



**PROFITABILITY OF SMALL- SCALE RICE PROCESSING IN KUMBOTSO LOCAL GOVERNMENT AREA OF KANO STATE, NIGERIA**

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**ABSTRACT**

The study examined the cost structure, returns, and profitability of small-scale rice processing in Kumbotso Local Government Area of Kano State, Nigeria. Primary data were collected from 90 small-scale rice processors using structured questionnaires and analyzed using descriptive statistics and farm budgeting techniques. The results revealed that rice processing in the study area is predominantly male-dominated (88.89%), with processors having an average age of 34 years and an average household size of eight members. Most (66.67%) processors possessed at least basic formal education and had an average processing experience of eight years, with mean monthly income of ₦196,667. The cost and returns analysis showed that the total cost of rice processing was ₦1,732,809 per month, with total variable cost accounting for 94.84% and total fixed cost representing 5.16% of the total cost. The purchase of paddy rice constituted the largest share of the total processing cost (63.48%), followed by processing charges (27.93%). The total revenue generated from 44 bags (100 kg bags) was ₦2,098,500, with a net processing income of ₦365,691 per month, a return on investment of 0.21, an operating ratio of 0.78 and a **benefit–cost ratio of 1.21**. Critical constraints to rice processing enterprise include poor transportation networks (97.8%), inadequate storage facilities (96.7%), unreliable power supply (94.4%), inadequate capital (93.3%), limited technical knowledge and skills (85.6%), and reliance on outdated processing equipment (81.1%). Our research highlights the important role of small-scale rice processing as a profitable business that helps generate income and improve rural livelihoods. Accordingly, improving rural infrastructure, expanding access to affordable credit, modernising storage systems, and carrying out targeted capacity-building initiatives should be the pivot of policy interventions. In this way, the efficiency and long-term sustainability of rice processing enterprises in the study area will be improved.

**Keywords:** Rice, Processing, Small-scale, Enterprises, Cost, Return

**INTRODUCTION**

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).

To address the supply shortfall and increase domestic production, the Nigerian government has in the past rolled out several initiatives including the Agricultural Transformation Agenda, the Anchor Borrowers' Programme, and border protection measures. In addition to enhancing paddy production,



these initiatives seek to strengthen processing and value addition as a means of attaining food self-sufficiency, job creation, and poverty alleviation. However, much of the efforts in the past has narrowed on improving farm-level output, with less attention paid to the economic position and competitiveness of small-scale rice processors who are crucial in the rice value chain.

As a post-harvest activity, processing of rice involves turning paddy into milled rice by using operations like cleaning, soaking, steaming, parboiling, drying, milling, destoning, polishing, grading, sorting and packaging (Umoh, 2025). In Nigeria, rice processing is often carried out by low-income small-scale firms characterised by relatively limited capital base and rely on simple equipment (Alabi *et al.*, 2025; Mohammed & Aliyu, 2025). Rice processors are a link between farmers and consumers, providing access to market and value addition that improves the final product in terms of both acceptability and longer shelf life. Rice processing has become an important activity in northern Nigeria, especially in Kano State, due to the emergence of rice processing clusters driven by a growing regional demand. Kumbotso Local Government Area in Kano State is a key industrial hub for small-scale rice milling and parboiling enterprises, leveraging on its closeness to major markets, transportation networks, and paddy-producing communities.

Despite their critical role, small-scale rice processors, are constrained by high costs of purchasing paddy, difficulty in accessing credit, inadequate storage and drying facilities, unreliable power supply, outdated milling technologies, and poor and volatile output prices amongst others (Mahmud, 2024; Alabi *et al.*, 2025; Mohammed & Aliyu, 2025). Accordingly, this affects the cost structures, profitability margins, and long-term sustainability of these enterprises. Hence, examining the costs of these enterprises and the returns they provide has huge implications for policy designs that enhance the competitiveness of the domestic rice value chain.

