

Profitability Analysis of the West African Cotton (Wacot) Out-Grower Scheme among Beneficiary Rice Farmers in Kebbi State, Nigeria

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Abstract: This study assessed the impact of the WACOT Out-Grower Scheme on the profitability of smallholder rice farmers in Kebbi State, Nigeria. Specifically, it examined the socio-economic characteristics of beneficiary and non-beneficiary farmers and compared their production costs, returns, and profitability. The study is significant because it provides empirical evidence on the effectiveness of contract farming in enhancing rice profitability, and rural livelihoods. A cross-sectional survey and quasi-experimental research design were adopted. Primary data were collected from 540 rice farmers comprising 270 beneficiaries and 270 non-beneficiaries selected through a multi-stage sampling technique across seven rice-producing Local Government Areas in Kebbi State. Data were analyzed using descriptive statistics and Cost-Benefit Analysis. The findings revealed that beneficiaries had better educational attainment, larger farm sizes, greater access to irrigation and extension services, and lower production costs (₦360,000/ha) than non-beneficiaries (₦396,800/ha). Beneficiaries also achieved higher average yield (5,200 kg/ha), total revenue (₦1,664,000/ha), net farm income (₦1,304,000/ha), return per naira invested (3.62), and benefit-cost ratio (4.62), demonstrating superior profitability. The study concludes that participation in the WACOT Out-Grower Scheme significantly enhances productivity, profitability, and institutional support for smallholder rice farmers. It recommends expanding farmers' access to quality inputs, extension services, irrigation infrastructure, affordable credit, and inclusive participation, particularly for women and resource-poor farmers, to strengthen sustainable rice production and food security in Kebbi State and Nigeria.

Keywords: WACOT Out-Grower Scheme; Smallholder Rice Farmers; Profitability.

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Introduction

Agriculture remains a critical sector in Nigeria's economy, serving as a major source of livelihood, employment, and food security for a large proportion of the population. It contributes significantly to rural development and poverty reduction, with over 70% of rural households depending on it for sustenance and income (Adewumi and Lawal, 2020). Given its central role, the sector has continued to receive attention from both government and private stakeholders aiming to improve productivity and ensure national food security.

Within the agricultural sector, staple food systems play a vital role in meeting the dietary needs of the population. Staples such as cereals, roots, and tubers form the foundation of food consumption patterns in Nigeria. Among these, rice has emerged as one of the most important staple foods, driven by rapid population growth, urbanization, and changing consumption preferences. Globally, rice provides about 20% of total caloric intake and feeds over 3.5 billion people (FAO, 2023). In Africa, particularly West Africa,

rice has become increasingly important as a daily dietary component.

The rice subsector in Nigeria has grown rapidly over the years, making the country the largest producer and consumer of rice in West Africa. In 2022, Nigeria accounted for approximately 44% of total rice output and 57% of the rice cultivation area in the region (WARDA, 2022). Despite this significant contribution, domestic production has not kept pace with the rising demand. Consequently, rice has become one of the fastest-growing commodities in Nigeria's food basket (Akinbode and Salimonu, 2019; Federal Ministry of Agriculture and Food Security, 2023).

This imbalance has resulted in a persistent demand-supply gap in the rice subsector. The increasing demand for rice far exceeds domestic production capacity, forcing the country to rely on imports to meet consumption needs (FAO, 2023; USDA, 2024). This situation exerts pressure on foreign exchange reserves and highlights inefficiencies within the domestic production system.

Addressing this gap has become a key priority for policymakers and stakeholders in the agricultural sector.

The Nigerian rice industry continues to be constrained by low productivity caused by costly inputs, ineffective extension services, and weak institutional framework. Whereas there have been attempts to overcome these challenges throughout-grower programs such as the WACOT program, there are questions about their effectiveness and consistency. In essence, there is a knowledge deficit in relation to the profitability and effectiveness of the program in Kebbi State, with various findings and lack of comparisons between beneficiaries and non-beneficiaries of the program. This gap affects decision-making on the sustainability or modification of the program and poses issues of equity. The findings hope to provide valuable feedback to stakeholders and inform improvements in policy design and implementation. It is against this background that this study provides answers to the following research questions:

1. What are the socio-economic characteristics of WACOT outgrower scheme beneficiary and non-beneficiary smallholder rice farmers in the study area?
2. How profitable are the two categories of rice farming in the study area?

