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PROFITABILITY ANALYSIS OF RICE (*Oriza sativa L.*) PRODUCTION AMONG SMALL-SCALE FARMERS IN KANO STATE, NIGERIA

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Abstract
This study focuses on profitability analysis of rice production among small scale farmers in Kano State, Nigeria. A multi-stage sampling techniques was used to select a sample size of 307 rice farmers in the study area on primary data were collected using a structured questionnaire. Descriptive statistics and farm budgetary technique were employed in analyzing the data collected. The results from this study revealed that the rice farmers had an average age of 39years, majority male (98.05%), married (85.99%), post-primary education (57%), household size (9 person), farming experience (19 years), farm size (0.97 hectare) and household monthly income of ₦92,812.64. The results from the farm budgetary techniques showed that rice production is profitable in the study area with an average variable cost, total cost of production, total revenue and net farm income of ₦819,146.32, ₦858,507.15, ₦2,458,143.33 and ₦1,599,636.18 per hectare, respectively. The Gross Margin Ratio (GMR) was estimated as 0.67 (67%), the operating ratio as 0.33, returns per naira invested was estimated as ₦1.86 and the benefit-cost ratio (BCR) was ₦2.86. This result implies that rice business in the study area is financially viable and profitable and can improve rural livelihood and food security of the rice producers. Major constraints faced by the rice farmers in the study area included high cost of fertilizer, low pricing of the rice paddy in the market, inadequate credit/finance and poor access to modern rice processing techniques. The study therefore concludes that rice production in the study area is a viable and profitable enterprise. The study recommended that policy makers in Nigeria should provide rice farmers with fertilizer and other farm inputs at a subsidized rate to ease the burden of high cost of production.

***Keywords:** Analysis, Rice Production, Small scale, Farmers, profitability.*

1.0 Introduction

Rice is one of the major staple foods in Nigeria consumed across all Nigerian ecological zones and socio-economic classes. The rice value chain has emerged as one of the fastest growing sub-sector in the Nigerian agriculture (Abdulwaheed, Opadotun and Amusat, 2017). Still, only about 57% of the 6.7 million metric tonnes of rice consumed in Nigeria annually is locally produced. This leads to a supply deficit of about 1.9 million metric tonnes which are mostly illegally imported. With the rapid growth in the country's population which was estimated to have exceeded 200 million, it is expected that the demand for rice will be sustained and increased in the foreseeable future (Stephen, 2020). Among the various food crops cultivated in Nigeria, rice (*Oryza sativa* L.) has become one of the most important staple foods due to its increasing consumption across rural and urban households. Rice consumption in Nigeria has increased considerably over the last three decades owing to population growth, urbanization, changing dietary preferences, rising incomes and the relative ease of preparation of rice-based meals (Mottaleb *et al*., 2021; Arouna *et al*., 2021;

IRRI, 2023). Consequently, rice has evolved from being a luxury commodity to a strategic food security crop and a major component of the Nigerian food system (FAO, 2023).

Rice has emerged as one of Nigeria's most important staple crops, supporting food security and income generation for millions of people (Wudil *et al*., 2023; Ogunleke *et al*., 2024). Its production and consumption are increasing globally driven by population growth, urbanization, and changing dietary lifestyles (Onyeneke *et al*., 2020; Andrade *et al*., 2022). Nigeria is a major rice consumer in Africa, with domestic production falling short of demand. According to Emmanuel and Gbigbi (2024) and Ekott (2025), Nigeria used around 7.6 million metric tonnes (MT) of rice in 2024, while local supply stood at 5.23 million MT. The Food and Agriculture Organization (FAO) puts Nigeria's rice consumption at 7.8 million MT in 2023, whereas per capita consumption stood at 33.2 kg (FAO, 2025). However, locally produced rice was only a small fraction of this figure, thus inducing the importation of milled rice. The dependence on rice importation arising from the significant supply-demand gap resulted in exerting pressure on foreign exchange earnings, notwithstanding policy measures put in place by successive governments to boost local production and processing (Akinsola *et al*., 2025).

