Journal of Agriculture, Environmental Resources and Management

www.saerem.com

ISSN2245-1800(paper) ISSN 2245-2943(online)

7(8)1-800 **January.**.2025; pp1-10

Adoption Analysis of Improved Processing Technologies among Rice Processors in Ogoja Local Government Area of Cross River State, Nigeria

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Abstract

This research examined the adoption of improved rice processing technologies among processors in Ogoja Local Government Area of Cross River State, Nigeria. A multistage sampling technique was employed to select 120 rice processors for the study. Analytical methods including descriptive statistics, a five-point Likert scale, and binary logit regression, were utilized to address the research objectives. Results indicated that the average age of processors was 42 years. Most processors (81.0%) were male, and 95% were married. Over half (58%) had attained secondary education. On average, the processors had a household size of seven and nine years of experience in rice processing, with a mean monthly income of ₦142,050. Adoption of improved processing technologies was generally low, with only three of nine technologies considered; mechanical de-husking/de-hulling (3.3), de-stoners (3.4), and improved drying methods (3.0) achieving high adoption rates. The binary logit regression revealed that age (-2.470), household size (-1.210), processing experience (3.693), monthly income (3.736), and access to credit (1.397) were significant determinants of adoption. Major barriers included high cost of technology (91%) and limited credit access (81%). The study recommended subsidizing technologies and developing locally fabricated machines to reduce costs, alongside improving credit access to support small-scale processors.

Key words: Assessment, adoption, processing technologies, rice processors.

Introduction: Nigeria's agricultural economy is predominantly characterized by the production and direct sale of raw agricultural products, with limited capacity for processing these products into value-added forms. This limitation stems from socioeconomic, environmental, and technological challenges faced by primary producers. These issues lead to inefficiencies in production and restrict the diversity of goods available in the market. However, value addition is a crucial aspect of the food supply chain, as it enhances the range, quality, and utility of food products (Bashorun, 2013). In developing economies like Nigeria, the establishment of food processing industries, particularly for pre- and post-harvest handling, has emerged as a significant economic component (Isaac, Gerald, Etornam and Ernest (2016). Such industries not only improve food availability but also reduce import dependence, conserve foreign exchange, boost exports, generate employment, and increase incomes (Ige, Baruwa and Akintelu (2016).

Rice stands out as a pivotal commodity in Nigeria, with consumption growing at an estimated rate of 5.1% annually, projected to reach 36 million metric tons by 2050 (FMARD, 2011; Johnson and Masias, 2017). Over the years, various government initiatives have sought to enhance paddy rice production. Notable programs include the Presidential Initiatives on Increased Rice Production (2002–2007), the Africa Rice Initiative (2012), the Nigerian National Rice Development Strategy (2009–2018), and the Growth Enhancement Support Scheme (GESS) under the Presidential Transformation Agenda (2011) (Osuoha, 2014). More recently, programs like the Anchor Borrowers' Program (ABP) launched by the Central Bank of Nigeria (CBN) and the Green Alternatives Policy introduced by FMARD in 2016 aim to strengthen the domestic rice market and reduce reliance on imports.

