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| Research Article

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Effect of Rice Milling Micro Small and Medium Scale Enterprises on Poverty Reduction in Anambra State, Nigeria

Nnaka Stanislaus Anene
Unizik Business School, Nnamdi Azikiwe University Awka, Anambra State, Nigeria

Ugochukwu Marius Ndubuisi Ph.D
Department of Business Administration, Federal University of Kashere, Nigeria

Ozoemena Paschaline Chidiebere
Department of Cooperative Economics and Management,
Federal Cooperative College Oji-River, Enugu State, Nigeria

Abstract: This study investigates the effect of rice milling micro, small, and medium scale enterprises (MSMEs) on poverty reduction in Anambra State, Nigeria. Using an econometric regression technique with the Ordinary Least Squares (OLS) model, we analyze the relationship between the income of rice millers and key independent variables: Milling Capacity, Access to Finance, Market Share, Labor Productivity, Adherence to Standards, and Adoption of Technology. Data were collected from 150 rice millers across various local government areas in Anambra State. The results indicate that Milling Capacity ($\beta = 0.45$, $p < 0.01$), Access to Finance ($\beta = 0.33$, $p < 0.05$), Market Share ($\beta = 0.28$, $p < 0.05$), and Labor Productivity ($\beta = 0.37$, $p < 0.01$) significantly contribute to the income of rice millers. Adherence to Standards ($\beta = 0.22$, $p < 0.10$) and Adoption of Technology ($\beta = 0.19$, $p > 0.10$) show positive but statistically less significant impacts. The overall model is robust with an R-squared value of 0.68, indicating that 68% of the variation in rice millers' income is explained by the independent variables. The findings suggest that enhancing milling capacity, improving access to finance, expanding market share, and increasing labour productivity are crucial for boosting the income of rice millers, thereby contributing to poverty reduction in the region. In conclusion, targeted interventions to support rice milling MSMEs in these areas can significantly impact poverty alleviation efforts in Anambra State. The study recommends policies that facilitate financial access, technology adoption, and quality standards adherence to enhance the productivity and income of rice millers, thus fostering economic growth and poverty reduction.

Key words: Rice Milling Capacity, Access to Finance, Market Share, Labour Productivity, Adherence to Standards, Adoption of Technology, Micro Small and Medium Scale Enterprises, Poverty Reduction.

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INTRODUCTION

Rice milling micro, small, and medium scale enterprises (MSMEs) play a crucial role in the agricultural and economic landscape of Anambra State, Nigeria. As a staple food, rice is a significant part of the diet for many Nigerians, and its demand continues to rise. This increasing demand has led to the proliferation of rice milling enterprises, which serve as a vital link between rice production and consumption. However, despite the importance of these enterprises, there is limited empirical research on their impact on poverty reduction in Anambra State. This study aims to fill this gap by examining the key factors influencing the income of rice millers and their implications for poverty alleviation (Obianefo, 2023; Ibi-Oluwatoba, Ogundele, Awoniyi & Okeya, 2020). The milling capacity of rice millers is a critical determinant of their income and overall performance. Milling capacity refers to the volume of rice that can be processed within a specific period. Enterprises with higher milling capacities are likely to generate more income due to economies of scale and increased production efficiency. This study's findings underscore the importance of milling capacity, showing a significant positive relationship between milling capacity and the income of rice millers (Chibuogwu, 2019; Okpe, Uji & Okpachu, 2014). Enhancing milling capacity through investment in modern equipment and technology could thus be a strategic approach to boosting the income levels of rice millers.

Access to finance is another pivotal factor influencing the success of rice milling enterprises. Financial constraints often hinder the growth and operational efficiency of MSMEs, limiting their ability to invest in necessary improvements and expansions. This study reveals that access to finance significantly impacts the income of rice millers (Okpe, Uji, & Okpachu, 2014; Anga & Abimiku, 2021), highlighting the need for financial institutions and government policies to provide more accessible credit facilities and financial support to these enterprises. Improved access to finance can enable rice millers to invest in better machinery, hire skilled labor, and expand their market reach, ultimately increasing their income and contributing to poverty reduction. Market share, representing the proportion of the market controlled by a specific enterprise, is crucial for the competitiveness and profitability of rice milling businesses. A larger market share often translates to higher sales volumes and increased revenue. The study indicates a significant positive relationship between market share and rice millers' income (Okpe, Uji, & Okpachu, 2014; Anga & Abimiku, 2021), suggesting that enterprises that capture a larger share of the market tend to be more financially successful. Strategies to enhance market share could include improving product quality, engaging in effective marketing campaigns, and establishing strong distribution networks (Anazodo, Ezenwile, Chidolue & Umetiti, 2014; Nwafor, Chukwueloka, Nwumeh & Umetiti, 2023.

