Cost
TR = Value of output + other by – products (Cost of selling the products)
TVC = Cost of all inputs. (Pre – harvest and harvest labour costs, transportation cost

RESULT PRESENTATIONS AND DISCUSSION
Result according to Table 1 showed that there was little or no gender inequality in tomato farming, 45(51.14%) were male and 43 (48.86%) were females. This indicated that women played significant role in vegetable (especially tomato) production, especially in the study area. Age is a very important demographic characteristic because it determines the size and quality of the labour force. Majority of the farmers were below 41 years (69.32%). This indicated a good supply of agile workforce in Tomato production in the study area. Most of the farmers were illiterate (82.95%). This could be a contributory factor to high post harvest losses in Tomato Production because only farmers with post primary education can appreciate and use most post harvest technology available. This result is consistent with the findings of Oduekun (1991) and Fawole and Fasina (2005). Coupled with this is the fact that majority (68.17%) of the farmers had below 16 years experience in tomato production, this could have an effect on post harvest losses in Tomato

Production. Their years of experience in tomato production might also preclude poor knowledge and

Table1: Summary of Selected Characteristics of Farmers.

Variables	Category	No. of Household
Gender:	Male	45 (51.14%)
	Female	43 (48.86%)
Age (years)	≤30	35 (39.77%)
	31-40	26 (29.55%)
	41-50	14 (15.91%)
	>50	13(14.77%)
Educational Level (years)	No Education	51 (57.95%)
	1-6	22 (25.00%)
	7-12	14 (15.91%)
	>13	1 (1.14%)
Marital Status	Single	12 (13.64%)
	Married	76 (86.36%)
Household Size	1-6	37 (42.04%)
	7-12	22 (25.00%)
	>12	29 (32.95%)
Experience in Growing		
Tomato (year)	1-5	29(32.95%)
	6-10	18 (20.45%)
	11-15	13 (14.77%)
	16-20	20 (22.73%)
	>20	8 (9.09%)
Tomato Farm size (Ha)	<1	9 (10.23%)
	1-5	45 (51.14%)
	6-10	15 (17.05%)
	>10	15 (17.05%)
Mode of Transporting Tomato		
	Bicycle	4 (4.55%)
	Motorcycle	20 (22.73%)
	Van/pick – up	64 (72.73%)

Source: field survey, 2007.

Majority of the farmers cultivated between 1hectare and 5 hectares of land 45 (51.14%) and more areas were being put to tomato cultivation. Babalola et al (2008) noted that as production scale increases farmers will have to contend with the problem of storage and transportation. Where these facilities are not adequate, losses are imminent. Mean household size was about 9 persons. This indicates high supply of family labour. However, it also highlights the likelihood of high poverty level among the farming households (Akinbile and Ndaghu, 2005; NBS, 2007; Babalola and Agbola, 2008). Most of the farmers 64(72.73%) made use of the 'pick – up' van as a means of transportation. This means of transportation is expected to reduce post harvest losses, but the time

adoption of preservation technology among the farmers.

taken to gather a pick-up load of fruits and the loading – offloading procedures often impact on fruit losses.

The use of Post Harvest Technology among Tomato Farmers in the Study Area
The post harvest technology popularly used in the study area includes sorting the fruits to exclude bruised ones. This is done prior to putting the fruits in baskets for temporary storage and controlled drying for long term storage. The cost of this technology is usually substantial. However, the use of post harvest technology is very minimal in the study area. Only five farmers out of the 88 interviewed employed the use of post harvest technology. The reason for this can be traced to low levels of education and farming experience among farmers as highlighted in Table 1. During the cause of this study, an extension programme by the local government in collaboration with the Agriculture Media Resources and Extension Centre (AMREC) of the University of Agriculture Abeokuta (UNAAB) was conducted to train tomato farmers on the ways they can preserve their produce and thus reducing the losses in a cost effective manner. The various ways included:
1) Making the Tomatoes into Tomato paste, Tomato ketchup and also Tomato juice.
2) They can also be preserved by cutting the Tomato into slices and drying them.
3) They can also be preserved by boiling them after which the shells are peeled off and they are rinsed. After rinsing, they are put in bottles in which there iswater and a teaspoon of preservative is added.

