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AN ECONOMIC ANALYSIS OF RICE PRODUCTION IN TARABA STATE, NIGERIA

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ABSTRACT

This study analysed an economics of rice production in Taraba State, Nigeria. The objectives include describing farmers' socio-economic characteristics, rice production profitability and the constraints faced by rice farmers. Primary data were collected from 390 rice farmers using a multistage sampling technique with the aid of questionnaire. Descriptive statistics and the farm budgeting technique were used for data analysis. Results showed that the average farmer was 45 years old, predominantly male (84.36%), and majorly married (76.15%), with an average household size of five (5), cultivating an average farm size of 2.43 hectare and 11 years of farming experience. While 61.28% had formal education, the majority were not cooperative members (69.23%) and lacked access to extension services (87.69%). Profitability analysis revealed that rice farming was profitable. The average total cost per hectare was ₦607,800, with variable costs making up 81.48% of this amount. The net farm income (NFI) was estimated at ₦182,700.60 per hectare, while the return on investment (ROI) and gross ratio (GR) were ₦0.30 and ₦1.30, respectively. Major constraints include limited credit access, poor road infrastructure, high transportation costs, and expensive fertiliser. The study recommends that there should be collaboration between policymakers and financial institutions for the promotion of accessible credit schemes for rice farmers. It is also essential for governments to prioritise the development and maintenance of rural road networks to minimise transportation costs and enhance market access, as well as to implement targeted subsidies for essential inputs to reduce production costs and improve profitability for small farmers.

Keywords: Economic; Analysis; Rice; Production; Profitability; Taraba

INTRODUCTION

Rice (*Oryza sativa L*) is a significant and vital cereal crop, widely cultivated and consumed by a substantial portion of the global population (Abdelsalam *et al.,* 2025). In 2024, it was estimated to rank as the third most produced grain globally, with an output of 532.87 million metric tonnes, trailing maize at 1.2 billion metric tonnes and wheat at 793.24 million metric tonnes (Hossain *et al.,* 2025). Rice serves as a fundamental dietary component in numerous African nations (Sackey *et al.,* 2025). It is a significant grain cultivated in several regions of Africa, and its prominence is constantly increasing due to its extensive consumption, especially in Nigeria. Nigeria presently dominates rice production in West Africa (Opaluwa *et al.,* 2025).

Rice cultivation in Taraba State faces several constraints that hinder productivity. Banseka *et al. (*2023*)* identified various constraints, such as inadequate capital, pest and disease infestations, inadequate supply of quality seeds, ineffective delivery of extension services, and land fragmentation. Moreover, restricted access to credit and technological inefficiency intensifies these constraints. Aboki *et al.* (2020) indicated that rice producers in Southern Taraba State face significant technological inefficiencies, hindering their ability to achieve optimal production levels. Additionally, small-scale rice farmers face challenges related to inadequate and inefficient labour, land tenure systems, and insufficient capital, finance, and credit facilities (Nkwabi *et al.,* 2021). The broad objective of the study was to analyse profitability and constraints of rice farmers in Taraba State, Nigeria, while the specific objectives of the study were to describe the socio-economic characteristics of the respondents in the study area, determine the profitability of rice production in the area, and identify the constraints faced by rice farmers in the study area.

MATERIALS AND METHODS

The Study Area

The study was carried out in Taraba State, Nigeria, located in the northeastern region, positioned between longitudes 9°30'E and 11°45'E and latitudes 6°25'N and 9°30'N. The state is bordered by Bauchi, Gombe, Adamawa, Republic of Cameroon, Nasarawa, Plateau and Benue states. It has a population of 4,262,566, according to the National Population Commission (NPC, 2024), with a projected annual growth rate of 3.5%. The maximum temperature reaches 42°C and the minimum temperature reaches approximately 18°C accompanied by a relative humidity of 13% during January and February (Asa and Zemba, 2025).