Labour productivity, defined as the output per worker, is an essential indicator of the efficiency and effectiveness of rice milling enterprises. Higher labor productivity typically leads to increased production and reduced operational costs, thereby boosting income. The study's results confirm the significant positive impact of labor productivity on the income of rice millers (Obianefo, Ezeano, Isibor & Ahaneku, 2023; Oparah, Iloanya & Ugochukwu, 2023). This finding suggests that investments in training and capacity building for workers, as well as the adoption of labor-saving technologies, can substantially improve productivity and profitability in the rice milling sector. Adherence to standards and adoption of technology are also important factors that can influence the income of rice millers, although their impacts are less pronounced in this study. Adherence to standards ensures that the rice produced meets quality and safety requirements, which can enhance consumer trust and demand (Obianefo, Ezeano, Isibor & Ahaneku, 2023; Oparah, Iloanya & Ugochukwu, 2023). While the study shows a positive relationship between adherence to standards and income, the statistical significance is lower, indicating that other factors may also play a significant role. Similarly, the adoption of technology, while positively correlated with income, does not show a strong statistical significance in this study. This suggests

that while technology adoption is beneficial, its impact may be mediated by other variables such as the scale of operations and the specific technologies used. This study highlights the multifaceted nature of factors influencing the income of rice millers in Anambra State. By focusing on enhancing milling capacity, improving access to finance, expanding market share, and increasing labor productivity, policymakers and stakeholders can create a conducive environment for rice milling MSMEs to thrive. These interventions can lead to higher incomes for rice millers, thereby contributing to poverty reduction and economic development in the region (Okwudiri, Nwafor & Umetiti, 2025; Nwafor & Umetiti, 2025). This study provides a foundation for future research and policy formulation aimed at supporting the growth and sustainability of rice milling enterprises in Nigeria.

Statement of the Problem

Despite the critical role that rice milling micro, small, and medium scale enterprises (MSMEs) play in the agricultural economy of Anambra State, Nigeria, there remains a significant gap in understanding their impact on poverty reduction. These enterprises are crucial in transforming paddy rice into consumable products, thereby adding value and creating employment opportunities. However, the extent to which these enterprises contribute to the economic well-being of their operators and the wider community has not been thoroughly investigated. This study addresses this gap by examining key factors that influence the income of rice millers, thereby providing insights into how these enterprises can be leveraged for poverty alleviation. One of the primary issues facing rice milling MSMEs is the limited milling capacity, which restricts their ability to meet market demand and scale their operations. Many of these enterprises operate with outdated and inefficient equipment, leading to suboptimal production levels. This study highlights the significant positive relationship between milling capacity and the income of rice millers, suggesting that enhancing milling capacity could substantially improve their financial outcomes (Gbadebo, 2024; National MSME Collaborative Survey, 2012).

Access to finance is another critical challenge that rice milling MSMEs in Anambra State face. Limited financial resources prevent these enterprises from expanding their operations, upgrading their equipment, and investing in quality improvements. The study reveals a significant positive impact of access to finance on the income of rice millers, emphasizing the need for better financial support mechanisms (Enechukwu, Akintoye & Ogboi, 2025; Abubakar, Umar, Gbanguba, Dauda, Garba, Hamisu, & Abubakar, 2023). The problem here is the inadequate access to affordable credit facilities and financial services, which stifles the growth and profitability of rice milling enterprises. Market share is crucial for the competitiveness and sustainability of rice milling MSMEs. However, many of these enterprises struggle to capture a significant portion of the market due to intense competition and limited marketing capabilities. The study's findings indicate a significant positive relationship between market share and income, highlighting the importance of market expansion strategies (Enechukwu, Akintoye & Ogboi, 2025; Abubakar, Umar, Gbanguba, Dauda, Garba, Hamisu, & Abubakar, 2023). The problem is that rice millers often lack the resources and expertise to effectively market their products and expand their customer base, limiting their income potential.

Labour productivity is a key determinant of the operational efficiency and profitability of rice milling enterprises. However, many MSMEs in this sector face challenges related to low labor productivity, often due to inadequate training and lack of skilled labor. The study shows that higher labor productivity significantly boosts the income of rice millers, pointing to the need for improved workforce development (John-Akamelu & Muogbo, 2018; Akinniran & Faleye, 2020). The problem is the insufficient investment in training programs and capacity building for workers, which results in lower productivity and reduced income. Adherence to standards is essential for ensuring the quality and safety of milled rice, which in turn affects consumer demand and pricing. However, many rice milling MSMEs do not fully comply with quality standards, impacting their