Recent macroeconomic challenges, including inflation, exchange rate volatility and increase in fuel prices, have significantly raised production costs and reduced farmers' purchasing power (World Bank, 2024; NBS, 2024). Profitability is a fundamental indicator of the economic performance and sustainability of agricultural enterprises. It reflects the ability of a farming business to generate returns above the costs incurred in production and serves as a basis for farmers' production and investment decisions (Goni *et al*., 2023). According to Alabi *et al*. (2023), profitability analysis provides essential information on the efficiency of resource utilization and the viability of agricultural enterprises. Similarly, Anyasie *et al*. (2023) argued that understanding the profitability of rice farming is critical for designing interventions aimed at increasing farmers' income and promoting agricultural commercialization.

The lack of current empirical information on the costs and returns associated with rice production among smallholder farmers in Kano State creates a knowledge gap that may hinder effective policy formulation, investment planning, and agricultural development interventions. Without reliable information on profitability indicators such as gross margin and net farm income, policymakers and development agencies may be unable to design targeted interventions that address the economic challenges facing rice farmers. Therefore, this study seeks to analyze the profitability of rice production among smallholder rice farmers in Kano State, Nigeria, with a view to providing empirical evidence that will guide policy decisions aimed at improving farm income, enhancing, promoting agricultural commercialization and strengthening food security. Specifically, this study described the socio-economic characteristics of smallholder rice farmers and estimated the profitability of rice farming among smallholder rice farmers in the study area.

2.0 Objectives of the Study

The broad objective of this study was to analyze profitability of rice production among small scale rice farmers in Kano State, Nigeria. The specific objectives were to:

i. acertain the financial profitability and
ii. determine economic profitability of rice production in the study area.

3.0 Methodology

The study was conducted in Kano State. Kano State is a commercial and agricultural State (KNSG, 2019). The State is located in the North Western part of the country and lies between latitudes 9^{O} 30' and 37N and longitudes 7^{O} 34' and 9^{O} 25E. The State has a total land area of about 42,582.8km square out of which Agricultural land occupies 30,684.8km square (KNSG, 2019). The population of the State stands at 13,076,900 people (NPC, 2016). The State has two distinct climate seasons (Dry and Rainy seasons), the dry season spans the period between October/November to

March/April, while the wet season spans the period between April/May to September/October, with an annual rainfall ranging between 787 and 960mm and a temperature ranging between 33^{O}C and minimum of 15^{O}C although it falls sometimes during Hamattan to as low as 10^{O}C (Olofin, 2008). The major crops cultivated are maize, rice, wheat, tomatoes, groundnut, sorghum, soya beans, millet, pepper, cabbage, onions and sweet potato. Other agricultural activities carried out in the state are animal husbandry, fishery, processing and marketing of agricultural products (NRPD, 2013).

A multi-stage sampling procedure was employed for the study. The first stage involved purposive sampling of Local Government Areas (LGA) from the major rice producing LGAs in the State. The second stage involved random selection of four (4) farming communities from each of the LGAs selected. The third stage involved the application of Taro Yamane (1967) formula for sample size determination and proportionate sampling to select the appropriate sample size of rice farmers per farming community. A total of 307 rice farmers were administered questionnaires for this study. Primary data was used for the study. The primary data was collected with the aid of a structured questionnaire administered to the sampled rice farmers by trained enumerators. The data for the study were analyzed using descriptive statistics and the farm budgetary techniques. This is a farm planning and budgeting tool used to determine the profitability of a given enterprise. The explicit form of the model is as follows:

NFI = TR – (TVC + TFC) …….. (1)

Where:

NFI = Net Farm Income of J^{th} rice producer in naira (₦)

TR = Total Revenue (₦)

TVC = Total Variable Cost (Cost of seed, fertilizer, herbicides, labour, water charges, transportation, etc)

TFC = Total Fixed Cost (Depreciation on fixed asset and Rent paid on lease of land).

