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DETERMINANTS OF CHOICE OF WAREHOUSING MANAGEMENT SYSTEMS AMONG RICE DISTRIBUTORS IN EBONYI STATE, NIGERIA

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ABSTRACT RESEARCH ARTICLE

This study examined determinants of choice of warehousing management systems among rice distributors in Ebonyi State, Nigeria. A multi-stage random sampling technique was used in choosing the sample. Primary data collected from total of 120 respondents that was the sample size for this study. Data used for the study were sourced primarily using questionnaire, observation and interview. Data collected were analyzed using simple descriptive tools like tables, means, percentages and frequencies as well as econometric tools like probit model. Findings showed that 70 of the 120 respondents (accounting for about 58%) used the traditional warehousing management system while the remaining 42% used the modern. The mean loss of about N4,000 and N2,000 for the traditional and modern warehousing users respectively. results showed that number of employees and credit were positively related to the categorical outcome while firm age, firm location, stock volume, distance to market, firm type and capital were all negative. The study recommends that rice distributors should be enlighten on the use of modern warehousing management system which sustain sales and enhances profitability.

KEYWORDS: Rice, warehousing, warehousing management system, sales sustainability, distributors.

INTRODUCTION

Rice as a cereal crop is cultivated in actually all the agro-ecological zones of Nigeria and is being fed on by each household in a first-rate volume in Nigeria as it is essential for food security in the country (Timothy, 2024). Rice has emerged as the most important staple food and the predominant cereal crop in Nigeria. The rice sector plays a critical role in conserving foreign exchange, improving the nation's economy and serves as a major source of calories (Akpokodje, Adetunji, andAdebayo, 2021). Rice not only feeds millions of people in Nigeria but also enhances agribusiness innovation and supports employment through farming, processing, storage and distribution. Key initiatives by the government to improve rice production over the years are anchor borrowers' programme which connects rice value chain entreprenuers with credit and inputs, presidential initiative on increased rice production, cross community price support measures, agricultural transformation agenda, and Nigerian national rice development agency. If these initiatives are sustained and scaled, rice production

could become a powerful engine for alliviation of poverty, inclusive growth and long term nation security (Timothy, 2022).

Rice is an important cash crop in Ebonyi State. Due to the profitability of rice, nearly 90% of households in Ebonyi State is Nigeria's largest rice producer with an average yield of 6.7 metric tons per harvest. About 15% of the land area is lowland ecology which is best suited for the growth and production of lowland rice system (Cletus, 2014; Anuedu, 2023).

Nigeria stands as the largest rice producer in Africa with an estimate of 5.23 million metric tons However, there has been a decrease in production over the last three years due to insecurity in northern rice producing regions, high input costs, and inadequate mechanization. The supply crunch due to flooding in some producing states.(International Trade Administration, 2025: The African Exponent, 2025). Despite being one of the major producers of rice in Africa, Nigeria continues to fill the demand - supply gap created by rapid population growth, consumer preferences and urbanization through rice import. To bridge this gap, there is a need for sustained investment investment in irrigation, post harvest systems which includes improvement on storage facilities, improved seed distribution and transportstion infrastructure (Timothy, 2019).

A good storing system ensures grains are protected from wet conditions, rodents, birds and insects. It is also necessary to maintain the temperature of the storage system to prolong seed life (IRRI, 2015). Farmers in Nigeria bear storage loss specifically from insect pest infestation. Storage damage induced by insect pests has begun to pose a serious hazard to reserves stored by rice farmers and distributors. Patrick (2013), stated that Nigeria records over 40 percentage put up harvest losses, which has led to hike in rice importation in the country. Up to 50% - 60% cereal grains are lost all through storage due to use of nearby storage facilities, there is need for the use of scientific way of storage such as warehousing (Deepak and Prasanta, 2017). The use of modern storage facility in storing grain is therefore important to prevent mould spoilage, pest infestation, and grain germination of dry rice. Rice grains after harvest are typically stored for the next harvest season, for selling and domestic consumption (Timothy, 2022). Since rice production is usually seasonal and consumption is ordinary and non-stop at some stage in the year, good storage is therefore required by rice farmers and distributors, and when rice is stored in good extent it is called warehousing (Nwele, 2016).