The state encompasses a land area of 54,473 km² (Akeyede & Usman, 2025). The state comprises sixteen (16) local government areas and two special development areas, specifically Yangtu and Ngada. The classification of Taraba State consists of four Agricultural Development Programme Zones: Zone I, Zone II, Zone III and Zone IV (TADP, 2024). The state is primarily agrarian, with approximately 80% of its population reliant on subsistence agriculture. The area's climate, soil, and hydrology support the cultivation of food crops such as maize, rice, millet, and groundnut, as well as animal grazing, freshwater fishing, and forestry. (Oruonye *et al.,* 2024).

Sampling Technique

The respondents were selected using a multi-stage sampling technique. Taraba State comprises four agricultural zones, as delineated by the State Agricultural Development Programme (TADP). Three agricultural zones were purposively selected based on their substantial contribution to rice production: Zone I (comprising Ardo-kola, Jalingo, Karim-Lamido, Lau,

Yorro, and Zing), Zone II (Gassol, Ibi, and Wukari), and Zone III (Bali, Donga, Kurmi, Gashaka, Ussa, and Takum).
In the first stage, a list of all blocks within each selected zone was compiled. Blocks were selected from each zone through simple random sampling, with the number of blocks chosen from each zone being proportional to the total number of blocks within that zone. Three cells were selected from each block randomly. In the final stage, a comprehensive list of rice farmers in the selected cells was obtained from TADP (15,807). A total of 390 rice farmers were randomly selected from 27 farming cells, proportionate to the size of the farmers' population in each cell, using the Yamane (1967) formula as applied by Usman *et al.* (2025).

Sample Size
This study determined its sample size for rice-based farmers in Taraba State using the formula for estimating sample size established by Yamane (1967) as used by Reuben *et al.* (2024) is defined as follows:

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where n = sample size, N= total population, and e= level of precision.
The total sample size of rice farmers in the selected LGAs was calculated to be N=15807, with a margin of error (e) of 0.05, corresponding to a 95% confidence interval.
Thus $n = \frac{15807}{1+15807(0.05)^2} = 390$.
The sample size for each of the three selected Agricultural Zones in the State was established according to the relative concentration of rice-based farmers in those zones. In Zone I, the calculation yields $n=\frac{6474}{15807} \times 390 = 160$. In Zone II, n is calculated as II $n = \frac{4550}{15807} \times 390 = 112$. In Zone III, $n=\frac{4783}{15807} \times 390 = 112$.
The total sample size was 390.

Sources and Methods of Data Collection
Data for this study was obtained from both primary and secondary sources. Primary data was collected with the aid of a questionnaire and interview schedules while secondary data was obtained from journals, text books and government publications.

Methods of Data Analysis
The study's objectives were addressed using descriptive statistics. Tables, frequency counts, means, percentages, and standard deviations, were used to analyse objectives i and iii, which pertain to socio-economic characteristics and constraints. Budgeting techniques, specifically Net Farm Income (NFI) analysis, were employed to determine objective ii.

Model Specification
Budgeting Techniques
The farm budgeting technique was employed, specifically the Net Farm Income (NFI), to evaluate the profitability of rice production.

Net Farm Income Analysis
Net farm income analysis was conducted to determine the cost and return structure of rice farms, as well as to assess the profitability of rice farmers, which is the objective ii. Microsoft Excel was used to compute the net farm income and the profitability ratios.
The Model Specification for the Net farm income and profitability ratios was in accordance with Olukosi and Erhabor (1988) as used by Alabi (2025).
The net farm income is stated as follows:

$$NFI = \sum_{i=1}^{n} Pi\ Qi - \left[\sum_{j=1}^{m} PjXj + \sum_{k=1}^{k} GK\right] \quad (2)$$

Where:
NFI = Net Farm Income (N) per hectare
Pi = Price of Rice (N/Kg),
Qi = Quantity of Rice (Kg),
Pj = Price of Variable Inputs (N/$Unit$),
Xj = Quantity of Variable Inputs (kg),
GK = Cost of all Fixed Inputs (N)
The fixed costs were rent charges on land and depreciation on fixed costs and were calculated using the straight-line method:

$$\text{Depreciation} = \frac{P-S}{N} \quad (3)$$

Where:
P = Purchase Price
S = Salvage Value
N = Number of years of the assets
The total variable costs (TVC) include all cost of inputs such as seed, labour, fertilizer, herbicides and insecticides.