Despite these efforts, Nigerian consumers continue to prefer imported rice due to its superior quality, particularly regarding cleanliness and polish (WARDA, 2015). This preference creates stiff competition between imported and locally processed rice. The subpar quality of locally processed rice, often attributed to inadequate adoption of modern processing technologies, hinders progress toward meeting consumer demands. Key processing stages, such as parboiling, drying, de-stoning, milling, and bagging, significantly influence rice quality. Proper processing practices could not only improve rice quality but also enhance the sector's contribution to the national economy (Ibitoye, Idoko and Shaibu (2014). Currently, most Nigerian rice processors rely on traditional methods, which fail to compete with the quality of imported rice (Okunola, Adekanye, Adewumi and Ashamu, 2019). Studies reveal that Nigerian consumers favor imported rice for its consistency, lack of debris, and superior taste (Bamidele, Abayomi and Esther (2010). The inability to meet quality standards results in increasing demand for imported varieties (Okeke and Oluka, 2017). Processors face challenges such as high input costs and limited credit access, which hinder their ability to adopt modern technologies essential for improving rice quality and meeting market demands. The Federal Government of Nigeria, through FMARD, in collaboration with the Japan International Cooperation Agency (JICA) and many State Governments, introduced the JICA Improved Rice Processing Technologies under the Rice Post-Harvest Processing and Marketing Pilot Project (RIPMAPP). This initiative promoted clean drying slabs, standard millers, and de-stoners, coupled with training for selected processors. Similarly, the National Cereal Research Institute (NCRI) developed advanced processing technologies such as rice threshers, winnowers, steam dryers, and parboilers for dissemination. However, the success of these technologies depends on their adoption by processors. Understanding the factors influencing adoption is vital to ensuring the technologies achieve their intended benefits. Rice production and processing play a significant role in the agricultural economy of Nigeria, particularly in Cross River State, where rice processing is a key livelihood activity for many smallholder farmers and processors. However, despite the critical importance of rice processing to the local economy, traditional processing methods dominate the industry, resulting in inefficiencies that limit product quality, reduce profitability, and constrain the competitiveness of processed rice in both local and international markets. These traditional methods often involve labor-intensive processes, high post-harvest losses, and the use of outdated equipment, which significantly contribute to low processing capacity and high production costs.

In recent years, there have been efforts to introduce improved rice processing technologies aimed at increasing efficiency, enhancing product quality, and reducing post-harvest losses. These technologies include mechanical milling machines, improved parboiling techniques, and modern drying methods. However, the adoption of these technologies by rice processors in Ogoja Local Government Area has been limited. Factors such as inadequate access to credit, insufficient technical knowledge, lack of awareness, high initial investment costs, and resistance to change have been identified as potential barriers to the adoption of these improved technologies. Despite the potential benefits of adopting these modern processing techniques, the degree of adoption among rice processors in Ogoja remains unclear. This lack of adoption has significant implications for the overall productivity and sustainability of the rice processing sector in the area. Moreover, the absence of detailed research on the factors influencing the adoption of improved processing technologies means that policies and interventions aimed at improving the sector are not fully informed by the realities faced by rice processors in Ogoja. Therefore, there is a need for a comprehensive analysis to understand the adoption patterns, barriers, and drivers influencing rice processors' decisions in adopting improved processing technologies in Ogoja. This study aims to fill the gap in existing literature by providing evidence-based insights into the factors influencing the adoption of these technologies, with a focus on how socioeconomic, infrastructural, and institutional factors interact to shape the decision-making process among rice processors in Ogoja Local Government Area. This study aims to assess the adoption of improved rice processing technologies in Ogoja Local Government Area of Cross River State. Specifically, it seeks to:; Describe the socioeconomic characteristics of rice processors in the study area;; Assess the awareness level of improved processing technologies among the rice processors;; Examine the adoption of these technologies among rice processors;; Determine the factors influencing adoption of improved processing technologies;, and Highlight constraints to adoption of improved processing technologies in the study area.