Result of regression analysis
The linear form was chosen as the lead equation on the basis of coefficient of determination, F-ratio, number of significant variables, sign of the coefficients and economic expectation. The adjusted coefficient of determination (R^{-2}) is 0.948 indicating that 94.8% of the variation of quantity of fruit loss from harvesting to marketing stage is explained by the specified variables (explanatory variables in the model specification). In order to establish the strength of the relationship, the empirical result in the equation above was subjected to F-test. The value of F-statistics was found to be significant at 1%. This implies that all the explanatory variables had a joint impact on the dependent variables. The result according to Table 2 showed distance of farm to

market (DIST) (p<0.05), age of fruits at harvest (AFH) (p<0.01), area of land cultivated (ALC) (p<0.01), quantity of fruits harvested (QFH) (p<0.01) as the significant, variables which positively impact on tomato losses. 1 percent increase in these variables will lead to 0.056, 0.089, 0.025 and 0.987 percent increase in quantity of fruits lost from harvesting to marketing stage respectively.

Table 2: Result of linear regression

VARIABLE	STANDARDIZED COEFFICIENTS	T - VALUE
Constants	-0.045	-3.329*
PHWD	-0.027	-1.085
HWD	-0.002	-0.058
DIST	0.056	2.228**
DFT	-0.009	-0.323
AFH	0.089	3.558*
ALC	0.025	0.919*
DFM	-0.008	-0.264
HBG	0.987	3.005*

Source: Computed from field survey, 2007
* Significant at 1% level ** Significant at 5% level
Dependent Variable = Quantity of fruit loss from harvesting to marketing stage.
R^2 (Adjusted Coefficient of determination) = 0.948;   F – value = 198.444

The longer the distance of the farm to the market, the longer the time it will take for the produce to get to the market and so, the losses will increase because of congestion of the tomato fruits and build up of heat. Increase in the age of the fruit at harvest also increased losses because tomato fruits ripen and softens with age and are more prone to mechanical damage and fermentation with age. The larger the area put into cultivation the higher the quantity harvested and chances of losses due to poor handling and lack of proper storage. Increase in the number of baskets harvested also resulted in increase in the losses because of poor storage facilities.

Table 3: GROSS MARGIN ANALYSIS

	Total Variable Cost	Total Revenue	Gross Margin	Average Gross Margin
Without loss	1,163.026	7,565,250	6,402,224	72,752.55
With loss	1,163,026	1,977,150	814,124	9,251.41

Source: Field Survey, 2007.

Result according to Table 3 showed the comparison between the Gross margin with loss and the Gross margin without loss. The average Gross margin with loss (9,251.41) was less than the average Gross margin without loss (72,251.41). This showed that post harvest losses reduced the income of the farmers in Imeko – Afon local government area of Ogun state. The percentage loss incurred by the farmers was 87.3%.

CONCLUSION AND RECOMMENDATION
The study investigates the effect of some identified factors on post harvest loss in Tomato production and generally the determinants of post harvest losses in the study area. Result from the socio-economic characteristic shows that majority of the farmers fall within an active workforce, majority are married with large families and little education and experience in farming . The regression analysis revealed distance from farm to market, age of the fruit at harvest, area of land put to tomato cultivation and the number of baskets harvested as the major determinants of post harvest losses in tomato production. 94.8% of the variation in the quantity of loss from harvesting to marketing stage is explained by these variables. The average gross margin with loss (9,251.41) is less than the average gross margin without loss (72,752.55). This goes to show that post harvest losses reduce the income of the farmers in the study area.

Based on the findings of this study, the following recommendations are made for policy actions to reduce the post harvest losses thereby increasing the standard of living of the Tomato producers in Imeko – Afon Local Government Area of Ogun State.

1) Provision of good storage facilities to store the produce that are harvested before they are being taken to the market. This will help to reduce the losses that occur at the farm level.
2) Training initiatives on post harvest handling of perishable products such as tomato should be encouraged and follow ups, feedback and adoption measurement should be conducted periodically for sustainability.
3) Roads linking farms to market should be improved to reduce transit losses.
4) Establishment of farmers market and cooperative marketing should be encouraged to reduce losses related to marketing functions. Furthermore,
5) Establishment of cottage industries processing Tomato into Tomato Ketchup, Juice and purees should be encouraged

With the reduction of post harvest losses, food availability would be increased significantly without necessarily cultivating an additional hectare of land. This is absolutely essential to achieve food and nutrition security in Africa by 2020.

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