



Dynamics of Income Inequality among Rice Growers in North West, Nigeria

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ABSTRACT

These studies focused on measurement and dynamics of income inequality among rice growers in North West, Nigeria. A multi-stage sampling design was utilized to select 200 rice growers in North West, Nigeria. Primary data were used based on a well-structured questionnaire. The questionnaire was subjected to validity and reliability test. The data were analyzed utilizing descriptive statistics, Gini-Coefficient, Probit Dichotomous regression model, and Kendall's coefficient of concordance. The result shows that the mean age of the rice farmers was 43 years, the farmers had 14 years' experience in rice farming and spent an average of 11 years in attending school education. Furthermore, 80% of the farmers were married, 60% of them were male, 65% had extension contact and 57% belonged



to cooperative society. Approximately, 75% of the rice growers belong to high income inequality group, while 25% of the rice growers belongs to low income inequality group. The significant drivers of income inequalities were education and experience at 1% probability level. A t-test results further showed that the t-calculated value of 17.434 which is greater than the t- tabulated value of 1.96 at 5% significance level. This suggests a statistical difference between the average cost (687,251.24) and average returns (1,875,000) of rice production. The substantial positive difference between returns and costs (1,187,748.76) strongly shows that rice production in the study area is economically viable. The challenges encountered by the farmers include lack of land ownership, lack of access to technology, inadequate credit access, poor market information and inconsistent government policy and support.

Keywords: Average return, cost, drivers, economic viability, income inequality

INTRODUCTION

The wealth and income disparity has been widening in both developed and developing nations over the last four decades (Oxfam, 2017). Economic disparity has reached severe proportions in Nigeria, and it manifests itself in the everyday struggles of the majority of the population against the outrageous wealth amassed by a select few. In contrast, nearly 112 million people lived in poverty in 2010 (Oxfam, 2017). According to the latest comprehensive data on global poverty, 736 million people (10% of the global population) lived in extreme poverty in 2015, down from 1.85 billion (35%) in 1990 (World Bank, 2018b). Economic inequality either in terms of income, expenditure, or wealth has long been recognized as major obstacle to poverty reduction at global, continental, and national levels (Ravallion, 2014). Reducing inequality within and between countries is part of the Sustainable Development Goals (SDG 10) that many countries aim to achieve by 2030 (Kunuwotor et al., 2020). A vicious cycle that undermines social cohesiveness, peace, and general development is created when income inequality, a powerful force impeding economic growth, combines with inadequate funding and capital availability (World Bank 2022). Poverty refers to the rate of change in the mean income of a population and the change in the income distribution, suggesting that poverty stems from changes in the average income or income distribution (World Bank, 2021). Poverty rates are more pronounced among smallholder farmers, who constitute the majority of the labour



force in the agricultural sector in sub-Saharan Africa, particularly Nigeria (World Bank, 2021). Even with a steady increase in spending and Nigeria's ranking as Africa's seventh-largest oil producer and exporter with the highest average real GDP growth rate of 7.0, the country continues to struggle with extreme poverty and huge income disparity. Comparing Nigeria to other nations, it has some of the greatest levels of inequality in the world (World Bank 2019). Approximately 63% of Nigerians are classified as multi dimensionally poor (National Bureau of Statistics, 2022). A delicate balancing action is required in Nigeria, where the agricultural industry struggles with issues like income disparity, poverty, unemployment, insecurity, and inadequate finance (Saini & Kaur, 2022). Other issues include access to capital, extension services, improved seedlings, and land resources. The income distribution and productivity of farmers have been notably influenced by the lack of access to money, the expensive cost of improved seedlings and technology, the significant economic inequality among farmers, and the inefficiencies in government programs and efforts (Saini & Kaur, 2022). Lower-income farmers face poverty and low productivity due to a lack of finance, limited access to capital, extension services, and expensive agricultural supplies.

Estimates of inequality are crucial for policy concerns since they hinder economic growth (OECD, 2015). Because higher income groups are less likely to consume than lower income groups, there is a negative correlation between income disparity and aggregate demand. People's trust in the government is negatively impacted, and corruption and nepotism are increased (OECD, 2015). There is a significant disparity in income between rural and urban areas of Nigeria (Akpan et al., 2020). Due to the fact that a high degree of income inequality creates an environment that is not conducive to economic growth and development, variances in the amount of money earned by people in rural areas are also becoming more prevalent, which may be closely related to the growing aspect of poverty, even among rural households (Akpan et al., 2020). This disparity in wealth or income between rural and urban areas typically explains rural-urban migration and impedes food security. Policymakers in Nigeria have long been concerned about the rising level of income inequality, which is not surprising given that poverty and inequality are positively correlated; as the rate of inequality rises, the poverty rate also rises. A growing body of evidence suggests that rising influence of the rich and stagnant incomes of the poor and middle class have a causal effect on income inequality crises, and thus directly detrimental to short and long-term growth. Furthermore, studies of Anyiam et al. (2023) have argued that a prolonged period of higher inequality in advanced economies was



