Techno-Science

Scientific Journal of Mehmet Akif Ersoy University

www.dergipark.gov.tr/sjmakeu

Original Research Article

hosted by JournalPark ACADEMIC

WASTE ANALYSIS IN POST-HARVEST FRUIT MARKETING: A MEASURE TO REDUCE ECONOMIC WASTAGE IN ILARO, OGUN STATE, NIGERIA

Raimot Adepeju LAWAL[1*], Taiwo Olusola OGUNSEİTAN [2], Olubisi Lawrence AAKO [2], Samuel Dare OLUWAGBAYİDE[4]

[1,2] *Department of Agricultural Technology, Federal Polytechnic, Ilaro, Ogun State, Nigeria*
[3] *Department of Mathematics and Statistics, Federal Polytechnic, Ilaro, Ogun State, Nigeria*
[4] *Department of Agricultural and Bio-Environmental Engineering, Federal Polytechnic, Ilaro, Ogun State, Nigeria*

ARTICLE INFO

Article History

Received	:	01/02/2021
Revised	:	19/04/2021
Accepted	:	22/04/2021
Available online	:	30/04/2021

Keywords

Post-harvest, Food waste, Food loss, Fruits, Marketing.

ABSTRACT

One of the major problems globally facing African farmers and threatening sustainable food and environmental security is food losses and waste. It constitutes economic wastage in rural areas. This study analyzed losses in post-harvest of fruit marketing in the Ilaro area of Ogun State, Nigeria. A purposive sampling procedure was used to select 116 fruit marketers. Well-structured questionnaires and interview schedules were used to obtain data on the socio-economic characteristics of fruit marketers and factors contributing to fruit wastage. Data were analyzed using descriptive statistics and multiple regression analyses with different model distributions. The findings showed that formal education, storage system, packaging materials for fruit, distance from fruits source, methods of sales of fruits, bad pricing of fruits, low standard transportation facilities, and low level of demand for fruits were significant at 5% level to the high level of post-harvest losses among the fruits marketers. The mean loss for fruit wastage among fruits marketers in the study area was 5363.99 NGN (Nigerian naira) per month. Therefore, fruits marketers need more enlightenment and training through extension agents on careful handling, transportation, and packaging of fresh fruits. Also, there should be the establishment of industries dealing with fruits; this will help the marketers in the area of the low level of demand for fruits thereby reducing post-harvest losses in the area

1. INTRODUCTION

One of the main problems facing African farmers, threatening sustainable food and environmental security is food losses and waste. Aulakh and defined food waste as a subset of the food losses due to human action or inaction [1]. Some human action that leads to wastage is leaving of food items to expiry, consuming of food beyond one's ability, over-preparing (cooking) of food, throwing away produce or leftovers of food, poor home storage management and poor planning of meals. According to Parfitt et al., food losses is differentiated from food waste as, food losses happen in the early stages of the food supply chain such as production, post-harvest, and processing or transportation stages while food waste happens in the final stages of the food supply chain, it associated to decisions and actions by food suppliers (retailers) and consumers [2].
Ajilore shows one-third of about 1.2 billion people that are going hungry in the world are found in Africa of which farmers are vulnerable [3]. Food and Agriculture Organization (FAO) (2011) estimated food wastes produced annually around the world to about 1.3 billion tons of a cost of $750 billion [4]. Aworh reported that billions of naira run annually in the post-harvest losses of fruits [5].

Fruits, as well as vegetables, remain a great source of vitamins and minerals. They contain substances that stimulate digestion in the body. Ali et al., found more jobs per hectare on-farm and off-farm can be created in fruits and vegetables than staple-based agricultural enterprises. And this favours landless labourers and farmers. Also, the marketing of fruits and vegetables adds to the returns of people living in both farming areas and city areas [6].