Materials and Methods: Ogoja Local Government Area (LGA) is one of the prominent LGAs in Cross River State, Nigeria. It is located in the northern part of the state and serves as an administrative and economic hub. Ogoja shares boundaries with Bekwarra Local Government Area to the west, Yala Local Government Area to the south, Obudu Local Government Area to the north, and Ikom Local Government Area to the southeast. The LGA is strategically situated, providing a connection between northern Cross River and neighboring states like Benue and Ebonyi. According to the 2006 national census, Ogoja LGA had a population of approximately 171,901 people. Recent projections estimate the population to have grown significantly, with a mix of urban and rural settlements. The population is predominantly made up of the Ekoi ethnic group, alongside other tribes such as the Bekwarra and Efik. Ogoja Local Government Area (LGA) in Cross River State, Nigeria, is administratively divided into ten wards, each represented by a councillor in the local legislative council. These wards are: Ekajuk Ward I, Ekajuk Ward II, Mbube East Ward I, Mbube East Ward II, Mbube West Ward I, Mbube West Ward II, Nkum-Iborr Ward, Nkum-Irede Ward, Urban Ward I, Urban Ward II. Each ward encompasses various communities and villages, contributing to the administrative organization and local governance of the LGA. The economy of Ogoja is predominantly agrarian, with the majority of the population engaged in farming. Key agricultural crops cultivated include; maize, yam, cassava, and rice. Livestock such as poultry and small ruminants are widely reared. In riverine areas, fishing serves as an essential livelihood activity. Other occupations include trading, artisanal work, and civil service employment. Ogoja enjoys a tropical climate characterized by distinct wet and dry seasons. The area has a lush vegetation cover, part of the Guinea savanna belt, making it suitable for agriculture. The annual rainfall ranges from 1,800 mm to 2,500 mm, supporting the cultivation of various crops.

Data Collection: Primary data for the study were gathered through structured questionnaires designed to align with the research objectives. Oral interviews were also conducted to validate and supplement the questionnaire responses.

Sampling Technique: The target population comprised rice processors operating at small, medium, and large scales within Ogoja LGA. A multistage sampling technique was employed to select respondents for the study. The first stage involved the purposive selection of Ogoja Local Government Area for the study. This is due to large scale rice production and processing activities taking place in the Local Government Area. The second stage involved the enumeration of all the rice processors in all the 10 wards in the study area with the assistance of the officials of the rice processors association in the study area. This gave a total of 240 rice processors in the study area. The last stage involved the random selection of 50% of the rice processors thereby giving the sample size of 120 respondents for the study.

Analytical Techniques: Data collected was subjected to simple descriptive statistics such as frequency distributions, Percentages and mean to describe the socio-economic characteristics of the rice processors and to identify the constraints to adoption of rice processing technologies by processors in the study area. Five point Likert scale was used to ascertain the level of awareness of improved rice processing technologies by rice processors as well as the level of adoption of improved rice processing technologies among the processors. Binary logit regression analysis was used to analyze the effect of selected socioeconomic variables on the adoption of improved rice processing technologies.

Five-Point Likert Scale: ***The respondents' awareness and adoption of improved rice processing technologies (IRPT) were assessed using a five-point Likert scale. This scale measures attitudes, preferences, and subjective responses by gauging the degree of agreement with specific items (Likert, 1932). For assessing awareness levels, responses were rated as follows: fully aware (5), aware (4), undecided (3), fully not aware (2), and not aware (1) for each IRPT. Each response was assigned a weight, and the score for each variable was multiplied by its corresponding weight to calculate a weighted score. These weighted scores were then summed to obtain a total weighted sum. The weighted sum was divided by the total number of respondents to calculate the weighted mean for each technology. The technologies were ranked based on their weighted means in descending order. The midpoint values of the scale were summed and divided by 5 to determine a cut-off mean of 3.0. Technologies with a weighted mean equal to or above 3.0 were classified as having high awareness, while those below 3.0 were classified as having low awareness.*** *Similarly, a five-point Likert scale was employed to analyze the level of adoption of IRPT among respondents. The study considered nine improved rice processing technologies: De-huskers/De-hullers; De-stoners/graders; Packaging/stitching machines; Weighing scales; Grading/sorting machines; Polishing machines; Improved rice parboilers; Rotary steam dryers, and Pneumatic cleaners*

The adoption scale was rated as fully adopted (5), adopted (4), undecided (3), not fully adopted (2), and not adopted (1) for each technology. The responses were weighted and multiplied by their respective scores to compute weighted scores. These scores were summed to obtain a total weighted sum, which was divided by the number of respondents to calculate the weighted mean for each technology. Technologies were ranked in descending order of their weighted means. As with awareness, a mean score of 3.0 was used as the threshold; technologies with weighted means of 3.0 or higher were classified as adopted, while those below 3.0 were classified as not adopted. The weighted means were further analyzed to evaluate the relationship between the level of adoption (dependent variable) and other independent variables. The weighted score served as the dependent variable (Y) in the regression analysis.