This study is justified by its potential to generate empirical evidence on the WACOT Out-grower Scheme's role in improving smallholder rice farmers' profitability and efficiency in Kebbi State, crucial amidst Nigeria's push for rice self-sufficiency. It aims to benefit government agencies like FMARD and CBN by refining intervention programs, while offering farmers practical insights on yields, profit, and technical services. A key contribution is its comprehensive assessment of economic efficiency, moving beyond prior yield-focused research to evaluate resource utilization. This will clarify if scheme investments yield optimal returns. Additionally, findings will inform the scalability of out-grower models, identifying best practices for other commodities and regions. Rooted in the need to strengthen rice production and rural development, this rigorous evaluation will provide a foundation for more effective and inclusive agricultural policies.

This study focuses on assessing the impact of the WACOT Outgrower Scheme on rice farmers in Kebbi State, Nigeria, with emphasis on profitability and efficiency of the participating farmers. The study was conducted in the seven (7) selected Local Government Areas (LGAs) of Kebbi State where the WACOT scheme is active. This includes LGAs such as Argungu, Augie, Birnin Kebbi, Dandi, Jega Suru and Yauri, which are prominent in rice production and known to have significant participation in the scheme.

Methodology

Study Area

Kebbi State was created in 1991 from the former Sokoto State, Kebbi has emerged as a leading center for agricultural production, especially in cereal crops such as rice, millet, sorghum, and maize. Kebbi State is located within Nigeria's Northern Guinea and Sudan-Sahel savannah ecological zones, characterized by low to moderate rainfall (600-1,200 mm annually), a prolonged dry season, and temperatures ranging from 21°C to 38°C. The vegetation consists mainly of short grasses and scattered trees, much of which has been degraded due to extensive cultivation of crops such as rice, millet, sorghum, maize, cowpea, wheat,

groundnut, and sesame. Agriculture is the backbone of the state's economy, engaging over 75% of the population, with most residents practicing smallholder farming alongside livestock production. The state also supports fishing, local crafts, and the collection of wild foods, which contribute to household livelihoods. Covering about 36,800 km² and comprising 21 Local Government Areas, Kebbi is strategically irrigated by the Rivers Niger and Rima, making it highly suitable for both wet- and dry-season agriculture. With an estimated population of 6.2 million, the state is one of Nigeria's leading rice-producing regions, playing a significant role in the national rice value chain through initiatives such as the Anchor Borrowers' Programme and the presence of the WACOT Rice integrated mill in Argungu.

The study adopts a cross-sectional survey research design combined with a quasi-experimental approach to evaluate the impact of the WACOT Out-Grower Scheme on profitability among smallholder rice farmers in Kebbi State, Nigeria. This research design was used to collect data from both beneficiaries (treatment group) and non-beneficiaries (control group) at a single point in time, allowing for a comparative analysis of outcomes such as profitability, productivity, and efficiency

Sampling Procedure and Sample Size

The study employed a multi-stage sampling technique to obtain a representative sample of beneficiary and non-beneficiary rice farmers in Kebbi State. In the first stage, seven Local Government Areas (Argungu, Augie, Birnin Kebbi, Dandi, Jega, Suru, and Yauri) participating in the WACOT Outgrower Scheme were purposively selected because they represent diverse upland and lowland rice-producing environments under both wet- and dry-season farming. In the second stage, the sampling frame of beneficiary farmers was obtained from the WACOT Outgrower Scheme record office. In the third stage, a proportionate sampling technique of 10% was applied to select 270 beneficiary rice farmers, following recommendations to minimize selection bias. An equal number of 270 non-beneficiary rice farmers were selected from the same locations for comparison, resulting in a total sample size of 540 respondents. This approach ensured adequate representation and comparability between the two groups.

Data Collection

The study adopts the use of primary data through a well-structured questionnaire to collect data directly from rice farmers in the sampled Local Government Areas (LGAs) of Kebbi State. This approach was chosen to ensure that data is timely, accurate, and specific to the research objective with the assistance of extension personnel well trained that would assist the researcher in the data collection. While Secondary information source was obtained from WACOT Rice Mill Ltd. operational reports, Kebbi State Agricultural Development Programme (KADP), Federal Ministry of Agriculture and Rural Development (FMARD), Central Bank of Nigeria (CBN) reports Federal office of statistics, and published academic articles, Journals, and policy briefs.

Data Analysis

The data collected for this study were analyzed using descriptive and inferential statistics. Data was analyzed using descriptive statistics such as (frequency, percentage, ranking etc.) and Cost - Benefit Analysis (CBA).

The mean, frequency and percentage to describe socio-economic and constraints was derived from the following formula.

