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ASSESSMENT OF THE EXTENT OF POST-HARVEST LOSSES ALONG THE CASSAVA VALUE CHAIN IN ANAMBRA STATE

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Abstract:
Addressing food security challenges is vital to the future of Africans and Nigerians. Despite the economic importance of cassava to the teaming populace in Nigeria, it is not devoid of post-harvest losses. This study explored the extent of post-harvest losses along the cassava value chain in Anambra State. The study adopted a descriptive survey design and was conducted in Anambra State in the South-Eastern part of Nigeria. The study population comprises all cassava farmers in the state's four Agricultural Zones (AZs): Onitsha, Aguata, Awka, and Anambra. Multistage, purposive, and random sampling techniques will be used to select the respondents for the study. Primary data was used for the study and collected using a well-structured questionnaire. Data collected was analyzed using descriptive statistics, Shannon's diversity index, and the Tobit regression model based on the study's objectives. The study revealed that the size of cassava postharvest loss is 266,116 kg. The chain of highest loss is at harvesting, which accounts for about 55 % of the total loss, followed by the loss at processing, 33 %, and then a loss at distribution, 12 %. The Tobit regression result of the factors responsible for cassava post-harvest loss shows that poor processing skills, farmers' well-being, poor planning, and pest and disease attacks are the significant factors determining cassava post-harvest loss in the study area. The study, therefore, recommends that policies be implemented to help the farmers reduce the losses, especially by enforcing adequate training of local farmers in cassava processing.

Keywords: *cassava; postharvest loss; farmers, Shannon's diversity index; Tobit regression*

INTRODUCTION

Improving the effectiveness of the food system is essential to achieving increased food security in an environmentally responsible manner. Production practices, crop losses, and waste rates influence the food system's efficiency in producing agricultural biomass and its utilization in meeting human nutritional requirements. Growing insinuation suggests that about one-third of the food produced in the world per year for human consumption is lost or wasted (Aktas et al., 2019a, 2019b; Bogale, 2021; González et al., 2013; McLean, 2021; Stuart, 2015). Food losses and waste total approximately $680 billion in industrialized countries and around $310 billion in developing countries (Sawicka, 2020). Crop production undergoes a series of operations such as harvesting, drying, transportation, storage, whole selling, and retailing before reaching the consumer, and there are sizable losses in crop output at all these stages. In developing countries, crop losses occur in the production chain and hit small farmers the hardest. A considerable percentage of total production is lost before it reaches the market due to problems ranging from improper use of inputs to lack of proper post-harvest storage, processing, or transportation facilities. These losses can be as high for root crops, fruits, and vegetables, including cereals and oilseeds. Indeed, losses occurring due to post-harvest processes have received even less attention, with limited research on cassava production in Nigeria.

Post-harvest loss (PHL) is the reduced quantity and quality of crops produced after harvest (Ibrahim et al., 2022). In Nigeria, post-harvest loss has been estimated to range between 5 and 20 percent for grains, 20 percent for fish, and as high as between 50 and 60 percent for tubers, fruits, and vegetables. The post-harvest losses for roots and tubers, with particular emphasis on cassava roots, were about 35% of the national post-harvest losses. A post-harvest loss contributes to the reduction of food supply, leading to high food prices in the market, thereby aggravating the country's food insecurity situation. The main reasons for the post-harvest loss, among others, are inherent weaknesses in post-harvest handling techniques due to poor management practices, lack of infrastructure and appropriate equipment, and limited access to the market (FAO, 2017; Teferra, 2022). Reducing post-harvest losses, especially in developing countries, could be a sustainable solution to increase food availability, reduce pressure on natural resources, eliminate hunger and improve farmers' livelihoods (Kumar & Kalita, 2017).