associated with the global financial crisis by intensifying leverage, extending credit excessively, relaxing mortgage underwriting standards, and allowing lobbyists to push for financial deregulation. With rice being a vital industry and one of the widely consumed agricultural commodities in Nigeria, efforts are being made to increase farmers' incomes through farming. Rice production can be used to develop the nation's economy, preserve the majority of rice farmers' foreign exchange, and enhance their revenue distribution. According to Anyiam et al. (2023), a number of microenterprises, particularly those that handle rice before and after harvest, have the potential to significantly reduce income disparity and support the economic growth of nations like Nigeria. With consumption predicted to increase at a rate of 5.1% per year and production reaching 36 million metric tons (MT) by 2050.

Rice (*Oryza sativa*) is one of the most important staple foods for about half of the human race (Food and Agriculture Organization, 2020). It ranks third after wheat and maize in terms of worldwide production, with the expansion of the cultivated land area which has witnessed steady rise in production and consumption in Nigeria. Despite several interventions of government at different level to eradicating hunger, poverty, malnutrition and boost in production especially in rice farming; poverty and vulnerability of smallholder farmers has constantly witness a decline in recent years. Government effort through poverty alleviation, access to food and reduction in income inequality has evidences of remarkable success but the impact on the livelihood of the smallholder farmers is not felt. Income inequality has been a problem affecting every nation in the world especially in sub-Saharan Africa, Nigeria is not left out (FAO, 2021). Today, two of every five sub-Saharan Africans live in extreme poverty, and they do so in the mist of the world severe wealth and income inequality (World Bank, 2019b). Income inequality possess an adverse socio-economic and political consequence with the potential to cause instability in the economy and unsustainability of resources (International Monetary Fund, 2023). Income inequality is the extent to which income is evenly distributed within a population, low income rice farmers consume majority of their farmer produce and have very little to improve on their income, while high income rice farmers expand their economies of scale to generate more income, this consequently leads to income disparity.

Rice being a vital staple food in Nigeria can serve as a means of conserving foreign exchange for the rice farmers, increase their income and also contribute to the economy at large. Small businesses especially those involved in value addition can help reduce income inequality and contribute to economic growth



and development of Nigeria. In Nigeria, rice has witnessed boost in yearly production due to the initiatives and programs from the government at various tiers to boost agricultural production through ban of imported rice, subsidies, supply of improved seeds, these has resulted to rise in the price and quantity of locally produced rice. However, this has not reflected on the income of the rice farmers in the regions, income and poverty still persist among rice farmers (Anigbogu, 2019).

The main aim of this study was to measure the dynamics of income inequality among rice growers in North West, Nigeria.

MATERIALS AND METHODS

These studies were investigated in North West, Nigeria. The simple random sampling approach was utilized to select Kaduna and Kano States because rice is predominantly grown in the two states. A simple random sampling approach was utilized to select 200 rice producers within the two states. The approach was utilized because it avoids element of bias in selecting the rice growers. Secondly, the sampling approach gives the probability for every grower to have equal chance of being selected. The disadvantages of the simple random sampling approach were under-representation of certain sub-groups, difficulty accessing lists of the full population, time consuming, the process may cost individual a substantial amount of capital, cumbersome, sample selection bias can occur, and challenging when the population is heterogeneous and widely spread. The sample frame of rice producers approximately 400 respondents. The total sample number consists of 100 rice growers selected each from the two states, respectively. Primary data of cross-sectional sources were used based on a well-structured questionnaire that was subjected to validity and reliability test.

This sample number was estimated based on the established formula of Yamane (1967) as follows:

$$n = \frac{N}{1+N(e^2)} = \frac{400}{1+400(0.05)^2} = 200.....(1)$$

Where,

n = The sample number

N = The total number of rice growers,

e = 5%



The data obtained were analyzed using descriptive statistics, Gini-coefficient, Probit dichotomous regression model, and Kendall's coefficient of concordance.