The Straight-line method of estimating depreciation was used to determine depreciation of fixed assets in this study:

$$D = \frac{P - S}{T} \quad \ldots\ldots (2)$$

Where: P = Initial cost of the asset (₦),

S = Salvage value is the estimated value of asset at the end of it useful life and

T = Useful life of the asset is the number of years the asset is expected to be used.

The study also estimated the Gross Margin Ratio (GMR), Operating Ratio (OR), Returns per naira invested and Benefit Cost Ratio (BCR), to further assess the profitability optimality of the rice farming enterprise in the study area following Onubogu et al. (2026) and Alabi *et al*. (2023). These estimates are computed as follows:

$$Gross\ Margin\ Ratio\ (GMR) = \frac{Gross\ Margin}{Total\ Revenue} \quad \ldots\ldots (3)$$

Operating Ratio (OR) is expressed as: $= \frac{TVC}{TR}$ …… (4)

Returns per naira invested in rice processing enterprise is given as: $= \frac{NFI}{TC}$ ……. (5)

Benefit Cost Ratio (BCR)= $= \frac{TR}{TC}$ …….. (6)

Where:

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

TC = Total Cost (₦)

NFI = Net Farm Income (₦)

4.0 Results and Discussion

4.1 Socio-economics characteristics of the rice farmers

Table 1 reveals the Socio-economic characteristics results of the rice farmers in the study area. The results show that the mean age of the rice farmers in the study area is 39years, while those between 35 to 44 years are 30.62% indicating that the farmers are in their active age. This implies that the rice farmers are young with vigour and are in their economically active age bracket. This is in line with the findings of Onubogu et al. (2026) in Anambra State, who opined that farmers in their active age are industrious in the rice production industry. The result also showed that majority of the rice farmers are male (98.05%), which is the characteristics of farming activities in Northern Nigeria, where the male gender dominated farming activities, leaving their female folks to handle post-harvest activities like winnowing and threshing. The marital status of the farmers showed that majority of them are married (85.99%), which implies why they are fully involved in farming activity to generate income for family welfare.

The level of education of the rice farmers showed that 57% of them have post-primary education, which implies a high level of educational exposure among the farmers. Education is a key to adoption of innovation and technology among farmers. This is in agreement with the findings of Onubogu et al. (2026) in Anambra State, who stated that exposure to formal education position farmers to better understanding of the farming enterprise. The mean household size of the rice farmers is 9 persons, with majority having household size ranging from 1 to 10 persons. Higher household sizes can be beneficial for the farmers as members of the households can serve as family labour for the rice farmers, but on the other hand, large family size may result to higher level of expenditure for the farmers, and high demand for food.

The rice farmers have an average of 19 years of farming experience in rice production, with about 66.77% having farming experience that is more than 10years. Farming experience plays a key role in managerial skill and resource use efficiency on the part of the farmer and has the tendency of proper application of farming operations among the respondents. This is in line with the findings of Adekunle (2022) who stated that the mean farming experience of rice farmers in Ondo state was 19.7 years, but disagrees with that of Ivom et al. (2026) who opined that the average years of experience by rice farmers in Benue State is 9.2 years. The main primary occupation of the rice farmers is farming (90.55%), while those involved in trading, processing, mason and carpentry are 5.21%, 2.28%, 0.98% and 0.98%, respectively.

The average farm size of the rice farmers was less than one hectare (0.97 hectare), which indicated that they are small-holder rice farmers. Majority (43.65%) of the farmers in the study area have a farm size between 0.6 hectare to 1 hectare. There is need for increment in the area of land used for rice farming in the study area. On the average, the rice farmers' household monthly income was ₦92,812.64, with about 66.12% having income less than ₦100,000 per month. With an average household size of 9 persons, it implies that majority of the rice farmers in the study area are low-income earners. The number of extension visit to the rice farmers in the study area was very poor, while 78.18% of the farmers do not have access to credit and 73.29% do not belong to any farmers association.