A few previous studies from various rice-producing areas in Nigeria highlighted that small-scale processing can be profitable under favorable conditions (Bose *et al.*, 2020; Abdullahi *et al.*, 2022; Gaya *et al.*, 2024; Olubusayo *et al.*, 2024; Sadiq *et al.*, 2024). It is important to note, however, that profitability levels are context-specific due to differences in scale of operation, the type of technology adopted, managerial efficiency, and market access. The existence of a cluster of small-scale processors in Kumbotso Local Government Area (LGA) makes it an appropriate study area for economic analysis. The clustering of mills is a pointer to potential economies of agglomeration, including shared access to labor, input suppliers, and markets. Moreover, clustering may also amplify competition, with consequent influence on pricing behavior and profit margins. A cost and returns analysis in this context is therefore essential to establish if these firms offer adequate returns to support continued investment and expansion.

The study has two main objectives, namely to: (i) identify and estimate the cost components associated with small-scale rice processing and (ii) determine the net returns and profitability ratios of processors within the study area. By generating empirical evidence at the local level, the study expects to provide important insight to the growing body of literature on agro-processing economics and offer policy-relevant recommendations for improving the performance of Nigeria's rice value chain.

## **METHODOLOGY**

### **Study Area and Sampling**

The study was carried out in Kumbotso Local Government Area (LGA) of Kano State, Nigeria. Kumbotso LGA is one of the most significant rural areas in the state, located at *latitude 11°53'17"N and longitude 8°30'10"E*. It has an area of 157.8 km<sup>2</sup> and a population of 294,391 people in 2006 and a projected population of 551,096 in 2025 at an annual growth rate of 3.3% (National Bureau of Statistics [NBS], 2025). The LGA has borders with Rimingado LGA on the north-west, Madobi LGA on the south and south-west, Tarauni LGA on the east and Gwale LGA on the north. Kumbotso LGA is a hub for rice processing operations, carried out mostly by small-scale processors. Its nearness to important rice producing and marketing locations and accessibility to road networks, gives it an edge for agro-processing activities.

The selection of small-scale rice processors was carried out in two stages. Firstly all 11 wards in the LGA were selected since they are all characterized by rice processing activities. Then, a sampling



frame of small-scale rice processors in each selected ward was drawn from a list obtained from Women Farmers Advancement Network (WOFAN) in collaboration with the Kano State Agricultural and Rural Development Authority (KNARDA). Finally, a **proportionate (30%) sampling technique was applied to sample** the number of processors from each community relative to the total number of processors identified. A total of **90 small-scale rice processors** were randomly selected and used for the study.

#### **Data Collection and Analytical Technique**

Primary data were used for this study and collected with the aid of a structured questionnaire administered to selected small-scale rice processors. Data collected were analyzed using descriptive statistics and budgeting techniques. Descriptive statistics were used to achieve objective i (describe socio-economic characteristics of the processors and objective iii (identify the constraints associated with rice processing). Farm budgeting techniques was used to achieve objective ii (assess cost and returns in rice processing per ton).

The net processing income (NPI) was expressed as:

$$NPI = TR - TC$$
$$TC = TFC + TVC$$

Where:

$NPI$  = Net processing income (₦)

$TR$  = Total revenue (₦)

$TC$  = Total cost (₦)

$TFC$  = Total fixed cost (₦)

$TVC$  = Total variable cost or operating cost (₦)

Operating ratio is expressed as:  $\frac{TVC}{TR}$

Returns per naira invested in rice processing enterprise is given as:  $\frac{NPI}{TC}$

Benefit cost ratio =  $\frac{TR}{TC}$

## **RESULTS AND DISCUSSION**

### **Socio-economic Characteristics of the Small-Scale Rice Processors**

Table 1 presents the socioeconomic characteristics of the small-scale rice processors. The result shows that **88.89% of the rice processors were male**, while **11.11% were female**. This shows that men are dominant in rice processing in the study area, attributed to the **capital requirement, the labour-intensive nature of the business, and control over productive resources**, reflecting the cultural dynamics in northern Nigeria. This finding aligns with earlier research pointing to male-dominance agro-processing enterprises arising from greater access to capital, land, and machinery (Akinagbe & Ayibiowu, 2020; Sani *et al.*, 2023; Abdullahi, 2025). The average age of processors was 34, with 44.44% being above 36 and 27.78% aged between 31 and 36, suggesting that they are economically active, which is comparable to similar studies carried out in nearby Kano areas that reported mean ages of around 42 years (Kabiru *et al.*, 2024).