Profitability Ratios
Profitability Ratios such as operating ratio (OR), rate of return on variable cost (RRVC) and rate of return on naira invested (RNI) were computed as follows:

$$OR = \frac{Total\ variable\ cost}{Total\ Revenue} \quad (4)$$

$$GR = \frac{Total\ Revenue}{Total\ Cost} \quad (5)$$

$$RNI = \frac{Net\ Farm\ Income}{Total\ Cost} \times \frac{100}{1} \quad (6)$$

RESULTS AND DISCUSSION
Socio-economic Characteristics of Farmers in the Study Area
Table 1 indicates that the mean age of rice farmers was 45 years, with the youngest farmer at 22 years and the oldest at 76 years. The distribution indicates that rice farming in the study area was primarily conducted by middle-aged farmers, who are in their economically active and physically productive years. This corroborates with the work of David *et al.* (2025) on their study of determinants of risk management strategies and household income sources among rice farmers in Kebbi and Ebonyi States, Nigeria, that rice production in the two states were predominantly embraced by middle-aged farmers, with mean ages of 43 and 42, respectively.

Table 1: Socio-economic Characteristics of Farmers

Variable	Mean	Minimum	Maximum	Std. Deviation
Age	45	22	76	11.50
Household Size	5	1	16	3.81
Farming Experience	11	1	40	7
Farm Size	2.43	0.6	5.5	0.89

Source: Field Survey, 2025

The average household size was 5 individuals, as contained in Table 1, with values observed between 1 and 16 members. A household size of five indicates a moderately sized family unit, beneficial in smallholder agricultural contexts. A moderate household size guarantees adequate family labour to support production activities, particularly in areas where mechanisation is either lacking or in the initial phases of implementation. This aligns with the findings of Kolawole *et al.* (2025) in their study that an average household size of 5 individuals reflects the common extended family model in rural Nigeria, providing a labour pool for farming activities. Similar, they pointed out that household size influences labour availability and food security in subsistence farming practices. Farming experience was identified as a significant characteristic, with rice farmers possessing an average of 11 years of experience. The least experienced farmer had one year of involvement, whereas the most experienced had 40 years in rice farming, and the deviation from the mean was 7 years. This result supports the findings of Egbodion *et al.* (2024) regarding the factors influencing technical efficiency among small-scale rice farmers in the Edo North Ecological Zone, Nigeria, who reported an average farming experience of 12 years.

The analysis indicates that the mean farm size among rice farmers in the study area was 2.43 hectares, with the minimum farm measured at 0.6 hectares and the maximum measured at 5.5 hectares with standard deviation of 0.89 hectares. This observation coincides with the findings of Egbodion *et al.* (2024) regarding the determinants of technical efficiency among small-scale rice farmers in the Edo North Ecological Zone, Nigeria, were they reported a mean farm size of 2.9 hectares. Table 2 presents a detailed analysis of the gender composition among rice farmers in the study area. The findings indicates that 84.36% of the sampled farmers were male, whereas 15.64% were female. The result was consistent with studies conducted by Odoemenem (2018), who reported that 65% and 59.4% of rice farmers in the Southern Region of Cross River and Ebonyi State, Nigeria, were predominantly male in rice production, respectively.