marketability and income. The study finds a positive but less statistically significant relationship between adherence to standards and income, indicating that while important, this factor alone may not be sufficient (Akolgoa & Asumboya, 2016; Ampadu-Ameyaw, Omari & Owusu, 2017). The problem lies in the lack of enforcement of quality standards and the limited awareness among millers about the benefits of adhering to these standards. Finally, the adoption of modern technology is vital for improving the efficiency and competitiveness of rice milling enterprises (Nwafor, Afuecheta & Umetiti, 2024; Umetiti & Nwafor, 2025). Despite this, many MSMEs in Anambra State continue to use outdated technologies, which hinder their productivity and profitability. The study's results show a positive but statistically less significant impact of technology adoption on income, suggesting that technology alone may not be the panacea (Akolgoa & Asumboya, 2016; Ampadu-Ameyaw, Omari & Owusu, 2017; Nwafor, Afuecheta & Umetiti, 2024). The problem is the high cost and limited accessibility of modern milling technologies, coupled with a lack of technical knowledge among millers on how to effectively utilize these technologies. Rice milling MSMEs in Anambra State face several interrelated challenges that affect their income and contribution to poverty reduction. By addressing issues related to milling capacity, access to finance, market share, labor productivity, adherence to standards, and technology adoption, policymakers and stakeholders can enhance the performance of these enterprises. This study provides a comprehensive understanding of these problems and offers a basis for developing targeted interventions to support the growth and sustainability of rice milling MSMEs, thereby contributing to economic development and poverty alleviation in the region.

Objectives of the Study

The main objectives of the is to examine the effect of rice milling micro small and medium scale enterprises on poverty reduction in Anambra state, Nigeria. Specifically, the study intends to:

i. Examine the effect of milling capacity on income of rice millers in Anambra State, Nigeria.
ii. Determine the effect of access to finance on income of rice millers in Anambra State, Nigeria.
iii. Ascertain the effect of market share on income of rice millers in Anambra State, Nigeria.
iv. Evaluate the effect of labour productivity on income of rice millers in Anambra State, Nigeria.
v. Examine the effect of adherence to standards on income of rice millers in Anambra State, Nigeria.
vi. Ascertain the effect of adoption of technology on income of rice millers in Anambra State, Nigeria.

Hypotheses of the Study

Ho_1: Milling capacity on income of rice millers in Anambra State, Nigeria

Ho_2: Access to finance on income of rice millers in Anambra State, Nigeria

Ho_3: Market share on income of rice millers in Anambra State, Nigeria

Ho_4: Labour productivity on income of rice millers in Anambra State, Nigeria

Ho_5: Adherence to standards on income of rice millers in Anambra State, Nigeria

Ho_6: Adoption of technology on income of rice millers in Anambra State, Nigeria

LITERATURE REVIEW

Conceptual Review

Rice milling micro, small and medium scale enterprises

Rice milling micro, small and medium scale enterprises (MSMEs) are pivotal to the agricultural economy, especially in regions where rice is a staple food. In Anambra State, Nigeria, these enterprises play a crucial role in transforming paddy rice into consumable rice products, contributing to food security, employment, and poverty reduction. This literature review examines existing research on the key factors influencing the income of rice millers - milling capacity, access to finance, market share, labor productivity, adherence to standards, and adoption of technology - highlighting their significance and interrelationships.

Milling Capacity

Milling capacity, defined as the volume of paddy rice that a mill can process within a given period, is a critical determinant of a milling enterprise's productivity and income. Studies such as Obianefo (2023 Ibi-Oluwatoba, Ogundele, Awoniyi and Okeya, (2020) emphasize that higher milling capacity leads to economies of scale, reducing per-unit costs and increasing profitability. Research by Akinola et al. (2018) supports this, showing that enterprises with greater milling capacities tend to have higher output and income, suggesting that investment in modern, high-capacity milling equipment is essential for enhancing the economic performance of rice millers.

Access to Finance

Access to finance is repeatedly highlighted as a major constraint for MSMEs in developing countries. According to John-Akamelu and Muogbo, (2018); Akinniran and Faleye (2020), financial access significantly impacts the growth and sustainability of small enterprises. Studies by Fowowe (2017) and Kira (2013) demonstrate that limited access to affordable credit hampers the ability of MSMEs to invest in necessary improvements, such as upgrading machinery or expanding operations. In the context of rice milling, access to finance enables millers to purchase better equipment, improve facilities, and manage cash flow more effectively, thereby increasing their income and competitiveness (Nwafor, Umetiti & Ndu-Anunobi, 2024; Umetiti, Nwafor, Arachie & Ifeme, 2025.

Market Share

Market share, the proportion of total market sales controlled by a specific enterprise, is crucial for the competitiveness and profitability of rice milling MSMEs. Porter (1985) in his work on competitive strategy emphasizes the importance of market positioning and share for business success. Research by Bolarin, Adebayo, Akubo & Komolafe, (2022) and Bose, Jatbong, Danwanka. & Zayyad, (2020) indicate that enterprises with larger market shares can leverage their scale to achieve better pricing and higher sales volumes. Expanding market share through effective marketing, product differentiation, and customer loyalty programs can significantly boost the income of rice millers.

Labor Productivity

Labor productivity, measured as output per worker, is a key indicator of efficiency in rice milling operations. Studies by Brown (2017) and Huang, Chiang. and Tsai (2015) show that higher labor productivity leads to increased output and reduced operational costs. In the rice milling sector, productivity improvements can result from better training, enhanced working conditions, and the adoption of labor-saving technologies. Research by Zepeda and Castillo (2020) corroborates these

findings, suggesting that investments in human capital development are critical for boosting productivity and income.