Table 1: Socio-economic characteristics of Rice farmers in the study area (n=307)

Variables	Frequency	Percentage (%)	Mean
Age			
Less than 25years	18	5.86	
25 - 34	85	27.69	
35 – 44	94	30.62	39
45 – 54	75	24.43	
55 and above	35	11.40	
Sex			
Male	301	98.05	

Female	6	1.95	
Marital Status			
Single	41	13.36	
Married	264	85.99	
Widow/Widowed	2	0.65	
Education Level			
Non formal education	2	0.65	
Informal/Adult education	3	0.98	
Qur'anic education	59	19.22	
Primary education	68	22.15	
Secondary education	119	38.76	
Tertiary education	56	18.24	
Household Size			
1 – 10	198	64.50	
11 – 20	92	29.97	9
21 – 30	17	5.54	
Years of Experirnce			
Less than 10 years	102	33.22	
10 – 19	120	39.09	19
20 – 29	58	18.89	
30 and above	27	8.79	
Primary Occupation			
Farming	278	90.55	
Trading	16	5.21	
Processing	7	2.28	
Mason	3	0.98	
Carpentry	3	0.98	
Farm Size			
0.1 - 0.5 ha	112	36.48	
0.6 - 1.0 ha	134	43.65	0.97
1.1 - 1.5 ha	16	5.21	
1.6 ha and above	45	14.66	
Household Monthly Income			
Less than 50,000	121	39.41	92,812.64
50,000 - 99,000	82	26.71	
100,000 - 149,000	43	14.01	
150,000 - 199,000	31	10.10	
200,000 and above	30	9.77	
Extension Visit			
No visit	129	42.02	
1 – 5	150	48.86	3
6 – 10	12	3.91	
Above 10	16	5.21	
Access to Credit			
Yes	67	21.82	
No	240	78.18	
Member of Association			
Yes	82	26.71	
No	225	73.29	
Total	**307**	**100**	

Source: Field Survey (2025)

4.2 Profitability of rice production in the study area

The results on cost and returns as stated in Table 2 indicated that on the average, the total variable cost per hectare of rice cultivated in the study area was ₦819,146.32 per hectare, constituting 95.42% of the total cost, out of which fertilizer application took 60.84% of the total variable cost. The total fixed cost estimated as depreciation of the fixed assets was ₦39,360.83 per hectare, constituting 4.58% of the total cost of production. This showed that in rice production in the study area, variable cost of production was dominant over fixed cost of production suggesting that rice production depends mainly on operational input than on capital assets. Therefore, the total cost was estimated as ₦858,507.15 per hectare. The findings here revealed that inorganic fertilizer used was one of the major farm inputs that consumed a larger part of the farmers' cost of production. This finding reflects the high dependence of rice farmers in the Northern part of Nigeria on inorganic fertilizer for nutrient supply. Abdullah et al. (2026) in Kaduna State, also reported similar results, that expenditure on fertilizer formed the largest cost item of the total variable costs.

Seed constitutes 11.37% of the total variable cost (₦93,135.33 per hectare), while pesticides and herbicides application consumed an average of ₦45,941.86 per hectare, which is 5.61% of the total variable cost. This is in agreement with the findings of Kaka et al. (2020) and Abdullah et al. (2026), who reported that cost of seed is one of the costs that consumes more money in rice production. Labour cost was 11.63% of the total variable cost constituting both hired and family labour. The higher cost of hired labour (₦85,839.30) underscores the labour-intensive nature of rice farming activities, particularly during planting, land preparation, weeding and harvesting, while the transportation cost constitutes only 4.62% (₦37,825.84 per hectare).

