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DRIVERS OF RICE VALUE ADDITION AMONG WOMEN SMALLHOLDER FARMERS IN RURAL KOGI STATE, NIGERIA

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ABSTRACT: *This study examined agricultural innovation and development as drivers of value addition decisions among women smallholder rice farmers in rural Kogi State, Nigeria. The specific objectives were to describe the socio-economic characteristics of respondents, assess agricultural innovation-related value addition practices and determine the factors influencing participation in rice value addition activities. primary data were collected from 100 women rice farmers using structured questionnaires, focus group discussions and key informant interviews. Data were analyzed using descriptive statistics and binary logistic regression. Findings revealed that the mean age of respondents was 38 years, most farmers operating small-scale holdings averaging 1.6 hectares. About 41% had primary education, 29% secondary education, 8% tertiary education, while 22% had no formal education. Results showed that women farmers were mainly engaged in basic value addition activities, with rice drying (84%), parboiling (78%) and milling (61%) being predominant, while 22% participated in packaging and branding, indicating low engagement in advanced value addition and weak adoption of innovation-driven processing practices. The logistic regression results indicated that education level ($p < 0.01$), access to credit ($p < 0.05$) and farm size ($p < 0.01$) had positive and significant effects on participation in value addition, while distance to market ($p < 0.05$) had a negative and significant effect. The model showed good explanatory power with a Nagelkerke R^2 of 0.452 and a classification accuracy of 78%, indicating a strong fit and predictive reliability. The study concludes that agricultural innovation and development significantly influence value addition decisions among women rice farmers. The study recommends improved access to credit, strengthened agricultural extension services, investment in rural infrastructure, and targeted support for women in agro-processing to enhance value chain participation and rural development outcomes.*

KEYWORDS: *Agricultural innovation, value addition, women farmers and rice production*

Introduction

Rice is one of the most widely consumed staple foods in Nigeria and plays a significant role in ensuring national food security, employment generation, and rural economic development. Rapid population growth, urbanization, and changing dietary patterns have significantly increased the demand for rice across the country. Nigeria has therefore made considerable efforts to expand domestic rice production in order to reduce reliance on imports and strengthen national food security. Despite these efforts, domestic rice production continues to face several challenges related to productivity, post-harvest management, and value chain development (Food and Agriculture Organization, 2018; United States Department of Agriculture, 2022).

Agricultural innovation and development have increasingly been recognized as critical drivers for transforming traditional agricultural systems into more productive, efficient and market-oriented sectors. Agricultural innovation involves the introduction and adoption of improved technologies, modern production techniques, institutional arrangements and improved processing methods that enhance productivity and competitiveness within agricultural value chains (World Bank, 2019; Spielman and Birner, 2008). In the rice sector, innovations such as improved seed varieties, mechanized milling technologies, improved parboiling systems, modern storage facilities and better market linkages can significantly enhance value addition, reduce post-harvest losses and improve farmers' incomes (Arouna *et al.,* 2017).

Kogi State, located in North-Central Nigeria, is one of the important rice-producing states in the country due to its favorable agro-ecological conditions, fertile soils and availability of water bodies suitable for rice cultivation. Areas such as Ibaji, Bassa and Ajaokuta are particularly known for their rice production activities. Rice farming in these communities is predominantly practiced by smallholder farmers who rely largely on traditional farming systems characterized by low mechanization, limited technological adoption and inadequate access to improved processing facilities (National Bureau of Statistics, 2020; Federal Ministry of Agriculture and Rural Development, 2021). As a result, the potential benefits of value addition within the rice value chain remain largely underexploited.

Women constitute a substantial proportion of the agricultural labor force in rural Nigeria and play an important role in both agricultural production and post-harvest activities. According to the Food and Agriculture Organization (FAO, 2011), women account for a significant share of agricultural labor in

developing countries and contribute immensely to food production, processing and marketing activities. In rice-producing communities, women are actively involved in various post-harvest operations such as drying, parboiling, milling, storage, packaging and marketing of rice. These activities form essential components of agricultural value addition, which involves transforming raw agricultural products into forms that are more marketable, valuable and profitable (Porter and Kramer, 2011; Kaplinsky and Morris, 2001).