Mean (x) = $\frac{\sum xif}{\sum f}$ (1)

Xi = observed Variable

f = Number of times the variable occurs

Percentage = $\frac{x_i}{\sum x_i} \times 100$ (2)

To compare the cost, returns, and profitability of WACOT out-grower scheme beneficiary and non-beneficiary rice farmers using Cost-Benefit Analysis (CBA), a model specification that clearly outlines the financial metrics used in the analysis. Below is a structured CBA model specification suitable for this comparison:

NFI = TR –TC (3)

Where

TC = TVC + TFC (4)

TR = Qi × Pi (5)

Π = TR – TVC (6)

Where:

TC = Total Cost of production for farmers

TVC = Total Variable Cost for farmer

TFC = Total Fixed Cost for farmers

TR = Total Revenue for farmer (Output quantity × Market Price)

NFI = Net Farm Income for farmers.

Results and Discussion

Socio-Economic Characteristic of WACOT Out-Grower Scheme Beneficiary and Non-Beneficiary Smallholder Rice Farmers

The socio-economic characteristics of WACOT out-grower scheme beneficiaries and non-beneficiaries presented in Table 1 which provide important insights into the demographic and production profile of WACOT out-grower scheme beneficiaries and non-beneficiaries in the study area. These characteristics have direct implications for adoption of improved technologies, access to institutional support, productivity, and profitability among smallholder rice farmers.

Age Distribution: The results show that the majority of rice farmers were between 31–50 years, representing 64.5% of beneficiaries and 64.1% of non-beneficiaries, indicating that rice production is dominated by economically active and experienced adults. Beneficiaries had a slightly higher proportion of farmers aged 41–50 years (35.6%) than non-beneficiaries (33.0%), suggesting that maturity and farming experience enhance

participation in contract farming. Middle-aged farmers are generally more willing to adopt improved technologies, utilize extension services, and manage production risks effectively. These findings agree with Akinbode and Daramola (2021), Zachariah et al. (2024), and Ragasa et al. (2022), who reported that middle-aged farmers are more likely to participate in agricultural innovations and contract farming schemes due to their experience and decision-making capacity.

Gender: Male farmers dominated rice production, accounting for 84.4% of beneficiaries and 81.1% of non-beneficiaries, while female participation remained below 19%. This reflects the prevailing cultural norms and land tenure systems in northern Nigeria, where men have greater access to land, credit, and extension services. Women continue to face significant barriers to productive resources despite their important contribution to agricultural labour (FAO, 2023). Similar findings by Liverpool-Tasie et al. (2020) and Adebayo and Okunmadewa (2020) attribute male dominance to better access to production resources. Zachariah et al. (2024) recommended increasing female participation in WACOT outgrower schemes. The comparable gender distribution across both groups suggests that the scheme has not significantly changed existing gender disparities in rice farming.

Marital Status and Household Size: Married respondents constituted the majority of rice farmers, representing 78.1% of beneficiaries and 73.3% of non-beneficiaries. This suggests that marriage enhances participation in contract farming by providing household labour and social support. Nwibo et al. (2019) noted that married farmers are better positioned to meet contractual production requirements due to larger family labour pools. The finding is consistent with Oyediran et al. (2025), who reported that 87.7% of contract rice farmers were married. It also supports the National Bureau of Statistics (2023), which found that married household heads dominate rural farming communities, while Ogunniyi et al. (2021) observed that married farmers are more likely to participate in agricultural interventions to improve household income.

Most respondents had household sizes of 6–10 persons (54.8% of beneficiaries and 51.5% of non-beneficiaries), providing an important source of family labour for labour-intensive rice farming activities while also increasing household consumption needs. Large household size serves as a proxy for labour availability and positively influences agricultural productivity. This finding agrees with Abdullahi et al. (2021), who reported that household size enhances labour supply in smallholder rice production. Similarly, Arouna et al. (2024) found an average household size of nine members among Nigerian rice farmers, while Musa (2025) identified household size as a significant factor influencing the adoption of climate-smart agricultural practices.

Table 1a: Socio-Economic Characteristics of WACOT Out-Grower Scheme Beneficiary and Non-Beneficiary Smallholder Rice Farmers in the Study Area

Variables	Beneficiaries		Non-Beneficiaries	
	Frequency	Percentage	Frequency	Percentage
Age (Years)				
20–30	32	11.9	41	15.2
31–40	78	28.9	84	31.1
41–50	96	35.6	89	33.0
51–60	49	18.1	43	15.9

Above 60	15	5.5	13	4.8
Gender				
Male	228	84.4	219	81.1
Female	42	15.6	51	18.9
Marital Status				
Single	29	10.7	35	13.0
Married	211	78.1	198	73.3
Divorced	12	4.4	16	5.9
Widowed	18	6.7	21	7.8
Educational Level				
No Formal Education	54	20.0	78	28.9
Primary Education	67	24.8	72	26.7
Secondary Education	98	36.3	84	31.1
Tertiary Education	51	18.9	36	13.3
Farm Size				
Less than 1 ha	38	14.1	61	22.6
1–2 ha	96	35.6	104	38.5
3–4 ha	87	32.2	71	26.3
Above 4 ha	49	18.1	34	12.6
Household Size				
1–5 persons	61	22.6	74	27.4
6–10 persons	148	54.8	139	51.5
Above 10 persons	61	22.6	57	21.1