* Corresponding Author: raimot.lawal@federalpolyilaro.edu.ng

To cite this article: Lawal, R., Ogunseitan, T., Aako, O., Oluwagbayide, S., (2019 Waste Analysis In Post-Harvest Fruit Marketing: A Measure To Reduce Economic Wastage In Ilaro, Ogun State, Nigeria. Techno-Science, vol. 4, no. 1 p. 27-32.

e-ISSN 2651-3722

In Nigeria, massive quantities of well-known tropical fruits such as mango, pineapple, plantain/banana, citrus, guava, pawpaw, watermelon, and cucumber are produced. Alao (2000) perceived that in Nigeria, the production of fruits and vegetables is seasonal because during the rainy season it always resulted in excess in the market, and in the dry season we do experience scarcity due to its shortage [7]. This is as a result of the harvesting and post-harvest handling processes such as packaging, transportation, and storage. A survey carried out by Ojewale (2019) estimated post-harvest losses in Nigeria ranges between 5% and 20% for grains; 20% for fish and 50% to 60% for tubers, fruits, and vegetables. This survey shows a massive loss of valued food regardless of the minimum requirement of food required to the population which is not met [8].

The marketing system for fruits and vegetables in Nigeria consists of three stages. These include; wholesalers going to the farmers to purchase the fruits in bulk from the farmers which is the primary center. Moving the gathered produce from the primary center, repackaging it, and carry it to the final stage where it will be disposed of to retailers. Finally, the retailers will now sort it out before disposing of it to the final consumers. The market margin from the marketing of fruits determines the price and the income that will accrue to the farmers.

Harvey (1978) reveals that, throughout the marketing practice of fruits and vegetables, fresh fruits and vegetables require different temperature with other factors that need to be provided for. Generally, the factors that decrease losses in post-harvest of fresh fruits, and vegetables remain equal with the affected maintenance of whole quality [9].

Busari et al. (2015) reported post-harvest losses in Nigeria, especially in fruits such as citrus, banana and pineapple, are enormous, the marketing system of these fruits places about 75% of the burden of these losses on the fruits marketers. The marketing chain of these fruits involves buying in small quantities from scattered farm holdings and assembling the fruits in bulk for transportation to the urban centers. Poor marketing systems, inadequate transportation, and storage facilities increase post-harvest losses of fruits and vegetables in Nigeria [10].

A huge amount of waste in the marketing of fruits occurs as a result of insufficient industries to transform fresh fruits into juice, which could have been another job opportunity for a lot of people. This paper therefore, examines the socio-economic characteristics of fruit marketers, factors contributing to fruit wastage, and determines the level of fruit wastage among fruit marketers using the best-fitted regression model.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in Ilaro, Yewa South Local Government area of Ogun State, Nigeria. Ilaro is the headquarters of the Yewa South Local government, well-known as YEWA LAND. Farming is the main occupation of the majority of Yewa people while others engaged in trading, hawking, and agricultural processing.

2.2 Sampling Techniques

One hundred and twenty (120) fruits marketers were selected using the purposive procedure and only 116 (96.7%) fruits marketers were used in the analysis of the study while the remaining were discarded due to incomplete and inadequate information. Hence, one hundred and sixteen (116) fruit marketers were selected to make the sample size.

2.3. Sources of Data

Data were collected from the fruit marketers using a well-designed questionnaire and interview schedule. Information on gender, age, marital status, years of formal education, fruits marketing experience, and estimated monthly monetary value of fruit loss during fruits marketing. Also, information on factors that contributed to fruit wastage such as storage system, distance from fruits source to the market place, package materials of fruits from source, methods of sales of fruit, level of demand of fruit, pricing of fruit, and standard transportation facility.

2.4. Analytical Techniques

Data were analyzed with descriptive statistics and multiple regression models. Descriptive statistics such as frequencies, percentages, means, and standard deviation were used. Multiple regression models that were used include different model distributions such as Gumbel (GU) regression model, Normal (NO) regression model, Gamma (GA) regression model, and Log-Normal (LOGNO) regression model.