The average household size was 8, with 62.22% having 6 -10 members, suggesting the availability of labor for processing activities. Large household sizes are common in rural northern Nigeria and may serve as a source of **family labour** for rice processing activities. Family labour reduces production costs and increases operational efficiency. This finding is consistent with **Joseph *et al.* (2024)** who reported that large households provide labour support for small-scale rice processing enterprises in Nigeria.

In terms of education, 37.78% of the processors had primary education, 28.88% had secondary education, 17.78% had non-formal education, and 15.56% had tertiary education. This indicates that most processors possessed at least basic education. Education plays a significant role in improving managerial ability, technology adoption, and record-keeping in agribusiness enterprises. Higher education equips processors to more likely adopt improved processing equipment and better marketing



methods. This result aligns with Lawal *et al.* (2023) who found significant association between education, efficiency and profitability in rice processing enterprises.

The results reveal a mean processing experience of 8 years with 47.78% having 6-10 years, supporting high profitability potential in Kano's rice sector driven by raw material availability. This suggests that most respondents possess **moderate experience in rice processing**, which can positively influence operational efficiency and profitability. Experience improves technical skills, managerial competence, and knowledge of market dynamics (Houessou *et al.*, 2023; Dhuniganh *et al.*, 2024).

The distribution of income shows that 66.67% of the respondents earned above ₦200,000, 14.44% earned between ₦50,000–₦100,000, 14.44% earned between ₦100,001–₦150,000, and 4.44% earned less than ₦50,000, with a mean income of ₦196,667. This indicates that rice processing is a relatively profitable enterprise in the study area. The high-income levels observed among most respondents suggest that the activity provides a sustainable livelihood source. This finding supports previous studies that reported that rice processing contributes significantly to household income and poverty reduction among rural processors in Nigeria (Sadiq & Sani, 2022; Lawal *et al.*, 2025; Mahmud *et al.*, 2025).

The result demonstrates reliance on informal credit (50%) over banks (10%) or government schemes (15.56%) and this underscores barriers for small-scale operators, mirroring national trends where processors depend on personal sources amid formal credit constraints. The dominance of informal credit sources indicates **limited access to formal financial institutions**, which may be due to high collateral requirements and complex loan procedures. This finding is consistent with **Mohammed and Aliyu (2025)**, who reported that small-scale agribusiness operators in Nigeria rely heavily on informal financial sources such as friends, family, and cooperative societies.

**Table 1: Socioeconomic and Institutional Characteristics of Small-scale Rice Processors**

Variable	Category	Frequency (n=90)	Percentage	Mean
Sex	Male	80	88.89	
	Female	10	11.11	
Age (years)	<25	9	10.00	
	25-30	16	17.78	34
	31-36	25	27.78	
	>36	40	44.44	
Household size	1-5	18	20.00	
	6-10	56	62.22	8
	11-15	11	12.22	
	>15	5	5.56	
Educational level	Non formal	16	17.78	
	Primary	34	37.78	
	Secondary	26	28.88	
	Tertiary	14	15.56	
Processing experience (years)	1-5	24	26.67	
	6-10	43	47.78	8
	11-15	19	21.11	
	>15	4	4.44	
Income level (₦)	<50,000	4	4.44	
	50,000 – 100,000	13	14.44	196,667
	100,001– 150,000	13	14.44	
	>200,000	60	66.67	
Sources of credit	Informal	45	50.00	
	Commercial banks	9	10.00	
	Government loan scheme	14	15.56	
	NGOs	12	13.33	
	Others	10	11.11	

**Source:** Field Survey, 2024



## Costs and Returns from Rice Production in the Study Area

### Cost Structure of Rice Processing

The cost and returns analysis of small-scale rice processing in the study area is presented in Table 2. The result indicates that the **total variable cost (TVC) was ₦1,643,391**, representing **94.84% of the total production cost**, while the **total fixed cost (TFC) accounted for only 5.16% (₦89,418)**. The **total cost (TC) of processing rice per month was ₦1,732,809**. The dominance of variable costs over fixed costs suggests that rice processing in the study area is **highly dependent on operational inputs rather than capital assets**. This pattern is common among small-scale rice processing enterprises where equipment investment is relatively limited compared with recurring operational expenses (Norbu, 2019). Similar findings were reported by **Olumayowa (2024)** who observed that variable costs accounted for over 78.6% of total processing costs in rice milling enterprises in Nigeria. Among the variable cost components, **paddy rice constituted the largest proportion of the total cost (63.48%)**, amounting to **₦1,100,000**. This implies that the cost of raw materials is the **most significant determinant of processing cost** in the rice value chain. The high cost share of paddy rice indicates that fluctuations in paddy prices could significantly affect processors' profitability. This observation agrees with **Bose *et al.* (2020)** who reported that the purchase of paddy accounts for the largest share of processing expenses in small-scale rice mills in Nigeria.