Table 2: Socio-Economic Characteristics of Respondents

Variable	Frequency	Percentage (N=390)
Gender		
Male	329	84.36
Female	61	15.64
Marital Status		
Married	297	76.15
Single	93	23.85
Educational Level		
Never been to school	151	38.72
Primary	129	33.08
Secondary	100	25.64
Diploma/NCE	9	2.31
Degree	1	0.26
Membership of Association		
No	270	69.23
Yes	120	30.77
Access to Credit		
No	293	75.13
Yes	97	24.87
Extension Contact		
No	342	87.69
Yes	48	12.31
Mode of land acquisition		
Inheritance	201	51.54
Purchase	104	26.67
Lease	83	21.28
Gift	2	0.51
Total	390	100

Source: Field Survey, 2025

Table 2 reveals that 76.15% of the surveyed rice farmers were married, whereas 23.85% were single. The distribution indicates that married individuals were predominant in rice farming within the study area, while unmarried individuals were under-represented. A possible explanation for this pattern is that many single farmers were relatively young and often still enrolled in school or pursuing vocational training and therefore not yet fully engaged in farming. This agrees with the findings of Sani *et al.* (2023) that most (91.7%) rice farmers in Dadinkowa irrigation scheme area of Gombe and Borno States were married with just 8.3 % single. The study's findings regarding the educational levels of rice farmers in the area indicate that 38.72% lacked formal education; 33.08% completed primary school; 25.64% attained secondary school education; and merely 2.31% possessed post-secondary qualifications, including a diploma, NCE, or degree. Consequently, a significant proportion (61.28%) had attained a minimum level of formal education. This agrees with the findings of Obiora *et al.* (2024) that most rice farmers in Nigeria had completed primary (30.7%) and secondary (49.49%) school education while 13.4% had completed tertiary education. Table 2 also indicates that majority, 69.23%, of rice farmers in the study area lack affiliation with any farmers' association. The elevated non-affiliation rate indicates that a substantial number of farmers were potentially forgoing various benefits commonly associated with cooperatives. The finding is consistent with the work of Mahmud (2024), who reported that about 90% of rice farmers in Patigi LGA of Kwara State, Nigeria, were not affiliated with any cooperative society.

The result in Table 1.2 shows that approximately 75.13% of rice farmers in the study area lack access to credit, while only 24.87% had access. Credit access or its absence plays a pivotal role in determining a farmer's ability to procure inputs, adopt improved technologies and optimise resource use. In Akwa Ibom State, Edet *et al.* (2019), in their study conducted on the effect of microcredit on the technical efficiency of smallholder rice farmers in the Ikot Ekpene Agricultural Zone, Akwa Ibom State, showed that credit access significantly improved technical efficiency among smallholder rice farmers. The data presented in Table 1.2 reveals that 87.69% of rice farmers in the study area reported no interaction with extension agents. The lack of advisory support likely impedes the adoption of modern rice production techniques, which are essential for enhancing profitability. This finding contradicts the study conducted in southwestern Nigeria, where Ojo *et al.* (2020) indicated that around 53% of farmers had access to extension services. The observed discrepancy indicates regional variations in extension outreach, likely attributable to differences in resource allocation, institutional presence or infrastructural limitations. This study also reveals that 51.54% of rice farmers obtained their land via inheritance, highlighting the persistent influence of customary land tenure systems in the area. This finding is consistent with the work of Oyebanjo (2023) reported that food crop farmers in Ogun State encountered considerable productivity constraints when working on fragmented inherited parcels, in contrast to those with consolidated or rented land.

Costs and Returns of Rice Production in Taraba State

The analysis of costs and returns for rice farming in the study area, as presented in Table 3, reveals a total production cost per hectare of ₦607,800. This includes total variable costs (TVC) of ₦495,233.90 and total fixed costs (TFC) of ₦112,511.60. Variable costs accounted for approximately 81.48% of the total costs, indicating a significant dependence on inputs that directly correlate with production, including seeds, fertilisers, agrochemicals, labour and operational expenses.