Warehousing is considered as one of the main spheres of logistics. The broad meaning is the storage of finished goods or materials for manufacturing, agricultural or commercial purposes. Warehouses are crucial components of most modern supply chains. They are likely to be involved in various stages of the sourcing, production and distribution of goods. At the dispatch point serving the next customer in the chain, warehousing is critical to the provision of high customer service levels (Sakil, 2013). Modern warehousing and traditional warehousing are the two sorts of warehousing. Some of the practices in the modern warehouse encompass the use of automated storage, systematic storage, just–in-time delivery, appropriate record of inventory etc. Modern warehousing management system performs an imperative role in the success of businesses these days such as growing market volatility, product range proliferation and shortening client lead times, promoting off season, bulk storage and distribution, normal delivery which enhances sales sustainability and profitability and leads to efficiency (Timothy, 2022).

Warehousing system refers to the aggregate of tools and operational methods used in the storage surroundings. Modern warehousing system in supply chain attributes to general sales growth by potential improvements in productivity, order accuracy, reduced space requirements, increased volume capacity, control of inventory and increased customer service. Both Okoruwa and Ogundele (2008) cited that rice farmers and distributors in Nigeria lose sources committed into their enterprise due to losses incurred as a result of using traditional storage (warehousing) device which affects their sales sustainability, profitability and efficiency. Therefore, business enterprises requires use of modern warehousing system, which paves way for elevated profitability, proper storage and protection of goods, meeting timely demand of the market, ensuring unremitting supply of goods, developing goodwill of the producers, coping with multi stock room inventories and improves competitive electricity etc. Ineffective management of warehousing systems leads to storage loss (Vipul, 2013).

To prevent losses the post-harvest system of rice requires enhancement in the use of resources. FOA (2018), stated that the estimated post- harvest loss of rice in Nigeria is 24.9 percent resulting in a notable loss of income for farmers. Ohagwu, Akubuo and Agu (2013), in their study on submit harvest losses of rice at Ebonyi mentioned that 1000kg/ ton of rice are loss throughout post harvest operation. Thus, losses associated with these plants restrict the profits of all farmers, threaten food safety and will increase stipulations of poverty among rural households, whose income stream relies upon on the capability to store excess farm produce for a later date (Timothy, 2022). Abedin, Rahman, Mia and Rahman, (2012) cited that stored rice grain is subjected to damages through the various biotic and abiotic factors. The biotic elements includes fungi, mites, insect, pest, rodent, birds, and many others and the abiotic elements includes temperature, moisture content, relative humidity, storage structure, natural calamities like heavy rain and floods, etc. If the damages of these biotic and abiotic factors are not observed on time, losses will be a whole lot greater. As a result, many distributors will sell right now in order to mitigate loss. Hence this study examines the determinants of choice of warehousing management systems among rice distributors in Ebonyi State, Nigeria.

Methodology

The study was conducted in Ebonyi State Nigeria, which is one of the major rice producing areas in Nigeria. The state was created in 1996 with 13 local Government Areas and 3 agricultural zones namely Ebonyi North (Izzi, Abakaliki, Ohaukwu and Ebonyi Blocks): Ebonyi Central (Ishielu, Ikwo, Ezza South and Ezza North Blocks) and Ebonyi South (Afikpo, Afikpo South, Onicha, Ivo and Ohazara Blocks). The State has a land mass of approximately 5,932km2 and lies within latitudes 410N and 1410N of the Equator and longitudes 30E and 150E of Greenwich meridian.