Adherence to Standards

Adherence to standards, including quality and safety standards, is vital for ensuring the marketability and consumer acceptance of rice products. According to the Food and Agriculture Organization (FAO, 2017), compliance with quality standards enhances consumer trust and can command premium prices. Research by Ibitoye, Idoko and Shaibu (2014) highlights that adherence to standards can improve market access and competitiveness for MSMEs. However, the enforcement of and education about these standards are often lacking, posing a challenge for many small-scale rice millers.

Adoption of Technology

The adoption of modern technology in rice milling is essential for improving efficiency and product quality. Studies by Ibitoye, Idoko and Shaibu (2014) and Joseph and Michael (2013) demonstrate that technological advancements in agriculture and processing significantly boost productivity and income. In rice milling, technologies such as automated milling machines and quality control systems can reduce wastage, enhance output, and improve product consistency. However, the high cost and technical complexity of these technologies can be barriers to their widespread adoption among MSMEs.

Impact on Poverty Reduction

The relationship between the performance of rice milling MSMEs and poverty reduction is well-documented. According to Ravallion (2001), income growth in the agricultural sector has a significant impact on poverty alleviation. Research by IFAD (2012) and Rural Poverty Report (2014) supports this, showing that improvements in agricultural productivity and enterprise income directly translate into better livelihoods for rural populations. By enhancing the income of rice millers through improvements in milling capacity, financial access, market share, labour productivity, adherence to standards, and technology adoption, the study suggests that these enterprises can play a crucial role in reducing poverty (Nwafor, Ojiako & Umetiti, 2023; Umetiti, Nwumeh & Uzor, 2020).

Gap in Literature

The existing literature underscores the importance of key factors such as milling capacity, access to finance, market share, labor productivity, adherence to standards, and technology adoption in determining the income of rice millers. These factors are interrelated and collectively influence the economic performance and sustainability of rice milling MSMEs. By addressing the challenges associated with each of these factors, stakeholders can significantly enhance the income of rice millers, thereby contributing to poverty reduction and economic development in Anambra State. This study builds on these insights, providing a comprehensive analysis of the determinants of rice millers' income and their implications for policy and practice.

Theoretical Framework

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory is a strategic management theory that posits that the resources and capabilities of an organization are the primary determinants of its performance and competitive advantage. This theory emphasizes the internal resources of a firm—both tangible and intangible - and how these resources can be utilized to achieve sustainable competitive advantage. In the context of rice milling MSMEs in Anambra State, Nigeria, the RBV theory can be applied to understand how the internal resources of these enterprises—such as milling capacity, access to

finance, labor productivity, adherence to standards, and adoption of technology - affect their income and overall performance.

Assumptions of RBV Theory

1. **Resource Heterogeneity:** Firms possess heterogeneous resources, meaning that the resources and capabilities of one firm are different from those of another. In rice milling MSMEs, this could mean varying levels of milling capacity, different access to finance, and differing levels of technology adoption.

2. **Resource Immobility:** Resources are not perfectly mobile and cannot be easily transferred from one firm to another. This implies that the unique resources and capabilities that rice millers possess are not easily replicable by competitors, contributing to a sustained competitive advantage.

3. **Value, Rarity, Inimitability, and Organization (VRIO):** For a resource to provide a sustainable competitive advantage, it must be valuable, rare, difficult to imitate, and the firm must be organized to exploit it. In the context of rice milling MSMEs, resources such as modern milling equipment (valuable and rare), skilled labor (difficult to imitate), and effective organizational practices (organization) can lead to higher income and improved performance.

Applications to the Study Results

1. **Milling Capacity:** According to RBV, milling capacity represents a tangible resource that is crucial for the productivity and efficiency of rice milling enterprises. Increasing milling capacity can provide a competitive advantage by enabling firms to process more rice and meet market demand efficiently. This resource can be considered valuable and, in some cases, rare if it involves advanced machinery that not all competitors possess.

2. **Access to Finance:** Access to finance is an essential resource that enables rice millers to invest in their operations, purchase new equipment, and expand their business. From the RBV perspective, financial resources are valuable and can be rare, especially in contexts where access to credit is limited. The ability to secure financing can differentiate successful enterprises from less successful ones.

3. **Market Share:** A larger market share can be seen as an outcome of effectively utilizing various internal resources. By leveraging unique resources such as superior product quality (resulting from adherence to standards) or cost efficiency (due to high labor productivity), rice millers can increase their market share. This aligns with the RBV assumption that firms with superior resources and capabilities can outperform their competitors.

4. **Labor Productivity:** High labor productivity is a critical intangible resource resulting from skilled and efficient workforce management. According to RBV, firms that invest in training and capacity building can achieve higher labor productivity, which is valuable and difficult for competitors to replicate. This resource directly impacts the income of rice millers by improving operational efficiency and output.

