INFLUENCE OF FARMERS' GROUP MEMBERSHIP AND ACCESS TO CREDIT ON THE TECHNICAL EFFICIENCY OF RICE FARMERS IN OBAFEMI-OWODE LOCAL GOVERNMENT AREA, OGUN STATE, NIGERIA

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ABSTRACT

This study examined how farmers' group membership and access to credit affect the technical efficiency of rice farms in Obafemi-Owode Local Government Area, Ogun State, Nigeria. Primary data were collected from 128 rice farmers using a semi-structured questionnaire administered via a two-stage random sampling procedure. We used the Cobb-Douglas stochastic frontier production function to estimate farm-level technical efficiency, while a Probit regression model assessed the determinants of credit access. Results showed that most respondents were male (57.8%), 64.1% were married, and 59.4% had attained secondary education. A majority (58.2%) belonged to village associations, and 41.4% accessed credit through cooperatives. The mean technical efficiency score was 95.28%, indicating that farms operated at a high level of efficiency relative to the production frontier. Socio-economic factors, including age, gender, marital status, and household size, significantly influenced credit decisions, while membership in farmer associations positively influenced access to credit. The study recommends strengthening rural credit institutions and farmer group structures to improve agricultural productivity and resource-use efficiency.

Keywords: Farmer group; Access to credit; Technical efficiency; Rice farmers; Stochastic frontier; Nigeria

INTRODUCTION

Rice (*Oryza sativa*) is a major staple grain in Nigeria, surpassing cassava in household food expenditure, and is consumed nationwide (Gyimah-Brempong et al., 2016; Adewuyi & Amurtiya, 2021). Over 50% of the world's population depends on rice as a primary dietary staple, with the crop supplying approximately 13% of dietary protein and 19% of caloric intake globally (Maclean et al., 2013; Ikhajiagbe et al., 2021; Zafar & Jianlong, 2023). Nigeria is West Africa's largest producer and consumer of rice and a leading global importer. Despite using approximately 3.2 million hectares for rice production and yielding about 3.7 million tonnes annually, domestic supply falls far short of total demand, estimated at 6.4 million tonnes in 2018 (USDA, 2018; FAO, 2019).

Technical efficiency (TE), defined as a farm's ability to achieve maximum output from a given set of inputs under existing technology, is a critical determinant of agricultural productivity. Improvements in TE offer a key pathway to close the supply-demand gap in Nigeria's rice sector without proportionate increases in resource use (Shah et al., 2008; Moges et al., 2017). Access to credit has been identified as a major enabler of TE, allowing farmers to acquire improved inputs, hire labour, and adopt better production practices (Balogun, 2011). However, rural rice farmers in Nigeria face severe constraints in accessing formal credit, including high interest rates, collateral requirements, and information asymmetry in credit markets (Balogun & Yusuf, 2011).

Farmer group membership has emerged as a social capital mechanism that can mitigate individual credit constraints by substituting social collateral for physical collateral, thereby facilitating group-based credit access (Anons, 2016; Ajani & Tijani, 2009). Despite growing recognition of the role of farmer organizations in agricultural development, empirical evidence linking group membership and credit access to technical efficiency in Nigeria's rice farming sector remains limited. This study helps fill this gap by empirically examining these relationships in Obafemi-Owode Local Government Area (LGA), Ogun State, a rice-producing area in southwestern Nigeria.

The specific objectives of this study were to: (i) describe the socio-economic characteristics of rice farmers in the study area; (ii) identify credit sources available to rice farmers; (iii) examine the determinants of credit access; (iv) estimate the level of technical efficiency; and (v) analyze the effect of farmer group membership and credit access on technical efficiency.

The concept of technical efficiency traces its theoretical foundations to Farrell (1957), who defined efficiency as a production unit's capacity to achieve the highest output from a given bundle of inputs. The production frontier defines the maximum achievable output for each input combination, and a farm's technical efficiency is measured as the ratio of its actual output to this frontier level (Coelli et al., 1998). Technical inefficiency—the failure to produce on the frontier—reflects wasted resources and represents a margin for productivity improvement without additional input use.