Value addition in rice production has become increasingly important for improving product quality, enhancing market competitiveness and increasing farmers' incomes. By processing paddy rice into higher-value products, farmers and processors are able to capture additional economic benefits within the value chain while also reducing post-harvest losses and improving product shelf life (Reardon *et al.*, 2019; FAO, 2018). Furthermore, value addition contributes significantly to rural employment generation and agro-industrial development in many developing economies.

Despite the potential benefits associated with value addition, women farmers often face several structural and institutional constraints that limit their participation in higher-value agricultural activities. These challenges include limited access to credit facilities, inadequate processing technologies, poor rural infrastructure, limited extension services and restricted access to profitable markets (Doss, 2017; Quisumbing *et al*., 2014). These constraints often reduce women's ability to adopt agricultural innovations and engage effectively in value-added agricultural enterprises.

Agricultural innovation and development initiatives are therefore essential for enhancing women's participation in rice value addition. Access to improved technologies, training programs, extension services, cooperative organizations, and financial resources can significantly influence farmers' decisions to engage in value-added activities (Feder *et al*., 1985; Rogers, 2003). When women farmers are empowered with appropriate knowledge, resources and institutional support, they are more likely to adopt innovative processing techniques and participate actively in agricultural value chains.

Value addition in agriculture has been widely recognized as a key strategy for improving farm incomes, strengthening rural economies and promoting inclusive agricultural development. According to the Food and Agriculture Organization (FAO, 2018), value addition plays a crucial role in improving food quality, increasing farmers' income and enhancing agricultural market competitiveness in developing countries. Empirical studies in Nigeria have also demonstrated that participation in agricultural value chains can

significantly improve rural household incomes and livelihood outcomes (Adekola and Oladele, 2021; Adegbite and Onigbinde, 2020).

Education and training have also been identified as important determinants of farmers' adoption of agricultural innovations. Ajibade and Yusuf (2020) reported that farmers with higher levels of education are more likely to adopt improved agricultural technologies and participate in value-added processing activities. Similarly, access to credit has been identified as a critical factor influencing farmers' investment decisions and their ability to adopt modern technologies (International Fund for Agricultural Development, 2020). Improving women's access to financial services can therefore significantly enhance their participation in agricultural value chains and improve their economic empowerment.

Despite the growing emphasis on agricultural innovation and value chain development in Nigeria, limited empirical studies have specifically examined how agricultural innovation influences women farmers' value addition decisions in rice production, particularly in rural communities of Kogi State. Understanding the determinants of women's participation in rice value addition is therefore important for designing policies and interventions aimed at promoting inclusive agricultural development, reducing rural poverty and strengthening food security.

This study therefore examines the role of agricultural innovation and development as drivers of value addition decisions among women smallholder rice farmers in rural communities of Kogi State, Nigeria.

Objectives of the Study

The main objective of this study is to examine the drivers of rice value among women smallholder farmers in rural communities of Kogi State, Nigeria. The specific objectives are to:

i. examine the socio-economic characteristics of women smallholder rice farmers in the rural communities of Kogi State;
ii. assess the level of value addition practices among women rice farmers in the study area; and
iii. determine the factors influencing women farmers' decisions to engage in rice value addition activities in the study area.

Methodology

The study was conducted in Ibaji, Ajaokuta, and Bassa Local Government Areas of Kogi State, Nigeria. Kogi State is located in the North-Central geopolitical zone of Nigeria and lies between latitude 6°30'N

and 8°50'N and longitude 5°20'E and 7°50'E. The state shares boundaries with several other states including Benue, Nasarawa, Niger, Kwara, Edo, Enugu, and Anambra, making it strategically important for agricultural production and food distribution in the country.