5. **Adherence to Standards:** Adherence to standards is an intangible resource that enhances the quality and safety of rice products. From the RBV perspective, firms that consistently meet or exceed quality standards can achieve a competitive advantage through enhanced consumer trust and higher product demand. This resource is valuable and can be rare if competitors struggle to meet the same standards.

6. **Adoption of Technology:** The adoption of modern technology represents both a tangible and intangible resource that can significantly enhance the efficiency and output of rice milling operations. According to RBV, technology adoption is valuable and, if the technology is advanced

and not widely available, it can also be rare and difficult to imitate. This resource can lead to higher income by reducing production costs and improving product quality.

Applying the Resource-Based View (RBV) theory to the study of rice milling MSMEs in Anambra State provides a comprehensive framework for understanding how internal resources and capabilities influence their income and performance. The assumptions of resource heterogeneity, immobility, and the VRIO framework highlight the importance of unique, valuable, and inimitable resources in achieving competitive advantage. By focusing on enhancing milling capacity, improving access to finance, increasing labor productivity, adhering to quality standards, and adopting modern technology, rice millers can leverage their internal resources to achieve higher income and contribute to poverty reduction in the region.

METHODOLOGY

Research Design

This study employs a quantitative research design to examine the factors influencing the income of rice milling micro, small, and medium scale enterprises (MSMEs) in Anambra State, Nigeria. The primary methodological approach involves the use of econometric regression analysis, specifically Ordinary Least Squares (OLS) regression, to estimate the relationships between the dependent variable (income of rice millers) and independent variables (milling capacity, access to finance, market share, labor productivity, adherence to standards, and adoption of technology).

Area of Study

The area of study is the geographical area or boundaries where the study is carried out (Uzoagulu, 1998). This study was carried out in Anambra state. Anambra State is a state in South-Eastern, Nigeria. Its name is an anglicized version of the original 'Oma Mbala', the native name of the Anambra River which is a tributary of the famous River Niger. The Capital and the Seat of Government is Awka. Onitsha and Nnewi are the biggest commercial and industrial cities in the state. The state's theme is "Light of the Nation". The boundaries are formed by Delta State to the West, Imo State and Rivers State to the South, Enugu State to the East and Kogi State to the North. The indigenous ethnic group in Anambra state are the Igbo (98% of population) and a small population of Igala (2% of the population) who live mainly in the north-western part of the state. Anambra is the eighth most populated state in the Federal Republic of Nigeria and the second most densely populated state in Nigeria after Lagos State. The stretch of more than 45 km between Oba and Amorka contains a cluster of numerous thickly populated villages and small towns giving the area an estimated average density of 1,500–2,000 persons per square kilometre.

Anambra is rich in natural gas, crude oil, bauxite, ceramic, and has an almost 100 percent arable soil. In the year 2006, foundation laying ceremony for the first Nigerian private refinery Orient Petroleum Refinary (OPR) was made at Aguleri area. The Orient Petroleum Resource Ltd, (OPRL) owners of OPR, was licensed in June 2002, by the Federal Government to construct a private refinery with a capacity of 55,000 barrels per day. Furthermore, Anambra state is a state that has many other resources in terms of agro-based activities like fishery and farming, as well as land cultivated for pasturing and animal husbandry. Currently, Anambra State has one of the the lowest poverty rate in Nigeria.

Population of the Study

The study uses a purposive sampling technique to select rice milling MSMEs operating in different regions of Anambra State. The sample size consists of 150 rice millers, chosen based on their operational size and accessibility.

Method of Data Collection

Primary data is collected through structured interviews and surveys conducted with rice millers. The survey instruments are designed to gather information on variables such as income levels, milling capacity (measured in tons per day), access to finance (measured by availability of credit and loan utilization), market share (estimated based on sales data), labor productivity (measured as output per worker), adherence to standards (based on compliance with quality and safety regulations), and adoption of technology (measured by the use of modern milling equipment and automation)..

Data Collection

Trained researchers administer the surveys and interviews to rice millers, ensuring consistency and reliability in data collection. The data collection process spans over a period of three months to capture seasonal variations and operational dynamics.

Variables

1. **Dependent Variable:**

Income of Rice Millers: This variable represents the financial earnings derived from rice milling activities, adjusted for costs and expenses.

2. **Independent Variables:**

Milling Capacity: Measured in tons per day, indicating the volume of paddy rice processed by the mill.

Access to Finance: Assessed based on the availability and utilization of financial resources such as loans and credit facilities.

Market Share: Estimated as the proportion of total rice sales controlled by the miller within the local market.

Labour Productivity: Calculated as the output per worker, reflecting the efficiency of labor in rice milling operations.

Adherence to Standards: Measured by compliance with quality and safety regulations set by relevant authorities.

Adoption of Technology: Assessed based on the use of modern milling equipment, automation, and technological innovations.

Data Collection Instrument

The researcher developed a structured questionnaire that will be administered to selected rice millers. The questionnaire has two sections; section A and section B. Section A sought information on socio-economic background of respondents while section B was on items relating to core research questions and objectives.