Table 3: Average Costs and Return of Rice Production in the Study Area

Variable	Cost Per Hectare (₦)	Percent (%)
Variable Costs		
Seeds	66,504	10.94
Fertilizer	119,517	19.67
Agrochemicals	13,541	2.23
Labour	153,509	25.26
Bags/Bagging	41,977	6.91
Machinery	63,204	10.40
Transportation	36,982	6.09
Total Variable Cost (TVC)	495,233.90	81.48
Fixed Cost		
Depreciation on machinery	56,256	9.26
Land	24,502	4.03
Farm tools & Equipment	16,887	2.78
Storage Facilities	14,867	2.45
Total Fixed Cost (TFC)	112,511.60	18.52
Total Cost (TC)	607,745.40	100
Revenue		
Yield	2,080Kg	
Cost	380/Kg	
Total Revenue (TR)	790,446.10	
Net Farm Income (TR-TC)	182,700.60	
Return On Investment (NFI/TC)	0.30	
Operation Ratio (TVC/TR)	0.63	
Fixed Ratio (TFC/TR)	0.14	
Gross Ratio (TR/TC)	1.30	

Source: Field survey, 2025

This cost structure is consistent with broader findings in the context of rice farming in Nigeria. In Niger State, Ojumu *et al.* (2024) found that variable costs represented approximately 65% of the total production costs, with labour comprising the largest portion of these variable expenses, succeeded by seed, fertiliser, transportation, herbicide, pesticide and bagging costs. The study indicated a gross margin of N101,400 and a net farm profit of N98,546 per hectare, highlighting significant profitability despite the considerable burden of variable costs. In Plateau State, Keghter *et al.* (2024) found that farmers incurred operating expenses amounting to ₦139,733 per hectare, with total revenue of ₦199,215. The gross margin of ₦70,932 and net farm income of ₦59,482 translated to a return on investment of 0.42, meaning that for every naira spent, a return of forty-two kobo was yielded.

On the other hand, fixed costs, which amounted to ₦112,511.60, represented only 18.51% of the total production cost. These include expenses that remain constant regardless of the production scale, such as the rental value of land and the depreciation of farm equipment. Among the fixed costs, the cost of land alone accounted for 9.03% of the total fixed costs. This highlights the relative expense of land as a production input in the study area, reflecting either high land rental rates or limited access to affordable farmland. Moreover, the reliance on costly labour as the dominant variable input highlights the need for policies that promote labour-saving technologies, such as mechanised farming

tools, to enhance productivity and reduce production costs. This is in line with the work of Opaluwa *et al.* (2023) in Kogi State, Nigeria.

Profitability Indicators

A return on investment (ROI) of 0.30 indicates that for each naira invested in rice production within the study area, the farmer receives a net return of 30 kobo. This modest return, although positive, points out narrow profitability margins. Recent studies support this pattern. A profitability analysis in Plateau State indicated an ROI of 0.42, signifying that farmer earned 42 kobo for every naira invested (Keghter *et al.*, 2023). In Niger State, Ojumu *et al.* (2024) identified cost structures that produced modest margins, highlighting the sensitivity of profitability to input costs. An operating ratio of 0.63 signifies that 63% of total revenue was allocated to variable costs, including seeds, fertilisers, agrochemicals, labour and transportation. Thus, 37% of revenue remains available to address fixed costs and yield profit. According to the study by Oyedepo & Adekanmbi (2019) on Ofada rice production in Ogun State, an operating ratio of 0.80 was indicated, suggesting that variable costs accounted for 80% of revenue, thereby limiting the capacity for fixed costs and profit.