The **processing cost (milling and related services)** was the second-largest component, accounting for **27.93% of total cost (₦484,000)**. This reflects the importance of milling operations in transforming paddy rice into milled rice. Efficient milling technologies are therefore essential for improving profitability and reducing operational losses. According to **Nafiu *et al.* (2023)**, processing efficiency plays a crucial role in determining the competitiveness of small-scale rice processors. Other operational costs were relatively small compared to the cost of raw materials and processing. **Transportation cost accounted for 1.15%**, while **packaging accounted for 0.51% of total cost**. Utilities such as **electricity (0.75%)**, **water (0.47%)**, **firewood (0.28%)**, and **labour (0.26%)** represented minor cost components. The relatively low labour cost observed in the study may be attributed to the use of **family labour and mechanized processing equipment**, which reduces the demand for hired labour.

Regarding fixed costs, **depreciation of milling machines accounted for ₦56,281 (3.25%)**, while **depreciation of buildings accounted for ₦33,137 (1.91%)**. The relatively small proportion of fixed costs suggests that most processors operate with **limited capital investment**, which is typical of small-scale rice processing enterprises. Similar results were reported by **Gaya *et al.* (2024)** and **Mahmud (2024)**, who found that fixed costs constitute a small fraction of total production costs in small-scale rice processing enterprises.

### Revenue and Profitability of Rice Processing

The total revenue generated from rice processing in the study area was **₦2,098,500 per month**, while the **net processing income (profit) was ₦365,691**. This indicates that rice processing is a **profitable agribusiness venture** in the study area. The profitability indicators further confirm the economic viability of the enterprise. The **benefit–cost ratio (BCR) was 1.21**, implying that for every **₦1 invested in rice processing, processors realized ₦1.21 in revenue**, yielding a profit margin of **₦0.21**. A BCR greater than one indicates that the enterprise is financially viable and profitable. This finding corroborates the results of **Mahmud (2024)** and **Bunza *et al.* (2025)** who also reported benefit–cost ratios greater than one in rice processing enterprises in Nigeria.

The **return on investment (ROI) was 0.21**, indicating that processors earn approximately **21 kobo for every ₦1 invested** in the enterprise. This positive return suggests that rice processing contributes significantly to the income of processors and has the potential to improve rural livelihoods. Additionally, the **operating ratio was 0.78**, which implies that **78% of total revenue is spent on variable costs**, leaving **22% as returns to fixed factors and profit**. An operating ratio lower than one indicates efficient cost management and profitability (Gaya *et al.*, 2024).

**Table 2: Cost and Returns Estimates of Rice Processing in the Study Area (per month)**

Variable	Unit	Quantity	Unit Price (₦)	Value (₦/ha)	Percentage
Paddy rice	100 kg	44	25,000	1,100,000	63.48
Firewood	Monthly	-	-	4,917	0.28
Water	Monthly	-	-	8,174	0.47
Electricity	Monthly	-	-	13,000	0.75
Labour	Man-days	5	900	4,500	0.26
Processing cost	Per 100 kg	44	11,000	484,000	27.93
Packaging	Per bag	44	200	8,800	0.51
Transportation	-	-	-	20,000	1.15
<b>Total variable cost (TVC)</b>				<b>1,643,391</b>	<b>94.84</b>
Depreciation of milling machine				56,281	3.25
Depreciation of building				33,137	1.91
<b>Total fixed cost (TFC)</b>				<b>89,418</b>	<b>5.16</b>
<b>Total cost (TC)</b>				<b>1,732,809</b>	<b>100.00</b>
<b>Total Revenue</b>				<b>2,098,500</b>	
Net processing income				365,691	
Operating ratio (TVC/TR)				0.78	
Return on investment (NPI/TC)				0.21	
Benefit cost ratio (TR/TC)				1.21	