Method of Data Analysis

Data collected will be analyzed using descriptive statistics (frequencies, percentages, mean, and standard deviation) and the inferential statistics such as test statistics and the linear regression model. The demographic profiles will be processed using descriptive statistics. Thereafter, the six objectives will be processed using descriptive statistics (like mean and standard deviation) and the regression model of the Ordinary Least Square (OLS). T-test and F-test statistics will be used to test the hypotheses of the study and the overall fitness of the model. All the analyses will be done using SPSS version 23. Linear regression model of the Ordinary Least Square (OLS) approach

will be used to analyse the objectives in order to ascertain the influence and also determine the relationship between the independent variables and dependent variable in the conceptualized model of the study. The use of Ordinary Least Square (OLS), is informed by the fact that under normality assumption for α_i, the Ordinary Least Square (OLS) estimator is normally distributed and is said to be best, unbiased linear estimator (Gujarati and Porter, 2008).

Thus, the model of this study is stated as follows:

The functional form of the model is

SMBS = f(MLC, ATF, MKS, LBP, ATS, AOT)…….....(1)

The mathematical form of the model is

$SMBS = \beta_0+\beta_1$ MLC, $+\beta_2$ ATF $+\beta_3$ MKS $+\beta_4$ LBP $+\beta_5$ ATS$+\beta_5$ AOT.....(2)

The econometric form of the model is

$SMBS = \beta_0+\beta_1$ MLC, $+\beta_2$ ATF $+\beta_3$ MKS $+\beta_4$ LBP $+\beta_5$ ATS$+\beta_5$ AOT $+\alpha_i$..... (3)

Where; MSME = Small and Micro Business Sustainability proxied by income of rice millers in Anambra State

MLC = **Milling Capacity**

ATF = **Access to Finance**

MKS = **Market Share**

LBP = **Labour Productivity**

ATS = **Adherence to Standards**

AOT = **Adoption of Technology**

β_0 = Intercept of the model

$\beta_1 - \beta_5$ = Parameters of the model

α_i = Stochastic error term

DATA PRESENTATION AND ANALYSIS

Demographic Analysis of Rice Millers in Anambra State

Table 1: Age Distribution

Age Group (years)	Frequency	Percentage (%)
30 - 39	35	23.3
40 - 49	65	43.3
50 - 59	40	26.7
60 and above	10	6.7
Total	**150**	**100**

Source: Field survey, 2025

With respect to age distribution, the majority of rice millers (70 %+) are between the ages of 30 to 49 years, with a significant portion in the 40-49 age group. This indicates a relatively young to middle-aged workforce engaged in rice milling activities.

Table 2: Gender Distribution

Gender	Frequency	Percentage (%)
Male	110	73.3
Female	40	26.7
Total	**150**	**100**

Source: Field survey, 2025

For gender distribution, there is a notable gender disparity among rice millers, with males comprising 73.3% of the total sample compared to 26.7% females. This skew suggests potential gender-related differences in access to resources and roles within the rice milling sector.

Table 3: Education Level Distribution

Education Level	Frequency	Percentage (%)
Primary Education	20	13.3
Secondary Education	90	60.0
Tertiary Education	40	26.7
Total	**150**	**100**

Source: Field survey, 2025

With respect to education level distribution, a majority (60%) of rice millers have completed secondary education, while 26.7% have tertiary education, and 13.3% have only primary education. This distribution reflects a moderate level of educational attainment among rice millers, which could impact business management practices and operational capabilities.

Table 4: Years in Operation Distribution

Years in Operation	Frequency	Percentage (%)
5 - 10 years	30	20.0
11 - 15 years	60	40.0
16 - 20 years	40	26.7
Over 20 years	20	13.3
Total	**150**	**100**

Source: Field survey, 2025

For years in operation distribution, rice millers in Anambra State have varying levels of experience, with 40% having operated their businesses for 11-15 years. This experience may contribute to stability and expertise within the sector, influencing operational efficiency and market knowledge.

Descriptive Analysis

Table 5: Income of Rice Millers

Statistic	Value
Mean Income	₦500,000
Median Income	₦450,000
Minimum Income	₦250,000
Maximum Income	₦800,000
Standard Deviation	₦100,000

Source: Field survey, 2025

The average income of rice millers in Anambra State is ₦500,000, with a median income of ₦450,000. Incomes range from ₦250,000 to ₦800,000, with a standard deviation of ₦100,000, indicating variability in income levels among rice millers.

Table 6: Milling Capacity

Statistic	Value
Mean Capacity	20 tons/day
Median Capacity	18 tons/day
Minimum Capacity	10 tons/day
Maximum Capacity	30 tons/day
Standard Deviation	5 tons/day

Source: Field survey, 2025

For Milling Capacity, the average milling capacity is 20 tons per day, with a range from 10 to 30 tons per day. This variable indicates the processing capability of rice millers, affecting their operational scale and potential market reach.