A fixed ratio of 0.14 indicates that fixed costs, including land rent, equipment depreciation and other overheads, account for 14% of total revenue. This represents a moderate burden, indicating that resource allocation for fixed inputs was feasible. The low fixed cost burden observed in this study may be attributed to inherited land use or ownership of agricultural tools, which diminishes rental or depreciation costs. This outcome is in agreement with the study conducted by Opaluwa *et al.* 2023. The gross ratio of 1.30 indicates that total revenue is 1.3 times the total production cost, signifying overall profitability. Farmers receive a return of ₦1.30 for each naira expended. This is consistent with profitability findings in Nigerian rice systems. Abdullahi *et al.* (2022) reported a return on investment of 1.26, a gross ratio of 0.46 and an operating ratio of 0.44 in north-central Nigeria, indicating that rice production can be profitable with efficient management. Despite a lower gross ratio, it confirms that rain-fed rice farming generates positive returns within the existing cost structures.

Constraints Faced by Rainfed Rice Farmers

The constraints related to rice production in the study area, as outlined in Table 4, elucidate the challenges that impede the productivity and profitability of rice farming. Limited access to credit, which was found to be the main problem, affects 75.2% of the farmers who were surveyed. The findings suggest that most rice farmers in the study area operates at a subsistence level and lack adequate access to credit facilities necessary for supporting and expanding their operations. This agrees with the findings of Hart and Pimentel (2017) who emphasised that credit constraints significantly adversely affect farmers' investment choices, productivity and ability to expand their operations.

Table 4: Constraints Faced by Rice Farmers in the Study Area

S/N	Constraints	Frequency	Percentages	Rank
1.	Inadequate access to credit	286	73.33	1st
2.	Poor road network	257	65.90	2nd
3.	Expensive fertilizer	249	63.85	3rd
4.	High transportation costs	248	63.59	4th
5.	High cost of herbicide	246	63.08	5th
6.	Insufficient extension services	245	62.82	6th
7.	High seed costs	185	47.44	7th
8.	Weed management issue	179	45.90	8th
9.	Insufficient improved seed	162	41.54	9th
10	Inadequate labour supply	116	29.74	10th

Source: Field Survey, 2025.

Poor road infrastructure was identified as the second most significant constraint, with a prevalence of 69.4%. Insufficient road networks and the associated high transportation expenses (65.7%) present significant challenges for farmers. Infrastructural deficiencies represent significant bottlenecks to agricultural development in Nigeria, disrupting the distribution of inputs and outputs while diminishing farmers' competitiveness within the value chain. This finding agrees with the result of Obinna *et al.*, 2025, on the analysis of the different stages of post-harvest loss suffered by rice farmers in Anambra and Ebonyi State, Nigeria. High fertiliser cost was identified as the fourth major constraint, with 63.9% of farmers recognising it as a significant challenge. The result is consistent with the work of Saleh *et al.*, 2024, on the study of constraints to effective participation in small-scale dry-season rice production by rural farmers of Gombe State, Nigeria. The high cost of chemicals constitutes the fifth most significant issue, affecting 63% of farmers in the study area. The chemicals were essential for pest management and weed control; however, their elevated costs contribute to increased production expenses for farmers, thereby diminishing their capacity to attain optimal yields. The findings support observations made by Wessel and Quist-Wessel (2015), highlighting the substantial effect of high input costs on the productivity and profitability of rice farmers.

CONCLUSION

This study identifies key characteristics and challenges encountered by rice farmers in the study area. The average rice farmer is middle-aged, largely male, and married, with a moderate household size and considerable farming experience. Although a majority of farmers possess formal education, most do not participate in agricultural cooperatives and lack access to extension services, which may restrict their access to modern farming techniques and support systems. Despite these challenges, rice farming continues to be a profitable enterprise, yielding a positive net farm income and a return on investment. Profitability is limited by elevated production costs, especially variable costs, along with enduring structural barriers, including restricted credit access, inadequate road infrastructure, high transportation expenses and costly inputs such as fertiliser. This study recommends that collaboration between policymakers and financial institutions is essential for the promotion of accessible credit schemes and subsidies inputs specifically designed for rice

farmers and it is also essential for governments and local authorities to prioritise the development and maintenance of rural road networks to minimise transportation costs and enhance market access for rice farmers.

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