**Source:** Field Survey, 2024

### Constraints Associated with Rice Processing in the Study Area

The major constraints affecting small-scale rice processing in the study area are presented in Table 3. The result shows that **poor transportation networks (97.8%) emerged as the most critical constraint**, indicating higher transaction costs of transporting paddy rice from farms to milling centres and moving processed rice to markets as well as possibility in contributing to post-harvest losses due to longer transit period. This finding is consistent with **Obianefo *et al.* (2023)**, who reported that inadequate rural transportation infrastructure significantly affects the efficiency of rice processing enterprises in Nigeria.

**Inadequate storage facilities (96.7%)** ranked as the second critical **constraint**, as lack of adequate storage facilities exposes rice to pest infestation, moisture damage, and contamination, which ultimately reduces product quality and market value. Insufficient storage capacity also forces processors to sell their products immediately after processing, often at unfavorable prices. This result aligns with the findings of **Nwachukwu *et al.* (2020)** and **Olumayowa (2024)** who observed that limited storage facilities significantly constrain rice processing enterprises in Nigeria.

Furthermore, **94.4% of rice processors identified inadequate power supply (ranked 3<sup>rd</sup>) as a major constraint**, suggesting that erratic and poor electricity supply can lead to operational delays, increased processing time, and higher production costs when processors resort to alternative power sources such as generators. The unreliability of electricity supply is a well-documented challenge facing small-scale agro-processing enterprises in Nigeria (**Nworie & Agbo, 2025**).

Other challenges facing rice processors include **inadequate capital (93.3%)**, **inadequate technical knowledge and skills (85.6%)**, and **reliance on traditional and outdated equipment (81.1%)**. These results align with the findings of **Achebe *et al.* (2024)**, **Olumayowa (2024)**, and **Mohammed and Aliyu (2025)**.



**Table 3:** Constraints Associated with Rice Processing in the Study Area

Constraints	Frequency*	Percentage	Rank
Poor transportation network	88	97.8	1 <sup>st</sup>
Inadequate storage facilities	87	96.7	2 <sup>nd</sup>
Inadequate power supply	85	94.4	3 <sup>rd</sup>
Inadequate capital	84	93.3	4 <sup>th</sup>
Inadequate knowledge and skills	77	85.6	5 <sup>th</sup>
Reliance on traditional and outdated equipment	73	81.1	6 <sup>th</sup>

\*Multiple responses

Source: Field Survey, 2024

## CONCLUSION AND RECOMMENDATIONS

This study demonstrated that although small-scale rice processing in Kumbotso LGA is characterized by high variable cost structure, it is nonetheless an economically viable venture with a moderate return on investment, indicating that rice processing is profitable in the study area. Rice processing is dominated by men who are mostly economically active and possess moderate years of experience. Our findings show that rice processing can be a viable source of livelihood, that allows for earning relatively stable incomes from the enterprise. However, the processors largely still draw from informal financial sources to support their operations due to limited access to formal credit facilities. The study also found key constraints that prevent rice processors from operating optimally. Poor transportation networks, inadequate storage facilities, unreliable power supply, inadequate capital, limited technical knowledge and skills, and reliance on traditional processing equipment pose significant challenge to rice processing. This leads to rising operational costs, reduction in efficiency, and restriction on the growth potential of rice processing enterprises.

To improve productivity, profitability, and the overall sustainability of small-scale rice processing in the area, the following recommendations are proposed:

- i. critical investment in the rehabilitation and construction of rural roads to facilitate the efficient movement of paddy rice from farms to processing centres and improve market access for processed rice should be the focus of interventions by relevant stakeholders.
- ii. Policies that promote the establishment of modern storage facilities such as silos and warehouse development and cluster-based storage infrastructure development, will facilitate the reduction of post-harvest losses and enable processors to maintain product quality and take advantage of favorable market prices.
- iii. Extension agencies, research institutions, and development organizations should prioritize capacity building by organising training programmes to enhance the technical and managerial skills of rice processors and encourage the adoption of improved processing technologies.

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