Probit Dichotomous Regression Model (PDRM)

The model following the research of Itse et al. (2023) and Olaitan et al. (2024) is explicitly stated as:

$$Y_i = \alpha_0 + \sum_{j=1}^k \alpha_j X_{ij} + \dots \alpha_n X_n + \mu_i \quad (2)$$

$$Y_i = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \mu_i \quad (3)$$

$$Y_i = \begin{cases} 1, & \text{if GC} > 0.5, \text{ High Inequality} \\ 0, & \text{if GC} \leq 0.5, \text{ Low Inequality} \end{cases}$$

Where,

Y_i = The Dependent Variable, (1, if GC > 0.5, High Inequality; 0, if GC ≤ 0.5, Low Inequality)

α_0 = Constant Term

$\alpha_1 - \alpha_6$ = Regression Coefficients

X_1 = Age (Years)

X_2 = Education in Years

X_3 = Farm Size (Hectare)

X_4 = Experience in Rice Farming (Years)

X_5 = Membership of Cooperatives (1, Members; 0, Otherwise)

X_6 = Amount of Credit Accessed (Naira)

μ_i = Error Term

Gini-Coefficient (GC)

The choice of this formula follows the research of Taru and Lawal (2011). The Gini-Coefficient is given as:

$$GC = 1 - \sum_{i=1}^n X_i Y_i \dots \dots \dots (4)$$

Where,

GC = Gini Coefficient

X_i = % Share of Each Class

Y_i = Cumulative % of their Sales

Kendalls' Coefficient of Concordance (W)

The choice of this formula follows the studies of Amesimeku and Anang (2021).

The Kendalls' Coefficient of Concordance (W) is stated below:



$$W = \frac{12S}{m^3(n^3 - n) - mT} \quad (5)$$

Where:

n = Number of Attributes or Objects that is Evaluated by Respondents

m = Number of Respondents

S = Sum Overall Subjects

T = Correction Factor estimated for Tied Ranks

$$T = \sum_{k=1}^g (t_k^3 - t_k) \quad (6)$$

Where;

t_k = Number for Tied Ranks for each (k) in 'g' Groups of Ties

Friedmans' Chi Square (χ^2)

$$\chi^2 = m(n - 1)W \quad (7)$$

The t-Test of Difference Between Means

This is stated thus:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (8)$$

Where,

\bar{X}_1 = Mean of Values in Group 1

\bar{X}_2 = Mean of Values in Group 2

s_1^2, s_2^2 = Standard Deviation in Group 1 and Group 2

n_1, n_2 = Number of Observation in Group 1 and Group 2

RESULTS AND DISCUSSION

The Continuous Variables of Farm-Specific and Socio-Economic Characteristics of Rice Growers

The result in Table 1 provided a comprehensive overview of the socio-economic characteristics of rice-based farmers in the study area. Here's a discussion of each of the mean values and their implications:

Age



The mean age of the farmers was 43 years; this suggests that rice growing was primarily undertaken by young individuals. This young farmer can easily adopt modern technologies; as older farmers are often more resistant to change (Anthony, 2023).

Experience

The number of years a farmer spent in farming gives an indication of the practical knowledge he/she has gained on how to cope with production, since experienced farmers are better risk managers than inexperienced ones. The rice farmers had an average of 14 years of experience which reflects that the farmers have deep knowledge of local rice farming practices. This result is in consonance with the findings of Alabi et al. (2023), who corroborates that farmers with longer years of farming experience would accumulate more and better knowledge and skills in making informed farm decision.

Education

The mean years of schooling among rice growers was estimated at 11 years. According to Alabi et al. (2022) who noted that low educational attainment among farmers limits their ability to adopt modern farming technologies, understand extension services, and access financial resources, and this perpetuates low productivity.

Household Size

Household labour helps to mitigate/ cope with the issue of scarce and costly hired labour and help reduce the cost incurred in labour purchase. The mean household size was evaluated at 8 persons; the result is in line with Anthony (2023) who reported that large household size complement labour and enhance productivity by reducing the cost of hired labour.

Farm Size

The results suggest that the average rice grower cultivates 1.43 hectares. This could mean that the farmers are smallholder farmers. Smallholder farmers are predominant in the sub-Saharan Africa.

Output

The average rice yield was estimated 3 tons per hectare, suggesting that the farmers were efficient and productive, which points that there are potentials of increase in output.