The average total revenue of ₦2,458,143.33 per hectare was generated from an output of 52 bags of 85Kg paddy rice. The estimated Net Farm Income was therefore ₦1,599,636.18 per hectare. This result indicated that rice farming is highly profitable in the study area. The high income generated suggest that rice production generated sufficient returns to cover the total production cost and the farmers were left with substantial returns. This finding implies that rice production is a viable venture and source of income for smallholder farmers in the study area and in Nigeria as a whole. This is significant for household welfare, livelihood and food security. This study is in congruent with the outcome of the work of Onubogu et al. (2026) and Anyasie et al. (2023) in Anambra State, who reported that there is profit in rice farming, which is economically viable despite fluctuations in input and sales prices. The operating ratio was 0.33, which implies that 33% of the total revenue is spent on variable cost, therefore leaving 67% as returns to fixed factors and profit and this is the value of the Gross Margin Ratio (GMR). An operating ratio less than one, indicated that there is an efficient cost management and profitability in the rice enterprise (Gaya et al., 2024). The returns per naira invested was estimated as ₦1.86. This implies that the rice production enterprise earns about ₦1.86 kobo for every one naira invested in the business. This positive return proposes that rice production in the study area contributes enormously to the income of the producers and has the potential to improve rural livelihood and food security. The benefit-cost ratio (BCR) of ₦2.86 implies that for every one naira invested in the rice production enterprise, rice farmers realized ₦2.86 in revenue, yielding a profit margin of ₦1.86. A BCR greater than one implies that the rice business is financially viable and profitable. The financial analysis results are in line with the findings of Abdullah et al. (2026) in Kaduna State and Onubogu et al. (2026) in Anambra State, who reported that rice production is highly profitable and a viable enterprise.

Table 2: Costs and Returns of the Farmers (₦/ha)

Production variable	Average quantity	Unit price (₦)	Average amount (₦)	Percentage contribution (%)
A. Variable cost				
Fertilizer (NPK)	170.20	1,240.23	211,087.15	25.77
Fertilizer (Urea)	158.61	1,811.11	287,260.16	35.07
Herbicide	5.29	5,483.35	29,006.92	3.54

Pesticide	2.89	5,859.84	16,934.94	2.07
Seed	70.99	1,311.95	93,135.33	11.37
Spray charges	13.52	1,354.86	18,317.71	2.24
Water charges	1ha	12,118.44	12,118.44	1.48
Hired Labour (man-days)	92.22	930.81	85,839.30	10.48
Family Labour (man-days)	51.44	182.76	9,401.17	1.15
Transportation	52	727.42	37,825.84	4.62
Commission	48	379.57	18,219.36	2.22
B. Total variable cost (TVC)			**819,146.32**	**95.42 of TC**
C. **Fixed cost**				
Depreciation costs on:				
Farm tools			3,571.36	9.07
Rent on land	1 ha	35,789.47	35,789.47	90.93
D. Total fixed cost (TFC)			**39,360.83**	**4.58 of TC**
E. Total cost (TC) = TVC + TFC =			**858,507.15**	
F. Total revenue (TR)	52bags	47, 271.99	**2,458,143.33**	
G. Gross Margin = TR – TVC			**1,638,997.01**	
G. **NFI = TR - TC =**			**1,599,636.18**	
Gross Margin Ratio (GMR)	0.67			
Operating Ratio (OR)	0.33			
Returns per naira invested	1.86			
Benefit-Cost Ratio (BCR)	2.86			

Source: Field survey (2025)

4.3 Cost and Returns

The results presented in Table 3, is the cost and returns estimates for 85Kg bag of paddy rice as operational in the study area. The farmers in the study area usually packaged their paddy rice in 85Kg bags based on the evidence from the data collected and observations during the data collection period. This results in Table 2 and the ones in Table 3 in terms of percentage contribution of variable cost and fixed cost are similar using an average estimated output of 52bags of 85Kg paddy rice from one hectare of the rice farm in the study area.

Total variable cost incurred in producing 85Kg bag of paddy rice was estimated to be ₦15,797.50, while the total cost stood at ₦16,554.44. With a total revenue of 47271.99, the net farm income realized from one bag of paddy rice in the study area is ₦30,717.55, implying that rice production in the study area is highly profitable and a worthwhile enterprise to venture into for income generation. This study agrees with the results reported by Bwala and John (2018), who opined that paddy rice production in Niger State generated positive net returns, signifying that rice farming contributed significantly to household income and poverty reduction among rural farmers.