There has been a clarion call for increased agricultural transformation on food and nutrition security, and there is uncertainty surrounding global agriculture's capacity to service this call. With an expected global population increase of more than 2 billion (from 7.6 to 9.8 billion) by 2050, natural resource depletion and a changing climate are further exacerbated by the recent Covid-19 pandemic, which is still putting pressure on an already stretched food supply. According to Rupa et al. (2018), a concerted effort must be made to apply zero tolerance for food waste in this twentyfirst century. Accordingly, Sawicka (2020) thought that post-harvest loss remains a threat to attaining global food security. Thus the position of the World Bank (2011) remains valid and critically important that reducing post-harvest loss (PHL) is a crucial response to global food availability as this would not only zero hunger but also be critical in achieving the global development agenda. Cassava is the basis of staple food in most developing nations and accounts for the maximum post-harvest losses on a calorific basis among all agricultural commodities (Kumar & Kalita, 2017).

Cassava (Manihot esculenta) is the third most important source of calories in the tropics, after rice and maize, and the second one in Africa (FAO, 2004). World cassava production stood at about 278 million tons; Africa's total production was about 170 million tons (about 56% of world production) (FAOSTAT, 2019), making Nigeria the largest producer of cassava in the world with an annual production of over 40 million metric tons (mt) (Adegboyega, 2013). The significant growers are the southern and Middle Belt states of the country. Cassava is an essential component of the diet of an average Nigerian. It is a staple food with a comparative productive advantage. Its ability to produce high yields under poor conditions and underground storage of its harvestable portion until needed gives it an edge. This has made it a classic` food security crop` and encouraged its cultivation by resource-poor farmers (Danilola et al., 2019). In addition, starchy roots produce more food energy than any other staple crop and account for about 70% of the total calorie intake of more than half of Nigerians. Manihot esculent has a shelf life generally accepted to be 24-48 hours after harvest, and apart from respiratory losses, cassava tissue becomes soft and rotten after exposure to the atmosphere for only a few days (Olayemi et al., 2011). Fresh cassava tubers are highly perishable under ambient conditions. During transport and processing, cassava root quality and quantity losses can occur with consequences on prices and returns along the value chain. From delayed harvesting to transport and processing, cassava roots may lose value. In addition to the physical loss of the crop, post-harvest deterioration causes a reduction in quality, which has implications for the marketing of cassava, leading to price discounts (Diego et al., 2014).

In the rural household of Anambra State, where cassava farmers are predominantly located, the storage of roots is rare. The farmers are left with only an option to consume or process them as soon as possible after harvesting. Unfortunately, this does not always happen, and significant roots spoil or incur various degrees of quality deterioration. These losses seriously impact income and quality food intake and constitute a bottleneck for transforming cassava from subsistence to a cash crop. However, achieving food sufficiency in Nigeria has remained a mirage as post-harvest loss continues to rear its ugly head in our agricultural system. Against this background, this study assesses the extent of post-harvest losses along the cassava value chain in Anambra State, Nigeria.

Addressing the challenges facing food security is very vital to the future of hundreds of millions of people in the world, and Nigerian in particular. Despite the economic importance of cassava to the teaming populace in Nigeria, it is not devoid of post-harvest losses. Post-harvest loss is an attribute of an inefficient food-functioning system. The deterioration of cassava roots causes a reduction in quality, which has implications for the marketing of cassava, leading to price discounts. Transportation of harvested roots through terrible bad roads to the market sometimes results in vehicles breaking down. Rural markets have designated days for market activities, so most farmers rarely meet up within the stipulated time. Hence there is periodic wastage of cassava roots. The use of locally fabricated and inefficient Cassava processing equipment has not helped in any way, and their processes record tremendous food losses due to poor processing practices and inefficient technology. The post-harvest diseases, crumbling infrastructure, and insufficient power supply are contributing factors. Affognon et al. (2015) added that non-standard bags could lead to loss of grain quality by permitting exposure to moisture, insects, and contaminants. Previous empirical studies (e.g., Arends-Kuenning et al., 2022; Balana et al., 2022; Bannor et al.,

2021; Bechoff et al., 2022; Etefa et al., 2022; Gathambiri et al., 2021; Kikulwe et al., 2018; Miljkovic & Winter-Nelson, 2021; Shee et al., 2019; Teferra, 2022; Usman et al., 2022) have underscored the trends in post-harvest losses in various crops and its implication on food insecurity. However, the broad objective of this study is to assess the extent and cost of postharvest losses along the cassava value chain in Anambra State.