Table 1. The continuous variables of farm-specific and socio-economic characteristics of rice growers

Variables	Description of Variables	Mean	SD
Age	Age of the respondents (years)	43	07.92
Experience	Number of years spent in rice farming	14	5.03
Education	Number of years spent in school education	11	2.86
Household Size	Number of people per household	8	3.09
Farm Size	Cultivated Farm Land in Hectares	1.43	0.90
Output	tons/hectare	3	0.89

Source: Field Survey (2024), SD-Standard Deviation

The Categorical Variables of Socio-Economic Features of Rice Growers

Marital status

Table 2 revealed that most of the respondents are married (80%), with smaller proportions being single (20%). Marital status is often associated with greater responsibility and household labour availability. This is also consistent with the studies of Alabi (2023) who observed that marital status enhances social stability and increases the likelihood of resource pooling for agricultural activities.

Gender

The result shows that 60% of the farmers were male, while 40% were female. This could imply that men play a significant role in agricultural activities.

Extension Contact

The result reveals that 65% of rice farmers reported having contact with extension agents, while 35% did not. While, a majority of farmers benefit from extension services, the remaining 35% highlight gaps in coverage. This result is consistent with the study of Oluwole and Odebode (2015) who reported that farmers who regularly interact with extension agents are more likely to adopt modern technologies, improve their efficiency and productivity.

Cooperatives Organization

The result revealed that 57% of the rice farmers were members of farm-based organizations, while 43% were not. Membership in such organizations facilitates access to inputs, credit, and collective marketing opportunities. This study is in agreement with outcomes of Barungi et al. (2016) who observed that participation in farmer groups enhances resource access and provides a platform for collective action, which is critical for smallholder farmers.



Table 2. The Categorical Variables of Socio-Economic Features of Rice Growers

Variables	Frequency	Percentage
Marital Status		
Single	40	20.00
Married	160	80.00
Gender		
Male	120	60.00
Female	80	40.00
Extension Contact		
Yes	130	65.00
No	70	35.00
Cooperatives		
Yes	110	55.00
No	90	45.00
Total	200	100.00

Source: Field Survey (2024)

Measurements of Income Inequalities among Rice Growers

Table 3 displayed a significant disparity in income levels among rice growers with 75% of rice growers experiencing high inequality, while 25% reflecting low inequality. This outcome is in agreement with the research of Anyiam et al. (2023).

Table 3. Measurements of Income Inequalities among Rice Growers

Measurement	Frequency	Percentage
≥ 0.5 (High Inequality)	150	75.00
< 0.5 (Low Inequality)	50	25.00

Source: Field Survey (2024)

Dynamics of Income Inequality among Rice Growers

The result of the Probit regression analysis as displayed in Table 4 revealed that the pseudo R square value of 0.7402. This indicates that the model explains approximately 74% of the variations in the outcome variable. The Log likelihood function value of -152.82 indicates the overall model is highly significant at 1% probability level. The chi square of 6 degrees of freedom and p-value of 0.000 further suggests that the independent variable influence the probability of the outcome.



Education

The result shows that education is positive and significant at 1% probability level. This suggests that for each additional year of schooling, output is expected to improve by 0.3472 units. This is in line with the findings of Alabi et al. (2021), who reported that education helps farmers to make better informed decision and increase welfare and productivity.

Experience

This finding shows that an increase in total crop output is associated with an increase in experience by 0.3696 units. This relationship is highly statistically significant at the 1% probability level. This suggests that the farmer enjoys increased income, improved food security and poverty alleviation in the study area.

The Constraints Faced by Rice Growers

The results of Kendalls' coefficient of concordance as presented in Table 5 revealed a significant, moderate, consensus among rice growers regarding the major challenges they encountered. Lack of land ownership was seen as the most critical issue, aligning with studies of Ani et al. (2022) who highlighted that land tenure security as a fundamental factor influencing agricultural productivity and investment.

Lack of access to technology (Rank 2) and lack of access to inputs (Rank 3) underscores the persistent challenges in agricultural development, particularly in developing countries. Limited access to modern farming technologies (e.g., improved seeds, machinery) and essential inputs (e.g., fertilizers, pesticides) significantly hinders productivity (World Bank, 2020). Inadequate credit accessed (Rank 4) remains a significant constraint with a mean of 24.48. Access to affordable credit is crucial for smallholder farmers to invest in inputs, technology, and other productivity-enhancing measures (Alabi et al., 2023).

The high mean suggests that financial constraints continue to impede rice farming operations in the study area. Poor market information and access ranked 5 and lack of education and training ranked 6 with a mean of 23.30 and 23.25, respectively, these highlights the importance of market linkages and human capital development. The farmers need timely and accurate market information to make informed decisions, also education and training are essential for adopting new techniques and improving farm management (Alabi et al., 2023). The lower



ranks of inconsistent government policy (Rank 7) and lack of government support (Rank 8), with mean values of 23.24 and 23.12, respectively while still representing challenges, were perceived as less critical on average compared to the other factors. However, inconsistent policies can create uncertainty and discourage investment in the agricultural sector (Jayne et al., 2018).