Table 3: Costs and Returns of the Farmers per 85kg bag of Paddy Rice

Production variable	Average quantity	Unit price (₦)	Average amount (₦)	Percentage contribution (%)
A. Variable cost				
Fertilizer (NPK)	3.27	1240.23	4,055.55	25.67
Fertilizer (Urea)	3.05	1811.11	5,523.89	34.97
Herbicide	0.10	5483.35	548.34	3.47
Pesticide	0.06	5859.84	351.59	2.23
Seed	1.37	1311.95	1,797.37	11.38
Spray charges	0.26	1354.86	352.26	2.23
Water charges/Bag	1	233.05	233.05	1.48
Hired Labour (man-days)	1.77	930.81	1,647.53	10.43
Family Labour (man-days)	0.99	182.76	180.93	1.15
Transportation/Bag	1	727.42	727.42	4.61
Commission/Bag	1	379.57	379.57	2.40
B. Total variable cost (TVC)			**15,797.50**	**95.43 of TC**
C. Fixed cost				
Depreciation costs on:				
Farm tools			68.68	9.07
Rent on land	0.02 ha	688.26	688.26	90.93
D. Total fixed cost (TFC)			**756.94**	**4.57 of TC**
E. Total cost (TC) = TVC + TFC =			**16,554.44**	
F. Total revenue (TR)	1	47, 271.99	**47, 271.99**	
G. NFI = TR-TC =			**30,717.55**	

Source: Field survey (2025)

4.4 Constraints faced by the rice farmers in their production activities

Table 4 shows the constraints facing rice farmers in the study area. The major constraints facing the farmers included high cost of fertilizer (98.05%), low pricing of the rice paddy in the market (91.21%), poor rice marketing system (90.88%), inadequate credit/finance (85.34%), the Results from Table 1 indicated that only 21.82% of the farmers had access to credit, which confirms this problem as a constraint facing the rice farmer in the study area. Farm production cannot be carried out without finances, as input cost is now on the high side, and poor access to modern rice processing techniques (79.15%) among others, as mentioned by the rice farmers in the study area. This result is in congruent with the findings of Abdullah, et al. (2026) and Onubogu et al. (2026), who opined that inadequate capital, problem of farm inputs, high cost of fertilizer and inputs and inadequate processing facilities, among others, are some of the constraints bedeviling rice production.

Table 4: Constraints facing the Rice Farmers (n=307)

S/No	Variables	**Frequency	Percentages (%)
1	Regular Flooding	65	21.17
2	Pest and diseases outbreak	187	60.91
3	Poor road network	200	65.15
4	High cost of fertilizer	301	98.05
5	Inadequate credit/finance	262	85.34

6	Inadequate fertilizer supply	221	71.99
7	low price of the rice paddy in the market	280	91.21
8	Inadequate extension services	185	60.26
9	Poor access to modern rice processing techniques	243	79.15
10	Low quality rice seeds	164	53.42
11	Theft of farm produce	135	43.97
12	Shortage of irrigation water	154	50.16
13	Lack of stable government policies on rice	254	82.74
14	Poor rice marketing system	279	90.88

**Multiple Responses allowed
Source: Field Survey (2025)

5.0 Conclusion and Recommendations

5.1 Conclusion

This study concludes that rice production in the study area was dominated by young farmers who are in their active age, married and predominant male. The enterprise is a viable venture with moderate return on investment. This showed that rice production as a business is profitable and a viable source of livelihood that can be relied upon as a relatively income source.