Stochastic frontier analysis (SFA), introduced by Aigner et al. (1977) and Meeusen and Broeck (1977), has become the standard econometric approach for estimating farm-level technical efficiency, particularly in agricultural economics. The stochastic frontier model decomposes the composite error term into a two-sided random noise component and a one-sided inefficiency component, enabling estimation of firm-specific efficiency scores. The Battese and Coelli (1995) model extended SFA to estimate efficiency scores and identify their determinants simultaneously.

Agricultural credit plays a pivotal role in enabling small-scale farmers to acquire inputs, adopt improved technologies, and expand production scale (Mgbakor et al., 2014; Adewale et al., 2022). Despite its importance, access to formal credit remains severely constrained for smallholder farmers in Nigeria due to collateral requirements, high interest rates, and geographic barriers (Balogun, 2011). Empirical evidence suggests that credit access positively influences agricultural production efficiency. Abdallah (2016) found that access to agricultural credit improved technical efficiency among Ghanaian farmers, while Edet et al. (2019) reported similar findings for smallholder rice farmers in Akwa Ibom State, Nigeria.

Microcredit programs have been proposed as an alternative to formal credit for reaching poor rural farmers. Namayengo et al. (2018) found positive effects of microcredit participation on household food security in Uganda, while Anang et al. (2016) demonstrated that smallholder rice farmers in northern Ghana who accessed agricultural microcredit achieved significantly higher technical efficiency scores than non-borrowers. However, the magnitude of the effect depends on loan conditions, repayment terms, and how credit is utilised.

Social capital, operationalized as membership in farmer groups, cooperatives, or village associations, has been recognized as a mechanism through which smallholder farmers can overcome individual credit constraints. By leveraging group social collateral in lieu of physical collateral, organized groups facilitate credit delivery from microfinance institutions and cooperatives (Ajani & Tijani, 2009; Grootaert, 1999). Members of organized farmer groups also benefit from collective bargaining, shared resources, information dissemination, and access to external development agency support (Anons, 2016; Luka et al., 2017).

METHODOLOGY

Study Area

The study was conducted in Obafemi-Owode Local Government Area (LGA) of Ogun State, southwestern Nigeria. The LGA is characterized by smallholder rice farming systems, with both rain-fed lowland and upland rice cultivation practiced across the area. Three villages with a predominance of rice farmers were selected as the study sites.

Sampling Procedure and Data Collection

A two-stage random sampling procedure was employed. In the first stage, three villages were randomly selected from the LGA based on the predominance of rice farming. In the second stage, 128 rice farmers were randomly selected from these villages and interviewed using a well-structured, semi-structured questionnaire. Data collected included information on socio-economic characteristics, production inputs and outputs, credit access, and farmer association membership.

Analytical Framework

Stochastic Frontier Production Function

The Cobb-Douglas stochastic frontier production function, following Battese and Coelli (1995), was specified as:

$$ln\ Yi = \beta 0 + \beta 1\ ln\ X1i + \beta 2\ ln\ X2i + \beta 3\ ln\ X3i + \beta 4\ ln\ X4i + \beta 5\ ln\ X5i + (vi - ui)$$

where Yi is the quantity of rice output (kg) for the ith farmer; X1 is farm size (hectares); X2 is quantity of seed (kg); X3 is total labour (man-days); X4 is quantity of agrochemicals (litres); X5 is quantity of fertilizer (kg); vi is a symmetric random error; ui is a non-negative inefficiency term; and β0 – β5 are parameters to be estimated. The technical efficiency of the ith farmer is defined as TEi = exp(-ui).

The inefficiency effects model included farmer group membership, age, sex, marital status, and household size as explanatory variables.