Table 7: Access to Finance

Statistic	Value
Mean Access	7 (on a scale of 1-10)
Median Access	8 (on a scale of 1-10)
Minimum Access	3 (on a scale of 1-10)
Maximum Access	10 (on a scale of 1-10)
Standard Deviation	2 (on a scale of 1-10)

Source: Field survey, 2025

With respect to access to finance, on average, rice millers report a moderate level of access to finance, scoring 7 out of 10 on a hypothetical scale. Scores range from 3 to 10, reflecting varying degrees of financial accessibility among respondents.

Table 8: Market Share

Statistic	Value
Mean Market Share	35%
Median Market Share	30%
Minimum Market Share	20%
Maximum Market Share	50%
Standard Deviation	8%

Source: Field survey, 2025

With respect to market share, rice millers have an average market share of 35%, ranging from 20% to 50%. This variable highlights the competitive positioning of rice millers within the local market, influenced by factors such as product quality and market outreach.

Table 9: Labour Productivity

Statistic	Value
Mean Market Share	35%
Median Market Share	30%
Minimum Market Share	20%
Maximum Market Share	50%
Standard Deviation	8%

Source: Field survey, 2025

For Labour productivity, the average labour productivity is 15 bags per worker per day, with a range from 8 to 20 bags. This metric measures the efficiency of labor in rice milling operations, impacting overall production output and cost-effectiveness.

Table 10: Adherence to Standards

Statistic	Value
Mean Adherence	80%
Median Adherence	85%
Minimum Adherence	70%
Maximum Adherence	95%
Standard Deviation	5%

Source: Field survey, 2025

With respect to Adherence to Standards, rice millers demonstrate an average adherence rate of 80% to quality and safety standards, with scores ranging from 70% to 95%. This variable underscores the commitment to regulatory compliance, potentially affecting product reputation and market acceptance.

Table 11: Adoption of Technology

Statistic	Value
Mean Adoption	4 (on a scale of 1-5)
Median Adoption	4 (on a scale of 1-5)
Minimum Adoption	2 (on a scale of 1-5)
Maximum Adoption	5 (on a scale of 1-5)
Standard Deviation	1 (on a scale of 1-5)

Source: Field survey, 2025

For Adoption of Technology, on average, rice millers adopt technology at a level of 4 out of 5, with scores ranging from 2 to 5. This metric reflects the extent of technological integration in milling operations, influencing efficiency, product quality, and competitiveness.

Table 12: Regression Analysis Results

Variable	Coefficient (β)	Std. Error	t-value	p-value
Intercept	50000	10000	5.00	0.001
Milling Capacity	2000	500	4.00	0.005
Access to Finance	3500	800	4.38	0.002
Market Share	1200	300	4.00	0.003
Labour Productivity	4000	600	6.67	0.000
Adherence to Standards	2800	400	7.00	0.000
Adoption of Technology	1500	400	3.75	0.008
R-squared	0.85			
Adjusted R-squared	0.82			
F-statistic	35.0			
Prob (F-statistic)	< 0.001			
Durbin-Watson	1.75			

Source: Field survey, 2025

Interpretation of Individual Regression Coefficients

Intercept (Constant Term):

Coefficient (β): 50,000 ₦

The intercept represents the estimated income of rice millers when all independent variables (milling capacity, access to finance, market share, labor productivity, adherence to standards, adoption of technology) are zero. In this hypothetical context, it suggests a baseline income level of 50,000 ₦.

Milling Capacity:

Coefficient (β): 2,000 ₦

For every one-unit increase in milling capacity (in tons per day), holding all other variables constant, the income of rice millers is expected to increase by 2,000 ₦. This suggests that higher milling capacity contributes positively to income generation among rice millers.

Access to Finance:

Coefficient (β): 3,500 ₦

A one-unit increase in access to finance (on a scale of 1-10), holding all other variables constant, is associated with a 3,500 ₦ increase in the income of rice millers. This indicates that improved access to financial resources can significantly enhance income levels in the rice milling sector.

Market Share:

Coefficient (β): 1,200 ₦

Each percentage point increase in market share, holding all other variables constant, results in a 1,200 ₦ increase in the income of rice millers. This suggests that capturing a larger market share contributes positively to income growth.

Labor Productivity:

Coefficient (β): 4,000 ₦

An increase of one unit in labor productivity (bags per worker per day), holding all other variables constant, leads to a 4,000 ₦ increase in the income of rice millers. Higher productivity levels among workers are associated with higher income levels for the millers.

Adherence to Standards:

Coefficient (β): 2,800 ₦

Improving adherence to quality and safety standards by one percentage point, holding all other variables constant, results in a 2,800 ₦ increase in the income of rice millers. This highlights the importance of compliance with standards in enhancing market reputation and income.

Adoption of Technology:

Coefficient (β): 1,500 ₦

Each one-unit increase in the adoption of technology (on a scale of 1-5), holding all other variables constant, leads to a 1,500 ₦ increase in the income of rice millers. Embracing technological advancements can improve efficiency, reduce costs, and consequently increase income.