It shares a border with Benue State to the North, Enugu State to the West, Imo and Abia States to the South and Cross River State to the East. The State has an estimated population of about 2.9 million people (NPC, 2016). Ebonyi State has an average rainfall of 1200mm – 2000mm with temperature ranging from 33^{o}C in the dry season and about 16^{o}C to 18^{o}C in the rainy season (EBADEP, Annual Record, 2005).

The people of Ebonyi State are predominantly farmers and traders. Their soil is organic and fertile which makes it very suitable for agriculture. The main crops produced in the State are rice, yam, palm produce, cocoa, maize, groundnut, plantain, banana, cassava, melon, sugar cane, beans, fruits and vegetables. Fishing is also carried out in Afikpo. The respondents were selected via multi stage random sampling method. First from each of the three

agricultural zones, four Local Government Areas were randomly selected to give a total of 12 Local Government Areas. Secondly, two communities were randomly selected from each of the twelve Local Government Areas to give a total of 24 communities. Finally, in each community, five rice distributors were randomly selected from each of the 24 communities to make a total of 120 respondents that was the sample size for this study.

Data used for the study were sourced primarily using questionnaire, observation and interview. Data collected were analyzed using simple descriptive tools like tables, means, percentages and frequencies as well as econometric tool like probit model.

Model Specification

The probit model was used to examine determinants of choice of various warehousing management system. The probit model is generally specified as:

$Yi^* = Xi\beta + \varepsilon$ ..... (1)

The latent continuous variable, Y* is a linear combination of some predictors, X, plus a disturbance term that has a standard Normal distribution. The latent variable Yi* exhibits itself in ordinal categories, which could be coded as 0, 1, 2,…, k. The response of category k is thus observed when the underlying continuous response falls in the *k*-th interval as:

$Y^* = 0$ if $Y^* \leq \partial_0$..... (2)

$Y^* = 1$ if $\partial_0 < Y^* \leq \partial_1$..... (3)

$Y^* = 2$ if $\leq \partial_0 < Y^* \leq \partial_2$..... (4)

Where Y* (I = 0, 1, 2) are the unobservable threshold parameters that will be estimated together with other parameters in the model.

In this study, two different storage/warehousing categories (modern and traditional) will be examined.

Probit $^{(\text{modern, traditional,})} = b_0 + b_iX_i + u_i$ (5)

Where;

Probit $^{(\text{modern, traditional})}$ = Traditional=0, Modern = 1 (modern and traditional)

b_0 = constant for storage/warehousing choice equation

X_i = is a vector of functions of variables

b_i = is a vector of parameters to be estimated for market participation

u_i = error term.

Explicitly the warehousing choice equation is modeled as follows;

Probit $^{(\text{modern, traditional})} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + u_i$..... (6)

Where,

X_1 = Age of the firm (Years)

X_2 = Number of employees

X_3 = Firm location (Dummy: 1 = urban, 0 = local)

X_4 = Volume of stock (Kg)

X_5 = Distance to nearest market (Km)

X_6 = Capital including depreciation, insurance (₦)

X_7 = Volume of credit (₦)

X_8 = Firm type (1=Sole proprietorship, 0=partnership)

X_9 = Educational status (years)

$b_1 – b_9$ = Coefficients of parameters to be estimated

e_i = error term

Results and Discussion

Objective 1: Categories of Warehousing Management Systems.

In this section, the warehousing management system used by the distributors is examined in Table 1. This will include the use of traditional and modern warehousing management systems.

As shown in the Table, 70 of the 120 respondents (accounting for about 58%) used the traditional warehousing system while the remaining 42% used the modern warehousing systems. The result is in line with the findings of Okoruwa and Ogundele (2008) who reported that rice farmers and distributors in Ebonyi State lose resources committed into their enterprise due to losses incurred as a result of using traditional storage (warehousing) management system. Therefore, business enterprises requires the use of effective warehousing management, which paves way for increased profitability.