Probit Regression Model

This was done to evaluate the accessibility and availability of credit. The general model following Gujarati (2003), Ajani & Tijani (2009), and Luka et al. (2017) is given as:

Pi [y=1] =[Fzi]

Where.

$$Zi = \beta O + \beta 1X1 \quad (1)$$

$$yi = \beta 1 + \beta 1X2i + \ldots + \beta kXki + ui \quad (2)$$

yi* is unobserved but yi ={0 if yi*<0

{1 if yi*≥0

$$P(yi = 1) = P(y1*0) \quad (3)$$

$$= P(ui \geq -\beta 1 - \beta 2\ X2i - \ldots . - \beta kXki)$$

Where i = number of farmers

yi = farmer's access to credit dichotomous variable (1= Yes, 0 = No)

β = A vector of unknown coefficients

Xi = Vector of characteristics of the ith individual and is the independent variable, which is the independent variables which are defined as follows ;

X1= Age of the farmer (years); X2= Gender (male =1, female=0); X3= Marital status (married=1, otherwise=0); X4= Household size (number); X5 = Membership of association (Yes=1, 0= Otherwise); X6 = Interest rate (%); X7 = Time Lag between request and granting loan (weeks); X8 = Payback period (years); X9 = Credit distance (Km); Ui = Error term.

Descriptive statistics were used to profile the socio-economic characteristics of respondents and patterns of credit source utilisation.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The socio-economic profiles of the 128 sampled rice farmers are presented in Table 1. Most respondents (57.8%) were male, consistent with the male-dominated nature of smallholder rice farming in southwestern Nigeria. A total of 64.1% of respondents were married, and 59.4% had attained secondary education, reflecting a relatively educated farming population compared to the national average for rural farmers. Regarding farmer association membership, 58.2% of respondents belonged to a village or cooperative association, indicating strong social capital in the study area. The age distribution showed that most farmers (48.4%) were in the 31–50 year age bracket, suggesting a predominantly active adult farming population.

Table 1: Socio-economic characteristics of sampled rice farmers

Variable	N = 128	Percentage (%)
Age (years)		
20 – 30 years	5	3.9
31 – 40 years	42	32.8
41 – 50 years	34	26.6
51 – 60 years	39	30.5
Above 60 years	8	6.3
Gender		
Male	102	79.7
Female	26	20.3
Marital status		
Single	22	17.2
Married	82	64.1
Widowed	23	18.0
Divorced	1	0.8
Educational qualification		
No formal	17	13.3
Primary	23	18.0
Secondary	76	59.4
Tertiary	12	9.4
Religious Affiliation		
Christianity	58	45.3
Islamic	65	50.8
Traditional	5	3.9
Employment status		
Employed	101	78.9
Unemployed	27	21.1

Source: Field Survey, 2023

Credit sources utilised by rice farmers

Figure 1 shows that respondents' credit sources include NGO/cooperative societies, government agencies, friends and relatives, personal savings, banks, and local lenders. However, respondents most often use NGO/cooperative societies and government agencies, with 41.4% receiving credit facilities from NGO/cooperative societies and 31.5% from government agencies. Meanwhile, 5.5% and 3.1% of respondents stated that they get credit facilities from friends and relatives and banks, respectively. In addition, only 0.8% of the respondents get credit facilities from local lenders. The cooperative was a readily available source of financing because of minimal constraints and its credit procurement experience. Although government agencies also offer loans to assist farmers, they sometimes delay credit delivery, unlike the banking sector, which requires many credentials and protocols.