Agriculture is the predominant economic activity in Kogi State, with a large proportion of the rural population engaged in farming and related agricultural enterprises. Major crops cultivated in the state include rice, cassava, maize, yam and sorghum. Among these crops, rice production has become particularly important due to increasing demand for locally produced rice in Nigeria.

Ibaji, Bassa and Ajaokuta Local Government Areas were selected for this study because they are recognized as major rice-producing areas in Kogi State. These areas are characterized by fertile alluvial soils, favorable rainfall patterns and extensive river floodplains which provide suitable ecological conditions for rice cultivation. The presence of major rivers and seasonal floodplains supports both upland and lowland rice farming systems. Rice farming in these communities is largely carried out by smallholder farmers who operate on relatively small landholdings using traditional farming techniques. Women play an essential role in both rice production and post-harvest processing activities. In many communities, women are actively involved in parboiling, drying, milling, packaging, and marketing of rice. These activities represent key forms of value addition within the rice value chain and contribute significantly to household income and rural livelihoods.

Despite the importance of rice production in these areas, farmers often face several challenges including limited access to improved technologies, inadequate processing facilities, poor rural infrastructure and limited access to credit. These challenges often limit the extent to which farmers can engage in value addition and benefit from agricultural innovations. The selection of these Local Government Areas therefore provides a suitable context for examining the role of agricultural innovation and development in influencing value addition decisions among women smallholder rice farmers.

The study adopted quantitative research approaches. This approach was considered appropriate because it allows for a more comprehensive understanding of the research problem by combining statistical analysis with in-depth insights from respondents. The quantitative component of the study focused on collecting measurable data relating to farmers' socio-economic characteristics, adoption of agricultural innovations, and participation in rice value addition activities.

A multi-stage sampling technique was employed in selecting respondents for the study. In the first stage, three Local Government Areas, Ibaji, Bassa, and Ajaokuta were purposively selected due to their prominence in rice production and the high involvement of women in rice processing activities within these areas. In the second stage, four major rice-producing communities were identified within each of the selected Local Government Areas. In the third stage, twenty-five lists of women rice farmers were selected from each of the communities in stage two. From stage 1 and 2, a total of 100 (4x25) women smallholder rice farmers were selected as the sample size for the study. This sample size was considered adequate to provide reliable information for the statistical analysis required in the study.

Primary data were utilized for the study. Primary data were collected directly from respondents through the use of structured questionnaires. A structured questionnaire was designed and administered to the selected women rice farmers. The questionnaire contained sections on respondents' socio-economic characteristics, access to agricultural innovations, value addition practices, institutional support, and constraints faced in rice processing and marketing.

The data collected for the study were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to describe the socio-economic characteristics of respondents, identify the types of agricultural innovations adopted and examine the various forms of value addition practices carried out by women farmers. These descriptive tools helped to provide a clear understanding of the demographic and socio-economic profile of respondents as well as their level of participation in rice processing and marketing activities.

In addition to descriptive statistics, inferential statistical analysis was employed to determine the factors influencing women farmers' decisions to engage in rice value addition activities. A binary logistic regression model was used for this purpose because the dependent variable participation in value addition is dichotomous in nature (participation or non-participation). All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) version 25.0.

Model Specification

To analyze the determinants of participation in rice value addition activities among women farmers, a binary logistic regression model was employed. Logistic regression is appropriate when the dependent variable is binary or categorical in nature. The logistic regression model estimates the probability that a

farmer participates in rice value addition activities based on a set of explanatory variables. The logistic regression model is expressed as:

$$P\ (Y=1) = 1/\ 1+e- (^{\beta}0+^{\beta}1^{X}1+^{\beta}2^{X}2+\ldots\ldots\ldots+^{\beta}k^{X}k),$$

Where:

- *P(Y = 1) = Probability that a farmer participates in rice value addition,*
- *Y = Dependent variable (1 = participates in value addition, 0 = otherwise),*
- *β_0 = Intercept or constant term,*
- *$\beta_1 - \beta k$ = Estimated coefficients of the explanatory variables,*
- *$X_1 - X_k$ = Vector of explanatory variables (age (years), farm size (hectares), years of farming experience (years), household size (number of persons), access to credit (binary: 1 = yes, 0 = no, education level (years of formal schooling),*
- *e = Base of the natural logarithm or error term*