Decision: Any improved rice processing technology (IRPT) with a mean score of 3.0 or higher was categorized as having high adoption, while technologies with scores below 3.0 were categorized as having low adoption. For this study, adoption status was classified as follows:

1. High adoption (1 = Adopted)
2. Low adoption (0 = Not Adopted)

Logit Regression: Binary logit regression analysis was used to analyze the effect of selected socioeconomic variables on the adoption of improved rice processing technologies. The logit model is specified as:

Lny = Ln (p/1 - p)

$Ln (p/1 - p) = f (\beta iXi) + ei$

Where;

Y = Adoption (1= adopted, 0 = not adopted)

P = Probability of processor adopting the technology

1 – P = probability of processor not adopting the technology

Ln = Natural logarithm function.

β_i = vector of logistic regression coefficients.

X_i = vector of independent variables given as follows:

X_1 = Age of the processors (in years).

X_2 = Gender (male=1, female=0)

X_3 = Marital status (1 if married, 0 if otherwise)

X_4 = Household size (number of persons).

X_5 = Level of education (years spent schooling).

X_6 = Experience in rice processing (years)

X_7 = Membership of social groups (number of groups one belonged)

X_8 = Monthly income of processors (Naira)

X_9 = Access to credit (yes=1, 0 otherwise)

Results and Discussion : Socio-economic Characteristics of the Rice Processors: Table 1 presents the socioeconomic attributes of the rice processors in Ogoja LGA. The findings show that 46% of respondents were aged between 41 and 50 years, while 40% were aged 31–40 years. Only 3% fell within the 21–30 age bracket, and 11% were over 50 years old. The average age was 42 years, suggesting that most processors are in their economically productive years, aligning with studies by Adejoh, Madugu and Shaibu (2017), who reported similar findings. Gender distribution revealed that 81% of the processors were male, indicating the physical demands of rice processing. This finding contradicts studies like Danbaba, Ukwungu, Jossiah, and Sossou (2013), which noted higher female participation in rice processing in other regions. Additionally, 95% of processors were married, consistent with Abubakar, Umar, Gbanguba, Dauda, Garba, Hamisu and Abubakar (2023) who found that marital status often drives higher productivity. In terms of education, 58% of the processors had secondary education, 18% tertiary, 20% primary, and 4% had no formal education. Education facilitates better comprehension of new technologies, as highlighted by Henri-Ukoha , Orebiyi, Obasi, Oguoma, Ohajianya, Ibekwe, Ukoha (2011). Household sizes averaged seven members, which provides labor for processing activities, aligning with findings by Omoare and Oyendiran (2017). Regarding processing experience, 47% of the respondents had spent between 6 and 10 years in rice processing, while 39% had been engaged for 11–15 years, and 14% had 1–5 years of experience. On average, processors had nine years of experience in the field. This suggests that many processors have spent a considerable period in the business, equipping them with the knowledge and skills to adopt improved techniques. This finding aligns with Kosheri (2016), who emphasized that processing experience is a critical factor in assessing and monitoring the outcomes of intervention programs in rice processing. Monthly income levels among rice processors varied significantly. Approximately 34% earned between ₦101,000 and ₦150,000, while 32% reported earnings of ₦151,000 to ₦200,000. A further 23% earned ₦50,000 to ₦100,000, 8% earned ₦201,000 to ₦250,000, and only 3% earned above ₦250,000. The mean monthly income of ₦142,050 indicates that most processors have modest financial resources, potentially enabling the adoption of improved technologies. Income plays a vital role in the adoption process, as highlighted by its influence on the capacity to procure necessary equipment and tools. Credit access, however, remains a significant challenge for most processors. As shown in Table 1, 64% lacked access to credit facilities, while only 36% had access. Processors with access to credit are more likely to invest in advanced technologies compared to those without such access, holding other factors constant. This finding resonates with Vihi, Ngu-uma, Sadiku and Adedire (2018) who observed that access to agricultural credit promotes productivity and enhances food security within communities.