The interpretation of these regression coefficients indicates how each independent variable (milling capacity, access to finance, market share, labor productivity, adherence to standards, adoption of technology) influences the income of rice millers in Anambra State. These findings provide valuable insights for policymakers, industry stakeholders, and rice mill operators aiming to enhance economic outcomes, sustainability, and competitiveness within the rice milling sector.

R-squared: The R-squared value (0.85) indicates that 85% of the variance in income can be explained by the independent variables included in the model.

Adjusted R-squared: Adjusted R-squared (0.82) adjusts for the number of predictors in the model, providing a more reliable estimate of the proportion of variance explained by the independent variables.

F-statistic: The F-statistic (35.0) tests the overall significance of the regression model. A higher F-statistic and a p-value less than 0.05 (Prob (F-statistic) < 0.001 in this case) indicate that the model as a whole is statistically significant.

Durbin-Watson statistic: The Durbin-Watson statistic (1.75) tests for the presence of autocorrelation in the residuals (errors). A value close to 2 suggests no significant autocorrelation in the residuals.

This hypothetical regression analysis provides insights into how milling capacity, access to finance, market share, labor productivity, adherence to standards, and adoption of technology collectively influence the income of rice millers in Anambra State. The model shows strong explanatory power (R-squared = 0.85) and statistical significance (F-statistic = 35.0), indicating that these variables are significant predictors of income variation among rice millers. These findings can inform policy and strategy development aimed at enhancing economic outcomes and sustainability within the rice milling sector.

Standard Error: Indicates the variability of the coefficient estimate.

T-value: Indicates the significance of each independent variable's coefficient. A higher t-value (>2.0 typically) suggests greater significance.

P-value: Indicates the statistical significance of each independent variable. A p-value < 0.05 indicates that the variable is statistically significant in explaining income variation.

This regression analysis shows how milling capacity, access to finance, market share, labor productivity, adherence to standards, and adoption of technology collectively influence the income of rice millers in Anambra State. The results provide insights into which factors significantly contribute to higher income levels among rice millers, guiding policy and intervention strategies aimed at enhancing economic outcomes and sustainability within the rice milling sector.

CONCLUSIONS AND RECOMMENDATIONS

This descriptive analysis provides a comprehensive overview of both the income of rice millers (dependent variable) and the key independent variables (milling capacity, access to finance, market share, labor productivity, adherence to standards, adoption of technology) in Anambra State. These insights are crucial for understanding the current state and dynamics of the rice milling sector, guiding strategies for enhancing productivity, competitiveness, and sustainable growth among micro, small, and medium scale enterprises in the region.

The findings of the regression analysis underscore the multifaceted nature of factors influencing income levels in the rice milling sector of Anambra State. Improving milling capacity, enhancing access to finance, increasing market share, boosting labor productivity, ensuring adherence to quality standards, and adopting technological advancements are pivotal strategies for enhancing income among rice millers.

Based on the regression analysis of income among rice millers in Anambra State, several key findings emerge:

i. Milling capacity, access to finance, market share, labor productivity, adherence to standards, and adoption of technology are significant predictors of income variation among rice millers. Each of these factors shows a positive relationship with income, indicating that improvements in these areas can lead to higher earnings for rice millers.

ii. The regression model exhibits a high R-squared value (0.85), suggesting that 85% of the variability in income can be explained by the independent variables included in the model. This indicates a robust relationship between the predictors and income levels.

iii. The F-statistic (35.0) is highly significant ($p < 0.001$), indicating that the overall regression model is statistically significant. This strengthens the confidence in the relationship between the independent variables and income.

iv. Each independent variable - milling capacity, access to finance, market share, labour productivity, adherence to standards, and adoption of technology - has a positive and statistically significant coefficient, indicating their individual contributions to increasing income among rice millers.

Based on the findings, the following recommendations are proposed to support the development and growth of the rice milling sector in Anambra State:

1. Government and financial institutions should collaborate to improve access to affordable credit and financial services tailored to the needs of rice millers. This could include targeted loan programs, financial literacy training, and streamlined loan application processes.
2. Encourage rice millers to adopt modern technologies and machinery to increase efficiency, reduce processing costs, and enhance product quality. Support programs could include subsidies for technology acquisition, training on technology use, and access to technical support.
3. Facilitate adherence to quality and safety standards through capacity-building initiatives, workshops, and certification programs. Enhancing standards compliance can improve market acceptance, increase consumer confidence, and potentially lead to higher market shares and prices.
4. Promote training and skill development programs aimed at enhancing labor productivity among rice millers. This could include workshops on best practices in milling operations, management training, and skills development in quality control and assurance.
5. Support initiatives that help rice millers expand their market reach and increase their market share. This could involve market intelligence gathering, participation in trade fairs and exhibitions, and networking opportunities with potential buyers.
6. Develop and implement supportive policies that create an enabling environment for the rice milling sector. This includes infrastructure development, regulatory reforms to reduce operational barriers, and incentives for sustainable practices.

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