Multiple linear regression models for fruits loss during fruits marketing is given by

$$\gamma = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon_i \quad (1)$$

where

γ = estimated monthly monetary value (NGN/N) of fruits loss during fruits marketing

β_0 = Constant
$\beta_1 \cdots \beta_k$ = Regression coefficients
x_1 = Gender
x_2 = Age in years
x_3 = Formal education
x_4 = Years of experience in Fruits marketing
x_5 = Storage system
x_6 = Packaging materials for fruit from fruits source
x_7 = Distance from fruits source in kilometres to the market place.
x_8 = Methods of sales of fruits
x_9 = Bad pricing of fruits
x_{10} = Seasonality
x_{11} = low level of demand
x_{12} = low standard transportation facilities
ε_i = Error term

To use the regression model, build in practice, the model should conform to the assumptions of linear regression. One of the assumptions of the regression model is that, the error distribution should be normal. In most cases, most data did not fit this assumption of regression. Hence, four regression models based on different distributions were fitted into the data to obtain the best-fitted model for the data.

3. RESULTS AND DISCUSSION

3.1. Socio-economic Characteristics of the Fruit Marketers

The socio-economic characteristics of fruit marketers that were selected for this study are; gender, age, marital status, formal education, and years of experience in fruit marketing. Details are presented in Table 1. It was found that 62.1% of the fruit marketers are females while 37.9% are males. This implies that fruit marketing activities are dominated by women. Most (69.8%) of the fruit marketers fall within the age of 30-39 years, 21.6% fall within the age of 40-49 years, 6.9% fall within the age of 50-59 years and 1.7% fall within the age of 20-29 years. 91.4% of the fruit marketers in the study are married, 6% are divorced while 2.6% are window. Half (50%) of the fruit marketers had secondary education, 30.2% had primary education, 6.9% had tertiary education while 12.9% had no formal education. This implies that most of the respondents had secondary education which helps in the marketing of their business. 64.7% of the fruit marketers had marketing experience in the range of 1-10 years. 17.2% of the fruit marketers had marketing experience in the range of 11-20 years and 18.1% of the fruit marketers had marketing experience in the range of 21-30 years.

Table 1: Socio-economic Characteristics of the Fruit Marketers. (n=116)

Characteristics	Frequency	Percentage
Gender		
Male	44	37.9
Female	72	62.1
Total	116	100
Age grouped (years)		
20 – 29	2	1.7
30 – 39	81	69.8
40 - 49	25	21.6
50 -59	8	6.9
Total	116	100
Marital Status		
Married	106	91.4
Divorce	7	6.0
Widow	3	2.6
Total	116	100

Years of formal Education		
No formal education	15	12.9
Primary education	35	30.2
Secondary education	58	50
Tertiary education	8	6.9
Total	116	100
Marketing experience		
1 – 10 years	75	64.7
11 – 20 years	20	17.2
21 – 30 years	21	18.1
Total	116	100

Sources: Field Survey, 2020

3.2. Comparison of Different Regression Models

Table 2 shows the comparison results of different regression models on the factors contributing to fruit wastage and the level of fruit wastage among fruit marketers in the study area. The Akaike information criterion (AIC) and Schwarz information criterion (SBC) were used in selecting the best-fitted regression models. The results revealed that, the normal model has AIC of 2300.653 and SBC of 2341.957, the log-normal model has AIC of 2462.451 and SBC of 2503.755, gamma model has AIC of 2442.292 and SBC of 2483.596 and also Gumbel model has AIC of 2248.861 and SBC of 2290.165. The model with the lowest AIC and SBC is chosen to be the best-fitted regression model. Hence, the Gumbel model is the fitted regression model used for determining the factors contributing to fruit wastage and the level of fruit wastage among fruit marketers.