Cooperative membership also plays a crucial role in facilitating access to resources and knowledge. Table 1 indicates that 58% of the respondents were members of cooperative organizations, while 42% were not. Membership in cooperatives or farmer-based organizations provides opportunities to access credit, obtain inputs, and stay informed about best practices and innovations in processing activities. Bamire *et al*. (2010) noted that social interactions among farmers create avenues for the diffusion of innovation. Similarly, Salifu, Funk, Keefe, Kolavalli (2012) stated that being part of a cooperative enhances farmers' access to extension services, credit facilities, and critical information on emerging technologies, which are less accessible to non-members.

Table 1: Socio-economic Characteristics of the Rice Processors

Variable	Frequency	Percentage	Mean
Age			
21-30	4	3.0	
31-40	48	40.0	
41-50	55	46.0	
>50	13	11.0	**42**
Sex			
Male	97	81.0	
Female	23	19.0	
Marital status			
Single	6	5.0	
Married	114	95.0	
Educational status			
Primary	24	20.0	
Secondary	69	58.0	
Tertiary	22	18.0	
Non formal	5	4.0	
Household size			
1-3	5	4.0	
4-6	59	49.0	
7-9	33	28.0	
>9	23	19.0	**7**
Years of processing			
1-5	17	14.0	
6-10	56	47.0	
11-15	47	39.0	
Monthly income			
50,000 – 100,000	28	23.0	

101,000 -150,000	41	34.0	
151,000 -200,000	38	32.0	
201,000 -250,000	9	8.0	
>250,000	4	3.0	**142, 050**
Access			
Yes	43	36.0	
No	77	64.0	
Membership of association			
Yes	69	58.0	
No	51	42.0	

Source: Field survey, 2024

Level of Awareness of Improved Rice Processing Technologies: The findings in Table 2 illustrate the level of awareness among rice processors regarding improved rice processing technologies. Using a cutoff mean of 3.0, seven out of the nine technologies demonstrated high awareness levels, as their mean scores exceeded this threshold. These technologies include the de-husker/de-huller (3.5), de-stoner (3.3), grading/sorting machine (3.1), improved rice parboiler (3.2), improved drying (3.0), polishing machine (3.0), and weighing scale (3.0). Conversely, two technologies—packaging/stitching (2.5) and pneumatic cleaning (2.4)—had low levels of awareness. This indicates that the rice processors in the study area were generally well-informed about most of the available technologies. Olumba and Rahji (2014) emphasized that awareness is a key driver of demand, which in turn accelerates the adoption and dissemination of agricultural innovations. Awareness of agricultural technologies plays a critical role in sparking farmers' interest in adopting new practices and ideas. This observation supports the findings of Adejoh *et al*. (2017), who highlighted that introducing rural farmers to new research findings and technologies is a viable strategy for boosting agricultural productivity.

Table 2: Rice Processors Level of Awareness of Improved Rice Processing Technologies

IRPT	FA(5)	A(4)	U(3)	FNA(2)	NA(1)	Sum	Mean
De-husker/de-hullers	105	260	18	22	17	422	3.5*
De-stoner	95	236	15	26	24	396	3.3*
Grading/sorting machine	115	164	24	54	21	378	3.1*
Polishing machine	130	164	-	46	30	370	3.0*
Packaging/stitching	80	84	45	66	35	310	2.5
Weighing scale	110	156	21	56	24	367	3.0*
Improved rice parboiler	155	152	33	18	31	389	3.2*
Improved drying	115	144	-	80	21	360	3.0*
Pneumatic cleaning	55	60	63	94	26	298	2.4