Table 4. The Results of Maximum Likelihood Evaluation of the Probit Regression Model

Variables	Parameters	Coefficient	Standard Error	$P > Z $
Constant	α_0	2.834***	0.3080	0.000
Age	α_1	0.0472	0.0787	0.834
Education	α_2	0.3472***	0.0423	0.000
Farm Size	α_3	0.0571	0.0713	0.906
Experience	α_4	0.3696***	0.1827	0.000
Cooperatives	α_5	0.1732	0.3330	0.782
Amount of Credit Accessed	α_6	0.0382	0.0955	0.820
Diagnostic Statistics				
$LR\chi^2$ (6)	69.47***			
Pseudo R^2	0.7402			
LLF (Log Likelihood)	-152.82			
Prob $> \chi^2$	0.0000***			

Source: Field Survey (2024),

*Significant at ($P < 0.10$)., **Significant at ($P < 0.05$), ***Significant at ($P < 0.01$).

Difference Between Costs and Returns in Rice Farming per Hectare

The result displayed in Table 6 shows that the t- calculated value of (17.434) is significantly greater than the t- tabulated value of (1.96), this suggests that there is a statistical difference in the cost and returns in the rice farming per hectare at 5% significant level.

This implies that the observed difference between the average costs (N687,251.24) and average returns (N1,875,000) further suggests that the rice production in the study area is economical viable. This aligns with the studies of Anthony (2023) who noted that rice farming is profitable.



Table 5. The Kendall's Coefficient of Concordance Results of the Challenges Faced by Rice Growers

Challenges	Overall Rank	Mean Rank Score
Lack of Land Ownership	1	25.87
Lack of Access to Technology	2	25.64
Lack of Access to Inputs	3	25.43
Inadequate Credit Accessed	4	24.48
Poor Market Information and Access	5	23.30
Lack of Education and Training	6	23.25
Inconsistent Government Policy	7	23.24
Lack of Government Support	8	23.12
Kendall's Coefficient (W)	200	
Chi Square	0.394	
df	547.31	
F-Critical	7	
F-Calculated	37.81	
Asymptotic Significance e	127.032	
	0.0000	

Source: Computed from Field Data (2024)

Table 6. The t-Test of Difference Between Costs and Returns in Rice Farming per Hectare

Variable	Estimates
Costs (Naira)	687,251.24
Returns (Naira)	1, 875,000
Standard Deviation Cost	273,915.62
Standard Deviation Returns	689,539.96
t-Calculated	17.434
t-Table	1.96

Source: Field Survey (2024)

CONCLUSION

The study revealed that the difference between the average costs of (N687,251.24) and average returns of (N1,875,000) was estimated at (N1,187,748.76), this further suggests and highlights that the rice production in the study area is economical viable and profitable if resources are optimally utilized. All stakeholders must therefore endeavor to play their part in ensuring that policies and initiatives are targeted to farmers to encourage the rice production, boost productivity, enhance income and welfare of the farmers.

The result revealed that 75% of the rice farmers experience high income inequality which was further reinforced that disparity in socio-economic



characteristics such as access to credit, education, experience, cooperative membership and land size contributed to income inequality thereby impacting on the economic disparity of welfare, income, and poverty status of the farm household.

The finding is also in agreement with the hypothesis that significant difference exist among the challenges faced by rice farmers in the study area, particularly with land ownership, technology, credit and input access. The consequences of income inequality include poverty and food insecurity, reduced agricultural productivity, and social and economic disparities.

RECOMMENDATIONS

In addressing the income inequality among rice growers, the following recommendations were made:

- (i) Land Reforms: Ensure equitable access to land through land reforms which can help reduce income disparities among rice groups
- (ii) Investment in Infrastructures: Investment in infrastructures like roads, irrigation facilities, storage facilities, access to market, and power supply
- (iii) Access to Credit and Financial Services: Ensure adequate supply of credit to rice groups at low interest rate, this will enable the rice groups to invest in their farms and enhance their productivity
- (iv) Agricultural Extension Services: The rice groups should be trained and provided with technical assistance, this will help them utilized new technologies, enhance their income and productivity.
- (v) Market Access and Information: The rice groups should be supported with access to market through cooperatives association and market information services, this will enable the rice growers to sell their produce at better prices
- (vi) Policy Interventions: Government should provide policies such as subsidies, tax break, supply of improved seeds, fertilizer subsidy, and subsidy on agrochemicals this will address income inequality and support peasant farmers.

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