Objective 2: Losses by Rice Distributors

In this section, the monthly storage losses incurred by rice distributors is examined and presented in Tables 2.

The result on Table 4.3 show that majority (71 and 80%) of the traditional and modern warehousing system users respectively incurred losses of about ₦2,500. The mean loss of about ₦4,000 and ₦2,000 for the traditional and modern warehousing users respectively imply that the use of the traditional system of warehousing attracted more losses than the modern. Since losses are bound to occur, the choice of a storage system has proven to be reasonable means of reducing its extent.

Objective 3: Determinants of Warehousing Management System Choice.

The probit was used to measure factors affecting the choice of various warehousing management systems by rice distributors in Ebonyi State and it is presented in table 3.

The Pseudo R^2 of 0.889 shows that 88.9% of variation in the choice of warehousing management system was as a result of changes in the explanatory variables included in the model. The goodness-of-fit measured by the chi^2showed that the choice of explanatory variables included in the ordered probit model explained the variation in decisions to store their goods. The results showed that number of employees and credit were positively related to the categorical outcome while firm age, firm location, stock volume, distance to market, firm type and capital were all negative. The various warehousing systems studied are modern and traditional. A positive coefficient favours the traditional system over the modern while a negative coefficient favours the modern.

The coefficient of firm age was negatively signed and significant at 1% probability level. This implies that older firms will favour the use of modern warehousing over the traditional. Age relates to experience whereby firm owners would have been able to weather the storms and risks of business including a shift from traditional to the use of modern warehousing. Older firms are also more customer oriented and in a bid to maintain their customer base may be forced to embrace better systems of doing business of which introducing a modern system of warehousing is one. However, the choice of the modern may also be unrelated to age especially if the firm is located in the rural area.

Number of employees was positively signed and significant at 1% probability level in relation to the choice of warehousing system. This result as earlier stated implies that a growing number of employees is in favour to the use of traditional warehousing system over the use of modern as modern system do not require several employees. Another reason could be the concept of "band wagon effect" where a particular system is patronized just because of people's perceived idea of the commodity, place or person and in this regard, if the traditional system of warehousing has been in place, introducing another system may not completely be beneficial to the firm. Finally, the result shows that these firm owners may one day decide to shift to the use of modern since it follows the traditional system.

Firm location coefficient was negatively signed at 1% probability level in relation to the choice of warehousing system. The negative coefficient is in favour of the use of modern system. The variable was dummied 1 for urban and o for rural and the negative coefficient shows that firms located in the urban areas are most likely to use the modern system of warehousing over the traditional. In the urban areas, there is high population which gives rise to competition in which case firms seek various means of out-performing perceived competitors, thus, the use of the modern system will give such firms more edge over others. The modern system ensures the preservation of quality of rice and as such can help keep the commodity for a long period of time, giving consumers time and place utility.

The results also showed a negative coefficient for stock volume in relation to the choice of warehousing system signed at 1% probability level of significance. The negative sign implies that the higher the stock volume, the more likelihood of the use of modern warehousing system over traditional. Increase in stock volume signifies increase in sales and to maintain such consistency, retain customers and be able to satisfy them, the use of the modern system may be very useful. This argument is complemented by the fact that spoilage is more experienced when stock volume increases due to poor ventilation and which could be maneuvered by the use of the modern system.

The result also showed that the coefficient of credit was significant at 5% and negatively signed in relation to choice of warehousing system implying that firms with more access to credit have higher probability likelihood to install the modern system of warehousing. This

appeals to common sense since access to credit implies access to funds which can be invested into the business. Modern warehousing system is expensive and this makes the need for external funding more necessary.