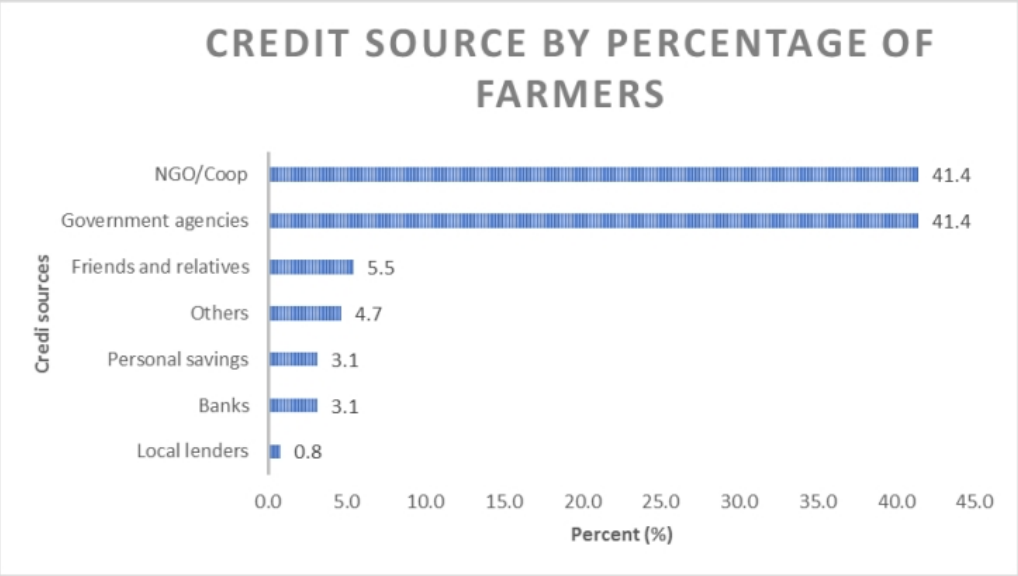

Figure 1. Credit source by percentage of farmers.

Source: Field Survey, 2023

The maximum likelihood estimates (MLE) of the Cobb-Douglas stochastic frontier production function are presented in Table 3. Farm size had a positive and significant effect on rice output ($p < 0.01$), confirming that cultivation scale is a primary driver of production among smallholder farmers. Labor was also positively and significantly associated with output ($p < 0.05$), reflecting the labor-intensive nature of rice production in the study area. The coefficient for seed quantity was positive and significant ($p < 0.1$), indicating that access to quality seed in adequate quantities is important for productivity. Agrochemical use and fertilizer application were not statistically significant, possibly reflecting inconsistent adoption patterns among sampled farmers.

Regarding inefficiency effects, membership in a credit association was negative and highly significant ($p < 0.01$), indicating that farmers in credit associations were associated with lower technical inefficiency—that is, higher efficiency. This finding supports the theoretical proposition that group membership facilitates better access to productive resources, information, and credit, thereby enabling farmers to operate closer to the production frontier.

Table 3: Maximum likelihood estimates of the Cobb-Douglas stochastic frontier production function

Variable	Parameter	Coefficient	Std. error	t-ratio
Constant	β_0	0.843***	0.360	23.15
Ln labour(Man-day)	β_1	-0.100***	0.015	-6.84
Ln Quantity of Seed planted (kg)	β_2	0.1941***	0.642	3.02
Ln farm size (Hectare)	β_3	--0.057	0.642	-0.24
Ln Quantity of fertilizer (kg)	β_4	0.0263	0.180	1.45
Inefficiency				
Constant	λ_0	-0.021	0.409	-0.53
Membership of credit Association	λ_1	-3.697***	0.444	-8.33
Sex	λ_2	-0.039	0.042	-0.93
Age (year)	λ_3	0.008	0.005	1.58
Marital status	λ_4	0.115	0.207	0.55
Household size	λ_5	-0.029	0.084	-0.35
Sigma-squared	$\sigma_s^2 = \sigma_u^2 + \sigma_v^2$	0.0603***	0.012	4.99
Gamma	$\Upsilon = \frac{\sigma_u^2}{\sigma_s^2}$	0.0000	0.000	0.001
Log-likelihood	-1.8986			
LR test of the one-sided error	14.86			
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*Note: *, **, *** denote significance at 10%, 5%, and 1% levels, respectively.*
Source: Field Survey, 2023

Table 4 presents the distribution of technical efficiency scores among the sampled rice farms. The mean TE score was 95.28%, indicating that on average, farms operated at a high level of efficiency relative to the stochastic production frontier. However, 23.44% of farms had TE scores below 0.50, suggesting that a subset of farmers experienced considerable productive inefficiency, potentially attributable to limited access to inputs, inadequate labour, and poor seed availability. About 68.75% of farms recorded TE scores above 0.80, reflecting a concentration of relatively efficient production in the study area.