The explanatory variables used in the model include socio-economic and institutional factors such as age, education level, household size, farming experience, farm size, access to credit, extension contact, cooperative membership, access to processing technology and access to markets. The parameters of the model were estimated using the Maximum Likelihood Estimation (MLE) method, which identifies the parameter values that maximize the likelihood of observing the sample data. The logistic regression model allows for the estimation of the direction and magnitude of the relationship between explanatory variables and the likelihood of women farmers participating in rice value addition activities.

Results and Discussion

Socioeconomic Characteristics of Women Rice Farmers

The socio-economic characteristics of respondents presented in Table 4.1 shows that the mean age of 38 years indicates that women rice farmers are within the economically active population. This age structure is important for agricultural transformation because farmers in this category are more likely to adopt innovations and participate in labour-intensive value addition activities (FAO, 2023; World Bank, 2023). The dominance of married women (72%) reflects the importance of household structure in agricultural production systems. In rural Nigeria, women's participation in agriculture is strongly shaped by household responsibilities and access to family labour (Doss, 2021; IFAD, 2024). Educational attainment shows that

22% of respondents have no formal education, primary level 41%, and secondary level 29% while only 8% reached tertiary level. This suggests relatively low human capital, which limits the ability to adopt improved processing technologies and innovation-driven value addition practices (FAO, 2023; World Bank, 2024). The mean farm size of 1.6 hectares confirms the smallholder nature of rice production. Recent evidence shows that smallholder systems dominate Nigeria's rice value chain and often struggle with mechanization and agro-processing investment (World Bank, 2026; Sanusi *et al*., 2025).

Socioeconomic Characteristics of Respondents (n = 100)

Table 1: Socioeconomic Characteristics of Respondents (n = 100)

Variable	Category	Frequency	Percentage (%)
Age	Mean = 38 years	-	-
Marital Status	Married	72	72
	Widowed	18	18
	Single	10	10
Education Level	No formal education	22	22
	Primary education	41	41
	Secondary education	29	29
	Tertiary education	8	8
Farm Size	Mean = 1.6 hectares	-	-
Household Size	Mean = 6 persons	-	-

Source: Field Survey, 2026

Value Addition Practices

The distribution of value addition activities (Table 4.2) shows that women farmers are mainly engaged in basic processing operations. Rice drying (84%) is the most common activity. However, reliance on traditional sun-drying systems exposes rice to contamination and post-harvest losses, reducing competitiveness in formal markets (FAO, 2023). Recent studies confirm that weak post-harvest infrastructure remains a major constraint in Nigeria's rice value chain (Sanusi *et al*., 2025). Parboiling (78%) is widely practiced and represents an important indigenous processing innovation. However, its continued reliance on firewood reflects limited diffusion of energy-efficient technologies, consistent with findings from IFAD-supported rural transformation programmes in Nigeria (IFAD, 2024). Milling (61%)

indicates moderate access to processing facilities, although most women rely on external service providers. This limits value capture and reinforces dependency within the value chain (World Bank, 2026). Packaging and branding (22%) remain very low, showing weak participation in higher-value segments of the rice market. Recent evidence shows that Nigerian smallholders are often excluded from downstream agro-processing due to limited capital, weak innovation systems, and poor market integration (FAO & IFAD, 2024; World Bank, 2023).

Value Addition Practices among Respondents

Table 2: Value Addition Practices among Respondents

Value Addition Activity	Frequency	Percentage (%)
Rice Drying	84	84
Parboiling	78	78
Milling	61	61
Packaging & Branding	22	22

Source: Field Survey, 2026

Determinants of Participation in Value Addition

The logistic regression results (Table 4.3) show that the model has good explanatory power, with a Nagelkerke R^2 of 0.452 and classification accuracy of 78%. This indicates strong model reliability in explaining participation behaviour. Education level has a positive and significant effect on participation in value addition. This aligns with recent findings that human capital remains a key driver of innovation adoption in African agrifood systems (FAO, 2023; Ozor et al., 2025).