5.2 Recommendations

Therefore, to boost productivity and increase income, the following recommendation were suggested:

i. Policy makers in Nigeria should provide fertilizer for the rice farmers at a subsidized rate to ease the burden of the high cost of fertilizer and thereby boosting the magnitude of rice production. If input cost like cost of fertilizer is reduced, more farmers will be encouraged to go into rice production and also, the existing rice farmers will likely increase the area of land used for rice cultivation.
ii. Based on the high net farm income generated from rice production in the study area, it was recommended that stake holders in the agricultural sectors should enlighten, educate and encourage farmers to go into rice production, by providing necessary resources needed for such. This will boost food production in the study area and Nigeria at large.

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References

Abdullah, A. S. Adamu, M. B., Magaji, A. A., Suleiman S. & Rabiu, N. (2026). Comparative Analysis of Profitability of participating and non-participating rainfed rice farmers in the Anchor borrowers' programme in selected LGAs of Kaduna State, Nigeria. *FUDMA journal of sciences (FJS).* 10 (4), 167–173. *DOI: https://doi.org/10.33003/fjs-2026-1004-4628*

Abdulwaheed, A., Opadotun, O.O., & Amusat, M.A. (2017). Rice self-sufficiency: A Review of government policies on rice production. *International Journal of Scientific and Engineering Research, 8*(2), 1289-1302.

Adekunle A.O. (2022). Rice farmers' Awareness and Perception of Climate Change in Ondo State, Nigeria. *European Journal of Agriculturre and Food Sciences*, 4(1), 81 – 85. https://doi.org/10.24018/ejfood.2022.4.1.355

Akınsola, G. O., Osasona, K. K., Bello, M. A., & Bello, W. O. (2025). Does Rice Importation Affect Production? Evidence from Nigeria. *Tekirdağ Ziraat Fakültesi Dergisi*, 22(2): 319-328.

Alabi, O.O., Bayei, J.D., Aluwong, J.S., Samson, Olumuyiwa S.A, & Ojokojo P.P. (2023). Profitability Analysis of Upland Rice Production Among Resource Poor Farmers in Kaduna State, Nigeria: A Stochastic Profit Efficiency Frontier Approach. *Agribusiness Management in Developing Nations, 1(2): 53-58.*

Andrade, J. F., Cassman, K. G., Rattalino Edreira, J. I., Agus, F., Bala, A., Deng, N., & Grassini, P. (2022). Impact of urbanization trends on production of key staple crops. *Ambio*, 51(5): 1158-1167.

Anyasie, I. C., Nwigwe, A. C. & Umebali, E. E. (2023). Comparative analysis of the profitability of rice seed and grain production enterprise among smallholder farmers in Anambra State, Nigeria. *International Journal of Science and Technology Research Archive*, 5(1): 35–49.

Arouna, A., Mottaleb, K. A., Parkhi, C. M. & Diagne, A. (2021). Adoption of improved rice varieties and its impact on household welfare in sub-Saharan Africa. *Food Security*, 13(5): 1127–1143.

Bwala, M. A. & John, A. U. (2018). Profitability analysis of paddy production: A case of Agricultural Zone I, Niger State, Nigeria. *Journal of the Bangladesh Agricultural University*, 16(1): 88–92.

Ekott, N. (2025, August, 15). SPECIAL REPORT: Despite huge investments, Nigeria's rice production can't meet local consumption. https://www.premiumtimesng.com/news/top-news/814300-special-report-despite-huge-investments-nigerias-rice-production-cant-meet-local-consumption.html

Emmanuel, F. E., & Gbigbi, T. M. (2024). Barriers and enablers: a study on the determinants of local rice consumption among households in Delta State, Nigeria. *African Journal of Agriculture and Food Science,* 7(4): 343-363. doi: 10.52589/AJAFS-NOYNLB9S

FAO. (2023). Promoting mechanization and post-harvest technologies in rice value chains. Rome: Food and Agriculture Organization of the United Nations.

FAO (2025). Food and Agriculture Organization Statistics. https://www.fao.org/faostat/en/#data

Gaya, H. I. M., Zongoma, B., Solomon, P. J., & Hassan, B. K. (2024). Profitability Analysis of Rice Milling and Marketing in Bauchi State, Nigeria. *Journal of Agripreneurship and Sustainable Development*, 7(2): 10-18.