The efficiency gap of approximately 5% between actual and maximum achievable output suggests scope for efficiency improvement through targeted interventions.

Table 4: Distribution of technical efficiency scores among rice farmers

TE Score Range	Frequency	Percentage (%)
< 0.50	30	23.44
0.50 – 0.80	10	7.81
> 0.80	88	68.75
Total	128	100.0
Minimum	0.1000	
Maximum	0.9915	
Mean	0.9528	

Source: Field Survey, 2023

Table 5 presents the Probit regression results identifying the determinants of credit access. The model's pseudo R-squared ($R^2 = 0.2660$) indicates that the included variables explain approximately 26.6% of the variation in credit access, suggesting that additional socio-institutional factors beyond those captured in this model also influence credit access. Membership in a farmer association was the strongest positive determinant of credit access (coefficient = 1.451, $p < 0.05$), with a marginal effect of 0.303, indicating that association members had a 30.3 percentage-point higher probability of accessing credit than non-members. This finding underscores the critical role of social capital in facilitating financial inclusion for rural farmers.

Interest rate charged per year was negatively and significantly associated with credit access ($p < 0.01$), confirming that high borrowing costs deter credit uptake. Payback period had a significant negative effect ($p < 0.05$), suggesting that short repayment windows restrict farmers' willingness to borrow. Other variables, including age, gender, marital status, household size, loan processing time, and distance to credit source, were not statistically significant, though their marginal effects indicate the expected directional relationships.

Table 5: Probit regression results — determinants of credit access

Variable	Coefficient	Std. Error	Marginal Effect	t-value
Age	-0.0299	0.0262	-0.0074	-1.14
Gender	0.6761	0.6077	0.1628	1.11
Marital status	-0.7063	0.4798	-0.1747	-1.47
Household size	-0.0603	0.1556	-0.0150	-0.39
Association membership	1.4505**	1.1556	0.3028	2.51
Interest rate (% per year)	-0.1706***	0.0353	-0.0424	-4.83
Loan processing time (weeks)	-0.1030	0.1339	-0.0256	-0.77
Payback period (years)	-1.8322**	0.8743	-0.4558	-2.10
Distance to credit source (km)	0.0452	0.7711	0.0112	0.59
R2 = 0.2660 Log-likelihood = -65.016 Prob > Chi^2 = 0.0000				

*Note: **, *** denote significance at 5% and 1% levels, respectively.*
Source: Field Survey, 2023

CONCLUSION AND RECOMMENDATIONS

This study examined the influence of farmer group membership and credit access on the technical efficiency of smallholder rice farmers in Obafemi-Owode LGA, Ogun State, Nigeria. The results demonstrate that rice farmers in the study area achieved a high mean technical efficiency of 95.28%, yet considerable heterogeneity existed, with a non-trivial proportion of farms operating well below the frontier. Farm size and labour were the most significant production inputs, while membership in credit associations was the most powerful determinant of technical efficiency improvement.

Smallholder farmers accessed credit mainly through cooperatives and informal networks rather than formal financial institutions, reflecting persistent barriers to formal credit access. Association membership significantly increased the probability of credit access and reduced technical inefficiency, underscoring the dual benefits of farmer group participation for productivity and financial inclusion.

Based on these findings, the study recommends: (i) strengthening rural financial institutions — particularly cooperative societies and microfinance banks — to provide accessible, affordable, and timely credit to smallholder rice farmers, with loan repayment schedules aligned to harvest cycles; (ii) scaling up farmer group formation programs to harness social capital as a conduit for credit access and knowledge sharing; (iii) implementing policies to improve resource use efficiency among younger farmers, including incentive programs to attract youth into rice production; and (iv) addressing the interest rate and collateral constraints that restrict formal credit access, through targeted agricultural credit guarantee schemes.

Limitation Of Study

- It was difficult to locate farmers without an extension agent. Farmers reside in villages far from urban communities, so transportation to reach them was not readily available.
- Also, data collection took place during the dry season. Farmers had only started land preparation ahead of the planting season.

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