Access to credit is also significant and positive, indicating that financial inclusion strongly influences agro-processing participation. Recent World Bank evidence shows that credit access enables smallholder farmers to invest in value addition technologies and market expansion activities (World Bank, 2026). Farm size positively influences participation, confirming that larger production scales encourage investment in processing activities due to economies of scale (Reardon et al., 2023; IFAD, 2024). Distance to market negatively affects participation, highlighting the role of infrastructure and market access constraints. Poor rural road networks and high transport costs continue to limit agricultural commercialization in Nigeria (FAO, 2023; World Bank, 2024).

Logistic Regression Results of Factors Influencing Value Addition Decisions

Table 3: Logistic Regression Results of Factors Influencing Value Addition Decisions

Variable	Coefficient	Std. Error	p-value	Odds Ratio	Decision
Constant	-1.124	0.582	0.051	—	—
Education Level	0.154	0.038	0.000***	1.167	Significant
Access to Credit	0.735	0.295	0.013**	2.085	Significant
Farm Size	0.212	0.072	0.004***	1.236	Significant
Distance to Market	-0.118	0.049	0.017**	0.889	Significant

Model Diagnostics Nagelkerke $R^2 = 0.452$, Hosmer–Lemeshow Test = 0.611, Classification Accuracy = 78%. **Source: Field Survey, 2026**

Conclusion and Recommendations

The study concludes that the level of rice value addition among women smallholder farmers in rural Kogi State is largely determined by a combination of enabling and constraining factors that shape their participation decisions. Although women are actively engaged in rice production, their movement into higher value addition activities remains limited, indicating a structural gap within the value chain. The evidence shows that key drivers such as education, access to credit, and farm size significantly enhance the likelihood of participating in value addition, demonstrating that capacity and resource access are central to upgrading within the rice value chain. On the other hand, constraints like poor market access, reflected by increased distance to markets, significantly reduce participation, reinforcing the role of infrastructure and institutional support in shaping outcomes. Therefore, the study affirms that improving women's participation in rice value addition is not simply a matter of increasing production, but of addressing the underlying drivers that influence their ability to engage in higher-return activities. Strengthening these drivers is essential for repositioning women within the value chain, enhancing income potential, and promoting sustainable rural economic development in Kogi State.

Based on the findings of the study, the following recommendations are made:

1. Strengthening Agricultural Innovation and Extension Services: There is a need to intensify agricultural extension services targeted at women rice farmers. Extension programmes should focus on modern rice processing technologies, hygienic handling practices, and value addition techniques such as improved parboiling systems, mechanized drying and packaging methods. This will enhance innovation adoption and improve product quality.
2. Improved Access to Credit Facilities: Financial institutions and agricultural development agencies should design gender-responsive credit schemes that are easily accessible to rural women farmers. Affordable credit will enable them to invest in processing equipment, storage facilities and small-scale agro-enterprises, thereby increasing their participation in value addition activities.
3. Investment in Rural Infrastructure: Government and development partners should prioritize the development of rural infrastructure, especially feeder roads and local markets. Reducing transportation barriers will improve market access, lower transaction costs and encourage women farmers to engage more in value-added production.
4. Promotion of Women Inclusion in Agro-Processing and Innovation Systems: Policies should deliberately promote the inclusion of women in agricultural innovation systems. This includes training programmes, cooperative strengthening, and support for women-led agribusinesses in rice packaging, branding and marketing.
5. Encouraging Cooperative Participation: Women farmers should be encouraged to join or form cooperative societies. Cooperatives can enhance collective access to credit, equipment, training and markets, thereby improving their capacity for value addition and market competitiveness.
6. Support for Agro-Processing Equipment and Technology Adoption: Government agencies and development partners should support the provision of affordable and appropriate-scale rice processing technologies. This includes improved mills, dryers and parboiling equipment suitable for smallholder women farmers.

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