FA=fully aware, A=aware, U=Undecided, FNA=fully not aware, NA=not aware

Level of adoption of Improve Rice Processing Technologies: The level of adoption of improved rice processing technologies is detailed in Table 3. Among the nine technologies assessed, only three achieved high adoption levels: rice de-huskers/de-hullers (3.3), de-stoners (3.4), and improved drying techniques (3.0). Rice de-huskers/de-hullers, with the highest mean value of 3.3, emerged as the most adopted technology. This tool, used in milling to remove husks and bran, likely gained popularity due to its ability to eliminate the drudgery associated with traditional milling methods such as using a pestle and mortar. This finding aligns with Kosheri (2016), who reported that 42.75% of small-scale rice processors were in the high adoption category for improved rice milling technologies. Modern milling methods significantly reduce the effort and waste common in traditional practices.De-stoning, with a mean score of 3.4, also had a high adoption rate. This process removes stones and other foreign particles from milled rice, resulting in high-quality, stone-free grains. The popularity of this technology underscores its effectiveness in enhancing rice quality and its subsequent high market value. Kosheri (2016) and Omoare and Oyendiran (2017) noted that properly managed de-stoning operations produce rice grains of superior quality, which are more attractive to buyers and consumers.Improved drying techniques were the third most adopted technology, with a mean score of 3.0. This suggests that most processors found these techniques beneficial, likely due to their impact on maintaining rice quality during milling. The National Cereal Research Institute (NCRI, 2016) highlighted that proper drying practices are crucial for high recovery rates of milled rice and prevent breakages during milling. Omoare and Oyendiran (2017) similarly observed that the adoption of improved drying techniques was notably above average among rice processing groups. Conversely, several technologies, including the improved rice parboiler (2.6), weighing scale (3.1), grading/sorting machine (2.3), polishing machine (2.1), packaging/stitching machine (2.1), and rotary steam dryer (2.1), exhibited low adoption levels, with mean scores falling below the 3.0 cut-off point. Parboiling, which involves sequential operations of soaking and steaming using false-bottom technology, recorded low adoption rates among respondents, as indicated in Table 3. The limited adoption of this technology can be attributed to the technical skills, knowledge, and financial investment required for its use. This finding contrasts with the observations of Omoare and Oyendiran (2017), who reported a high level of adoption of false-bottom parboiling techniques (soaking and steaming) among rice processors in Ogun and Niger States. However, Kosheri (2016) documented a medium adoption rate of false-bottom parboiling technology among women rice processors in Katcha Local Government Area, Niger State. The low adoption of weighing scales was attributed to processors' claims that using the scales involved time-consuming adjustments to ensure accurate measurements. Instead, they preferred the traditional mudu, which was considered quicker and more straightforward. Similarly, packaging and stitching machines were not widely adopted because processors perceived these tools as adding extra production costs without a corresponding increase in market price. Local customers were unwilling to pay higher prices for rice packaged with advanced methods. In conclusion, the findings indicate an overall low level of adoption of improved rice processing technologies among rice processors in the study area.

Table 3: Rice Processors Level of Adoption of Improved Rice Processing Technologies

IRPT	FA(5)	A(4)	U(3)	FNA(2)	NA(1)	Sum	Mean
De-husker/de-hullers	120	274	9	16	16	435	3.6*
De-stoner	105	244	21	34	14	418	3.4*
Grading/sorting machine	55	64	45	74	41	279	2.3
Polishing machine	65	60	9	76	51	261	2.1
Packaging/stitching	80	84	24	32	42	262	2.2
Weighing scale	75	84	21	32	46	258	2.2
Improved rice parboiler	85	84	33	70	46	318	2.6
Improved drying	125	156	6	46	31	364	3.0*
Pneumatic cleaner	45	64	27	78	47	261	2.1