The specific objectives are to:
1. Estimate the size/index of post-harvest loss of cassava along the supply chain in the study Area.
2. Analyze factors responsible for the post-harvest losses of cassava along the supply chain.

Materials and Methods

The study was conducted in Anambra State in the South-Eastern part of Nigeria. The state is bounded in the east by Enugu State, West by Delta State, South by Imo State, and North by Kogi State. It has an estimated population of 5,846,198 and is located between latitudes 5038'N and 6047'E and longitude 6036'N and 7021'E (ADP bulletin, 2018). It was reported to have a total land area of 4,865 sq km, of which 70% is arable land. Vegetation is tropical rainforest. There are four agricultural zones in the state. The primary occupation of the people is trading and farming. Most farmers are small-scale farmers and are majorly known for growing such crops as cassava, maize, rice, yam, cocoyam, okro, palm oil, and melon and keeping some livestock like poultry and sheep. Agricultural produce is widely sold in villages, communities, and cities-assembled markets. Each assembled market is identified with one of the four Igbo market days: Eke, Oye, Afor, and Nkwo.

Sample Size and Sampling Technique

The study population comprises all Cassava Farmers in the state's four Agricultural Zones (AZs): Onitsha, Aguata, Awka, and Anambra. Multistage, purposive, and random sampling techniques were used to select the respondents for the study. The first stage was the purposive selection of the four agricultural zones in the state since cassava farming is spread around the four Agricultural Zone (ADP bulletin, 2018). In stage two, four Local Government Areas were randomly selected from each of the four zones in the state to arrive at sixteen (16) LGAs. The stage III entails a random selection of four Communities across the sixteen (16) selected Local Government Areas making it a total number of 64 communities. The fourth stage was a random sampling of 5 cassava farmers from each of the 64 Communities giving a sample size of 320 respondents.

Data collection

Primary data was used for the study and were collected using a well-structured questionnaire administered to sampled cassava farmers in the study areas with the help of trained enumerators and research assistants.

Validation of Instrument

Experts in the Department of Agriculture and Department of Finance, Nnamdi Azikiwe University, Awka validated the instrument.

Reliability of the Instrument

The reliability of the instrument was established using the Cronbach Alpha coefficient.

Data Analysis

Data collected were analyzed using descriptive statistics, Shannon's diversity index(Avilez-López et al., 2020; Danilola et al., 2019; Konopiński, 2020), and Tobit regression model (Ding et al., 2017; Jassam et al., 2022; Kumari et al., 2021).

Results and Discussions

The study was conducted between February and May 2023. The data were analyzed using the Statistical Package for Social Sciences (SPSS, V23). A descriptive analysis of the respondents indicated that 68.3% were male and 31.7% were female. Similarly, the analysis showed that majority (32.3%) were between 18-30 years, (51.1%) were between the age of 31-59, while (16.4%) were above 60 years. 76.4% were married, with 14.8% indicating that they were single, while 8.8% respondents were widowed. It was observed that 38.1 respondents had basic primary education, 42.5% completed their secondary education, and 19.4% had tertiary education. Accordingly, 52.9% have below five years of farming experience, while 47.1% have more than five years of experience in farming.