Table 2: Result of Different Regression Models

Variables	**Coefficients**			
	Normal	**Log-normal**	**Gamma**	**Gumbel**
Intercept	-175.6	4.78222	6.30694	- 5363.99
x_1 = Gender	- 3086.9	-0.32189	-0.16650	-1213.37
x_2 = Age	-192.8	0.18337	0.00912	- 481.42
x_3 = Years of formal education	2537.1	0.65672	0.49901	2353.04
x_4 = Fruits marketing experience	977.0	0.31156	0.21930	15.31.00
x_5 = Storage system	- 7350.6	- 0.53492	- 0.49509	- 4012.28
x_6 = Packaging materials for fruit	290.0	- 0.20402	- 0.15188	1300.68
x_7 = Distance from fruits source	2516.2	0.01057	- 0.02774	3255.90
x_8 = Methods of sales of fruits	980.0	0.23507	0.16627	501.13
x_9 = Bad pricing of fruits	795.3	0.26203	0.18060	1349.55
x_{10} = Seasonality	- 108.4	0.08377	0.03490	626.53
x_{11} = low level of demand	2513.8	0.66667	0.51941	2424.45
x_{12} = low standard transportation facilities	1062.1	0.21799	0.16660	1440.76
AIC (Akaike information criterion)	2300.65	2462.451	2442.292	2248.861
SBC / BIC (Schwarz information criterion)	2341.96	2503.755	2483.596	2290.165

3.3. Factors Contributing to Fruit Wastage among Fruits Marketers.

The Gumbel regression model results in Table 3 shows the coefficient of formal education, coefficient of low level of demand for fruits, and coefficient of the low standard transportation facilities are positive and statistically highly significant at $p <$ 5% level. This shows that formal education, low demand for fruits, and low standard transportation facilities are directly dependent on post-harvest losses. There is a negative coefficient of the storage system which is statistically significant at p

< 5% level. This implies the storage system harms post-harvest losses which leads to a huge waste of fresh fruits and this affects the market rate of the fruits marketers. Coefficient of packaging materials for fruits from fruits source, coefficient of distance from fruits source to market place, coefficient of methods of sales of fruits and coefficient of bad pricing of fruits are positive and statistically significant at p < 5% level. This implies packaging materials for fresh fruits has a positive effect on post-harvest losses of fruits due to local and available packaging materials such as weave basket, buckets, sacks, etc. which increases the shelve life of the fresh fruits, thereby reducing the wastage level of the fresh fruits.

However, the level of post-harvest losses is directly dependent on the distance from the source of the fruit to the market place, because the distance from the source of the fruit to market place will determine the level of post-harvest losses. Methods of sales of fruits and bad pricing of fruits also determine the level of post-harvest losses. The level of attractiveness will increase the level of sales which increases the income of the fruits marketers and leads to the reduction of post-harvest losses. Hence, formal education, low level of demand for fruits, low standard transportation facilities, storage system, packaging materials for fruits from fruits source, distance from fruits source to the market place, Methods of sales of fruits, and bad pricing of fruits are the factors contributing to the level of fruit wastage among fruits marketers in the study area. The mean loss for fruit wastage among fruits marketers in the study area is ₦ 5363.99 per month. This implies individual fruits marketers lose a minimum amount of (₦ 5363.99) per month from fruits marketing given that other variables are constant.

Table 3: Result of Gumbel Regression Model

Variables	Coefficients	Standard error	p-value
Intercept	- 5363.99	4452.51	0.231
x_1 = Gender	-1213.37	754.22	0.111
x_2 = Age	-481.42	618.05	0.438
x_3 = Years of formal education	2353.04	672.87	0.000***
x_4 = Fruits marketing experience	15.31	516.24	0.976
x_5 = Storage system	- 4012.28	1859.30	0.033*
x_6 = Packaging materials for fruit	1300.68	628.75	0.041*
x_7 = Distance from fruits source	3255.90	1245.20	0.010*
x_8 = Methods of sales of fruits	501.13	213.69	0.021*
x_9 = Bad pricing of fruits	1349.55	412.37	0.001**
x_{10}= Seasonality	626.53	430.44	0.149
x_{11}= low level of demand	2424.45	637.12	0.000***
x_{12}= low standard transportation facilities	1440.76	373.89	0.000***