The variable 'firm type' was dummied 1 for sole proprietorship and 0 for otherwise. The negative coefficient favours the other type of enterprises such as partnership and limited liability thus, the result implies that partnership or limited liability type of businesses have more likelihood of installing the modern system of warehousing over the traditional. This business structure is usually large in size and clientele, open for investment through shares and bonds, thus their capital base is usually high and can afford to participate in expensive and risky ventures. The result further entails that while self-owned businesses could also use the modern warehousing system, they are disadvantaged especially in accessing credits given that financial institutions favour synergy through partnerships and social organizations (e.g. cooperative societies).

The coefficient of capital was negatively signed and significant at 1% level suggesting that distributors with enough capital will invest in the use of modern warehousing system over the traditional warehousing system.

Conclusion

Poor warehousing management leads to storage loss and food self-insufficiency due to huge post-harvest losses especially during storage of rice.. As such, adequate warehousing leads to bulk distribution, coping with seasonal fluctuations, regular delivery, customer retention, repeated purchase by customers which enhances sales sustainability and profitability and leads to efficiency.

The study therefore concludes that 70 of the 120 respondents (accounting for about 58%) used the traditional warehousing management system while the remaining 42% used the modern. However, majority (71 and 80%) of the traditional and modern warehousing system users respectively incurred losses of about ₦2,500. The mean loss of about ₦4,000 and ₦2,000 for the traditional and modern warehousing users respectively imply that the use of the traditional system of warehousing attracted more losses than the modern.

The probit was used to measure factors affecting the choice of various warehousing management systems by rice distributors. The Pseudo R^2 of 0.889 shows that 88.9% of variation in the choice of warehousing management system was as a result of changes in the explanatory variables included in the model. The results showed that number of employees and credit were positively related to the categorical outcome while firm age, firm location, stock volume, distance to market, firm type and capital were all negative. The various warehousing systems studied are modern and traditional.

Recommendations

Based on the findings from this study, the following recommendations were proposed.

Establishment of common/co-operative modern storage structures at village/union level should be initiated especially for small and marginal farmers towards enhancing their capacity of storing and thereby ensuring fair price of food grains.

Rice should always be stored in a well ventilated room and should also be protected during storage against insects and rodents by using appropriate insecticides in the traditional warehouse system.

For distributors to enjoy the market value of their stored rice, it must be maintained within the accepted market quality. Based on the analysis of storage losses done in this work, it was observed that storage loss is more severe with traditional warehousing system than modern warehousing system. Hence, this highlights the area that requires intervention; low-income distributors, who cannot maintain conditions required to produce good quality stored grain, due to their financial status or access to good storage management facilities should be help by the government.

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Table 1: Warehousing management systems by rice distributors

Warehousing management systems	Frequency	Percentages (%)
Traditional	70	58
Modern	50	42

Source: Field survey, 2025

**** WHS = Warehousing system**

Table 2: Monthly losses incurred by rice distributors

Amount	Traditional WHS		Modern WHS	
	Frequency (f)	**Percent (%)**	**Frequency (f)**	**Percent (%)**
1 – 2,500	50	71	40	80
2,501 – 5,000	12	17	6	12
5,001 – 7,500	8	12	4	8
Total	**70**	**100**	**50**	**100**
Mean	**4,000**		**2,000**	

Source: Field survey, 2025

**** WHS = Warehousing system**

Table 3: Probit estimates of warehousing system determinants

Variables	Coefficient	Standard error	t-ratios
Firm age	-.20838	.0347	-5.943***
Number of employees	.89585	.2908	3.079***
Firm location	-.8751	.1208	-7.231***
Stock volume (Kg)	-.99846	.2502	-3.992***
Distance to market (Km)	-.6134	.308	-1.990
Credit (naira)	-.12081	.0498	-2.420**
Firm type	-.75843	.248	-3.056***
Capital	-.183	.0397	-4.692***
LR $chi^2(8)$	114.34		
Log likelihood	-223.342		
Pseudo R^2	.889		

Source: Field survey, 2025

*****, ** and * = significant at 1, 5 and 10% respectively.**