Table 1: Demographic distribution of the respondents

Variables	Frequency	Percentage (%)
Sex		
Male	192	68.3
Female	128	31.7
Age		
18-30	86	32.3
31-59	187	51.1
60 above	47	16.4
Marital status		
Single	84	14.8
Married	212	76.4
Widowed	24	8.8
Education		
Primary	109	38.1
Secondary	156	42.5
Tertiary Education	58	19.4
Years of Farming		
Above 5 years	156	47.1
Below 5 years	165	52.9

Table 2: Shows Shannon's diversity index proportion loss for post-harvest

Cassava Value Chain	Losses (kg)	Pi	ln Pi	H =- (Pi × ln Pi)	Percentage loss as a proportion of total loss (%)
Harvesting	266,116	0.41	-0, 28	0.21	55
Processing	212,021	0.18	-1.46	0.33	33
Distribution	81,022	0.06	-2.31	0.23	12
Total	559,159		0.77	100	

Table 2 above shows Shannon's diversity index proportion loss for post-harvest in the cassava value chain in the study parameter. The analysis indicated that the size of cassava post-harvest loss is 266,116 kg. The chain of highest loss is at harvesting, which accounts for about 55 % of the total loss, followed by the loss at processing, 33 %, and then loss at distribution, 12 %. The loss across the value chain is not uniformly distributed, as revealed by a relatively low H-value. The intensity of the loss at the harvesting stage, being the highest, is in line with the report of (Bamikole et al., 2022; Naziri et al., 2014), which implicated the harvesting stage as the most vulnerable period for losses in cassava farming. Cassava undergoes post-harvest physiological deterioration once the tubers are separated from the main plant (Onyenwoke & Simonyan, 2014), contributing to post-harvest loss during harvesting.

The Tobit regression model was used to model the factors responsible for cassava post-harvest loss. It was assumed that the losses beyond a threshold were post-harvest losses. Ten percent was the threshold used in this study.

Table 3: Tobit regression result for the factors responsible for cassava post-harvest loss

Causes of post-harvesting losses	Coefficient	Std Error	t-value
Processing skills	0.46	1.61	0.32
Farmer's well-being	0.78	1.19	1.52
Poor planning	1.36	0.16	2.13
Pest and disease attack	1.45	0.14	1.16

Table 3 shows the Tobit regression result of the factors responsible for cassava post-harvest loss. The result shows that poor processing skills, farmers' well-being, poor planning, and pest and disease attacks are the significant factors determining cassava post-harvest loss in the study area. Indeed, previous studies have outlined various causes of post-harvest losses in cassava (Oluwatusin, 2017). The finding is aligned with several studies that found pests and diseases as determinants of cassava post-harvest loss (Masamba et al., 2022; Okungbowa & Kinge, 2021). However, the present study implicated processing skills, farmers' well-being, and poor planning as previously unexplored variables contributing to post-harvest losses in the cassava value chain in Anambra state.

Conclusion and Recommendations

The present study assessed the extent and cost of post-harvest losses along the cassava value chain in Anambra State. The study revealed an increased cassava post-harvest loss in the study area. The Shannon's diversity index proportion loss for post-harvest in the cassava value chain in the study parameter indicated that the size of cassava post-harvest loss is 266,116 kg. The chain of highest loss is at harvesting, which accounts for about 55 % of the total loss, followed by the loss at processing, 33 %, and then loss at distribution, 12 %. The loss across the value chain is not uniformly distributed, as revealed by a relatively low H-value. However, the concentration of losses at the harvesting stage calls for concern as there is a need for improved methods of mechanizing the harvesting process to reduce the losses at harvesting. Hence, reducing the losses at harvesting by a significant percentage would imply a remarkable reduction of the loss across the value chain.

The Tobit regression result of the factors responsible for cassava post-harvest loss shows that poor processing skills, farmers' well-being, poor planning, and pest and disease attacks are the significant factors determining cassava post-harvest loss in the study area. Poor processing describes the inability of many cassava farmers to adequately utilize the available mechanized options or proper manual skills in harvesting, processing, and distributing cassava products. Also, farmers' well-being entails the agro-psychological correlates associated with the stages of the cassava value chain. Indeed, planning is an essential part of the cassava value chain. Thus, the inability to accurately integrate the underlying variables in the cassava value chain will potentiate post-harvest losses. The study, therefore, recommends that policies be implemented to help the farmers reduce the losses, especially by enforcing adequate training of local farmers in cassava processing that should include psychological support and planning orientation. This would ensure the optimal use of various opportunities in reducing post-harvest losses.

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