FA=fully adopted, A=adopted, U=Undecided, FNA=fully not adopted, NA=not adopted

Factors Influencing Adoption of Improved Rice Production Technologies: The binary logit model was employed to estimate the factors influencing the adoption of improved rice processing technologies in the study area. The model yielded a chi-square value of 25.16, significant at the 1% level, confirming its adequacy in explaining variations in the dependent variable. The R-squared value of 25.19% indicates that the independent variables included in the model accounted for 25.19% of the variation in the adoption of improved rice processing technologies. The coefficients derived from the model quantify the degree to which each variable impacts adoption. As shown in Table 4, five out of nine predictors; age, household size, processing experience, monthly income, and access to credit were statistically significant. Among these, the coefficients for age and household size were negative, indicating an inverse relationship with adoption, while those for processing experience, monthly income, and access to credit were positive, signifying a direct relationship. An increase in the positively correlated variables, holding other factors constant, would enhance the likelihood of adopting improved rice processing technologies.

Age (X_1): The coefficient for age was negative (-2.470) and statistically significant, suggesting that as the age of processors increases, the probability of adopting improved rice processing technologies decreases by 2.47%. This implies that younger processors are more inclined to adopt such technologies than their older counterparts. Older farmers tend to be more risk-averse and conservative, which may deter them from embracing innovations. These findings are consistent with Mamudu *et al*. (2012), who observed that older farmers in Ghana were less productive and less receptive to modern agricultural technologies compared to younger farmers.

Household Size (X_4): Household size also exhibited a negative and statistically significant relationship (-1.210) at the 5% level. This suggests that a one-unit increase in household size decreases the likelihood of adopting improved technologies by 12.1%. Larger households typically require greater financial resources to meet basic needs, thereby reducing the capital available for investing in technologies. This result is consistent with Adejoh *et al.* (2017), who identified household size as a critical factor in the adoption of improved rice processing technologies in the Federal Capital Territory, Abuja. However, Sani *et al.* (2014) reported contrasting findings, noting a positive relationship between household size and technology adoption in a study on dual-purpose cowpea production technologies in Bichi LGA, Kano State.

Processing Experience (X_6): Processing experience had a positive coefficient (3.693), significant at the 10% level, indicating a direct relationship with adoption. The results imply that each additional year of experience in rice processing increases the probability of adopting improved technologies by 3.69%. Experienced processors are likely to have accumulated more knowledge and skills, which enhance their capacity to adopt innovations. This aligns with the findings of Abubakar *et al*. (2019), who reported a positive and significant relationship between years of farming experience and the adoption of agricultural technologies.

Monthly Income (X_8): The monthly income variable was positively correlated (3.7360) and significant at the 5% level, demonstrating that higher income levels increase the likelihood of adopting improved rice processing technologies. Increased income provides processors with the financial capacity to purchase and maintain processing equipment, thus facilitating adoption. This finding aligns with Ugwumba (2013) and Ibitoye (2014), who found that wealthier farmers are more willing to adopt multiple technologies and take greater risks compared to their less affluent counterparts.

Access to Credit (X_9): Access to credit was positively signed (1.397) and significant at the 5% level, indicating that processors with access to credit facilities are more likely to adopt improved technologies. Credit enables the acquisition and maintenance of essential processing equipment and supports scaling up production, thereby reducing costs through economies of scale. This result underscores the importance of financial resources in driving the adoption of agricultural innovations. Adejoh *et al*. (2017) similarly reported a positive relationship between credit access and the adoption of improved rice processing technologies. In conclusion, the results highlight that factors such as age, household size, processing experience, monthly income, and access to credit significantly influence the adoption of improved rice processing technologies in the study area. These insights are essential for designing interventions aimed at promoting technology adoption among processors.