Goni, A. A., Oladimeji, Y. U., Mani, J. R. & Isah, A. S. (2023). Do cluster farming practices improve profitability and productivity indices of smallholder rice farmers? Evidence from Borno State, Nigeria. *Agricultural Socio-Economics Journal*, 23(2): 221–230.

International Rice Research Institute (IRRI). (2023). Rice sector development report for sub-Saharan Africa. Los Baños, Philippines.

Ivom, G. A., Ochimana, G. A., Mando, l. & Ejembi, I. (2026). Profit analysis of rice (*Oryza sativa* L.) Farming business among smallholder farmers in Northwest Agricultural zone of Benue State, Nigeria. *Nigerian Journal of Agriculture and Agricultural Technology (NJAAT).* (2b), 299 – 310.

Kaka, Y., Gindi, A. A. & Khalid, A. B. (2020). Towards Rice Self-sufficiency in Nigeria: An Analysis of Technical Efficiency of Irrigated Rice Farms in Kebbi State, *Direct Research Journal of Agriculture and Food Science*, 8(4):103-110.

KNSG (2019). Kano State Government Official Diary, Directorate of Information, Kano, Nigeria.

Mottaleb, K. A., Arouna, A., Wirajanti, N. I. & Rahut, D. B. (2021). Economic and productivity effects of modern rice technologies among smallholder farmers in Africa. *Agricultural Systems*, 193: 103221.

National Bureau of Statistics (NBS) (2024). Selected food price watch report. Abuja, Nigeria.

National Population Commission [NPC] (2016). National Population Commission Retrieve from www.population.gov.ng/index.php/ Censuses.

Natural Resources and Potential for Development [NRPD] (2013). Kano state: Natural resources and potential for development 1998-2013.

Ogunleke, A. O., Olawuyi, S. O., & Adeyemo, T. A. (2024). The food security drive and the preference for local rice consumption among households in south-west Nigeria. *NURTURE: Journal of Pakistan Home Economics Association*, 18(4).

Olofin, E. A. (2008). The physical setting. In E. A. Olofin, A. B. Nabegu, & A. M. Dambazau (Eds.), *Wudil within Kano Region: A geographical synthesis*, 5–34. Adamu Joji Publishers.

Onubogu, O. H., Adaigho, D. O., John-Adindu, U. A., & Osegbue, E. G. (2026). Analysis of Rice Production in Anambra State Nigeria; *the Costs, Return, and Constraints*. *Cross Current International Journal of Agriculture and Veterinary Sciences, 8*(4), 92-99. https://doi.org/10.36344/ccijavs.2026.v08i04.002

Onyeneke, R. U., Emenekwe, C. C., Amadi, M. U., Munonye, J. O., Njoku, C. L., & Izuogu, C. U. (2020). Demand analysis of rice in Nigeria: application of quadratic almost ideal demand system model. *Asian Journal of Agriculture and Rural Development*, 10(1): 364-377.

Stephen, K. (2020). The quality of Nigerian home-grown rice. The conversation Trust. https://theconversation.com

United States Department of Agriculture, Foreign Agricultural Service (2018): World Agricultural Production. Circular Series, 4-18.

World Bank. (2024). Nigeria development update: Building resilience through agricultural transformation. Washington, DC: World Bank.

Wudil, A. H., Ali, A., Aderinoye-Abdulwahab, S., Raza, H. A., Mehmood, H. Z., & Sannoh, A. B. (2023). Determinants of food security in Nigeria: empirical evidence from beneficiaries and non-beneficiaries rice farmers of the Kano River Irrigation Project. *Frontiers in Sustainable Food Systems*, 7: 921-932.

Yamane, T., (1967). Elementary Sampling Theory, Volume 1: pp. 371 – 390, Englewood Cliff: Prentice Inc.