****** significant at 0.001, 0.01 and 0.005 respectively

4. CONCLUSIONS

Nigerian marketing of fruits system is still under-developed. Fruits and vegetable marketing is an avenue for increasing the nation's revenue and to provide a means of livelihood for most Nigerians and their families thereby reducing poverty in the nation. The marketing of fruits can improve the health of Nigerian citizenry and provide raw materials for industries. This sector is yet to meet up the world standard due to the ways of handling the harvested fruits, transportation, storage, and marketing distribution of fruits. The empirical result from the study shows formal education, low standard transportation facilities, and low level of demand for fruits are strong determinants of post-harvest losses among fruit marketers. The following recommendations therefore suggested:

1. Fruits marketers need more enlightenment and training through extension agents on careful handling, transportation, and packaging of fresh fruits.
2. There should be the establishment of industries dealing with fruits; this will help the marketers in the area of a low level of demand for fruits thereby reducing post-harvest losses in the area.

3. Governments need to encourage fruit farmers to use irrigation systems by providing funds to the farmers to use them or making the irrigation facilities available. And also they should reconstruct the poor roads in the rural areas because it causes accidents to marketers, delays the day to deliver the fresh fruits thereby contributing to fruits wastage during marketing.

REFERENCES

[1]. Aulakh, J., Regmi, A., Fulton, J. & Alexander, C. (2013). Estimating Post-Harvest Losses: Developing a Consistent Global Estimation Framework. In Proceedings of the Agricultural & Applied Economics Association's AAEA& CAES Joint Annual Meeting, Washington DC, USA, pp. 4-6 Indian Institute of Horticultural Research, Indian Council of Agricultural Research (ICAR-IIHR), (02.10.2018). Retrieved from https://www.iihr.res.in/post-harvest-technologies.

[2]. Parfitt, J., Barthel, M. & Macnaughton, S. (2010) Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050. Philosophical Transactions of the Royal Society of London. Series B, Biological science, 365(1554): 3065-3081.

[3]. Ajilore, B. (2013) Food Loss and Waste: A Threat to Sustainability. Available online at http://www.bailiffafrica.org/food-loss-and-waste-a-threat-to-sustainability-by-bunmi-ajilore/ .Retrieved September 20, 2020.

[4]. FAO (2011) Global Food Losses and Food Waste: Extent, Causes and Prevention. Rome, pp. 38.

[5]. Aworh O.C (2004). Food Preservation: the art, the science and the technology. The Postgraduate School, University of Ibadan, Nigeria pp. 61 Yeomans, J. S. (2014). A parametric testing of the firefly algorithm in the determination of the optimal osmotic drying parameters of mushrooms. Journal of Artificial Intelligence and Soft Computing Research, 4(4), 257-266.

[6]. Ali, M., Farooq, U. & Shih Y.Y. (2002). Vegetable Research and Development in the ASEAN Region: a guideline for setting priorities. In: C.G.Kuo (ed). Perspectives of ASEAN cooperation in vegetable research and development. Shanhua, Taiwan; pp. 20 – 64.

[7]. Alao, S.E.L (2000). The Importance of Post-harvest Loss Prevention, Ph.D. Thesis, Nigerian Stored Products Research Institute, Kano pp.1-10.

[8]. Caleb, Ojewale. (2019). Post-Harvest Losses make Food Security Hard to Achieve. Business Day Newspaper. Available online at http://www.post harvest-loss- make- food -security-hard-to-achieve-by-caleb- ojewale/. Retrieve September 12, 2020.

[9]. Harvey J.M. (1978). Reduction of Losses in Fresh Fruits and Vegetable Annual Review of Phytopathology. Vol. 16 (pp 321-341).

[10]. Busari Amed, O., Idris-Adeniyi, K.M and Lawal, A.O (2015). Food Security and Post-Harvest Losses in fruit marketing in Lagos metropolis, Nigeria. International of Agriculture and Food Sciences Journal, Vol. 3(3): 52-58.

Techno-Science *Paper ID: 872085*