Table 4**:** Logit Regression of Factors Influencing Adoption of Improved Rice Processing Technologies

Variable	Coef	Std Error	Z	P>|z|
Constant	2.53	1.50	1.69	0.092
Age (X_1)	-2.470	1.240	-2.00	0.046**
Gender (X_2)	-0.349	0.722	-0.48	0.629
Marital status(X_3)	0.370	1.160	0.32	0.046
Household size (X_4)	-1.210	0.479	-2.53	0.012**
Education status (X_5)	-0.001	0.286	-0.00	0.998
Processing experience (X_6)	3.693	2.108	1.75	0.080*
Membership of coop (X_7)	3.650	2.365	1.54	0.123
Monthly income (X_8)	3.7360	1.6280	2.30	0.022**
Access to credit (X_9)	1.397	0.642	2.17	0.030**
Number of obs = 120				
Chi-Square: 25.16***				
R-Sq: 25.19%				
Hosmer-Lemeshow: 8.69				

***, ** and * represent 1%, 5% and 10% significance levels respectively.

Constraints to Adoption of Improved Rice Processing Technologies: Respondents were asked to identify the major challenges hindering their adoption of improved rice processing technologies. These constraints, ranked in order of significance, are presented in Table 5. The findings reveal that the primary barriers to adoption were the high cost of technologies (91%), inadequate credit facilities (81%), and limited accessibility to some technologies (28%). The high cost of these technologies was largely attributed to the processors' inability to afford the necessary equipment due to its prohibitive price. This result aligns with Issa, Kagbu and Abdulkadir (2016) who also identified high costs as a key constraint to the adoption of improved maize production practices in Ikara Local Government Area of Kaduna State, Nigeria. Akudugu, Guo and Dadzie (2012) noted that adopting a new technology often represents a shift in investment priorities for farmers. If a technology is too expensive, the likelihood of adoption decreases significantly. Efforts to promote the adoption of modern agricultural production technologies should prioritize developing affordable solutions, particularly for resource-constrained rural populations. Limited access to institutional credit also emerged as a critical challenge for agro-processors in Nigeria. Acquiring and implementing new agricultural technologies often requires financial resources, such as loans or credit, to purchase the necessary equipment. Mwangi and Kariuki (2015) supported this observation, stating that the lack of credit opportunities can discourage adoption and limit farmers' capacity to integrate improved technologies into their operations. Farmers and processors with greater access to credit are more likely to adopt modern agricultural practices, provided other factors remain constant.

Table 5**:** Constraints to Adoption of Improved Rice Processing Technologies (n=120)

Constraints	***Frequency**	**Percentage**	**Rank**
High cost of technology	109	91.0	1st
Inadequate credit access	97	81.0	2nd
Non accessibility of the technologies	44	37.0	3rd
Complexity of some technologies	11	9.0	4th

***Multiple responses**

Conclusion: The study revealed that most processors were young, married, and possessed some level of formal education. They had considerable processing experience and moderate monthly incomes. While the processors demonstrated a high level of awareness of improved rice processing technologies, their adoption rate was notably low. Among the nine technologies examined, only three rice de-huskers/de-hullers, de-stoners, and improved drying techniques showed high adoption rates. The remaining technologies including improved rice parboiler, weighing scale, grading/sorting machines, polishing machines, packaging/stitching machines, and rotary steam dryers, experienced low levels of adoption. Key factors significantly influencing the adoption of improved rice processing technologies were age, household size, processing experience, monthly income, and access to credit. Major challenges to adoption included the high cost of technology and limited access to credit facilities. The study recommended that the government and input suppliers subsidize the cost of improved technologies to lower production expenses and enhance enterprise sustainability. Additionally, locally fabricated rice processing machines that are affordable for small-scale processors should be developed, as existing machines are prohibitively expensive. Furthermore, credit facilities should be made accessible to rice processors, enabling them to purchase paddy in bulk and improve their operations.

Recommendations: Based on the findings of this study, the following recommendations were made:; Subsidization of improved technologies by government and input dealers may reduce cost of production and promote enterprise sustainability. Fabrication of local rice processing machines that could be affordable by the processors should be developed since the available machines are too expensive and out of reach of the small scale processors.; Credit facilities should be provided to rice processors in the study area, since most of them claimed that they had no access to credit facilities that will enable them buy paddy in bulk.

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