Source: Field Survey, 2026

Educational Level: Educational attainment was generally higher among beneficiaries than non-beneficiaries. Secondary education was the most common level among beneficiaries (36.3%), with 18.9% attaining tertiary education, compared with 31.1% and 13.3%, respectively, among non-beneficiaries. Conversely, primary and no formal education were more prevalent among non-beneficiaries. This suggests that better-educated farmers are more likely to participate in the WACOT outgrower scheme and adopt improved agricultural practices. The finding is consistent with Olagunju and Salimonu (2022), Arouna et al. (2024), Omodara et al. (2025), Asfaw et al. (2012), and the World Bank (2024), all of whom reported that education enhances technology adoption, participation in contract farming, and improved farm income.

Primary Occupation and Farm Size

Rice farming was found as the primary occupation of most respondents, accounting for 83.0% of beneficiaries and 80.4% of non-beneficiaries, highlighting its importance as the main source of household income and rural livelihoods. This suggests that the WACOT Out-Grower Scheme has strong potential to improve farmers' welfare through increased productivity and profitability, consistent with Eze et al. (2022) and Arouna et al. (2024). The presence of farmers with secondary occupations indicates income diversification, which may influence participation in contract farming (Omodara et al., 2025). Most respondents cultivated 1–2 hectares, confirming the dominance of smallholder farming. However, a larger proportion of beneficiaries (50.3%) operated farms of 3 hectares and above compared with non-beneficiaries

(38.9%), suggesting that scheme participation may support farm expansion through improved access to inputs and production services, consistent with Amaza and Tijani (2020), and Musa (2025).

Rice Cultivation System, Land Tenure, Farming Experience and Access to Extension Services

Beneficiaries of the WACOT Out-Grower Scheme demonstrated greater adoption of both rain-fed and irrigated rice farming (61.5%) than non-beneficiaries, who relied mainly on rain-fed production (53.0%). This suggests improved access to irrigation, which enhances year-round production, reduces climate-related risks, and increases productivity, consistent with Liverpool-Tasie et al. (2020) and Arouna et al. (2024). Land tenure patterns were similar across both groups, with inherited land being the dominant tenure system, providing secure land-use rights that encourage long-term investment and participation in contract farming (Place et al., 2020; World Bank, 2023; Zachariah et al., 2024). Beneficiaries also had relatively greater farming experience, which is associated with improved technical knowledge and productivity (Ojo & Bamire, 2021; Oyediran et al., 2025). The most notable difference was access to extension services, with 78.9% of beneficiaries compared to 44.8% of non-beneficiaries receiving advisory support. This highlights the WACOT scheme's role in strengthening institutional linkages, promoting Good Agronomic Practices (GAP) and Yield Enhancement Techniques (YET), and improving technology adoption and productivity (Zachariah et al., 2024; Omodara et al., 2025).

Table 1b: Socio-Economic Characteristics of WACOT Out-Grower Scheme Beneficiary and Non-Beneficiary Smallholder Rice Farmers in the Study Area

Variables	Beneficiaries		Non-Beneficiaries	
	Frequency	Percentage	Frequency	Percentage
Primary Occupation				
Farming	224	83.0	217	80.4
Trading	19	7.0	24	8.9
Civil Service	15	5.6	12	4.4
Artisan/Others	12	4.4	17	6.3
Rice Cultivation Systems				
Rain-fed	104	38.5	143	53.0
Irrigated	166	61.5	127	47.0
Type of Land Tenure				
Inherited	139	51.5	148	54.8
Rented	76	28.1	69	25.6
Purchased	39	14.4	31	11.5
Communal	16	5.9	22	8.1
Years of Farming Experience				
1–5 years	36	13.3	49	18.1
6–10 years	88	32.6	97	35.9
11–15 years	97	35.9	81	30.0
Above 15 years	49	18.1	43	15.9
Access to Extension Service				
Yes	213	78.9	121	44.8
No	57	21.1	149	55.2

Source: Field Survey, 2026.

Cost and Returns of WACOT Outgrower Scheme Beneficiary and Non-Beneficiary Smallholder Rice Farmers.

The cost and returns analysis revealed that WACOT Out-grower Scheme beneficiaries achieved lower production costs and higher profitability than non-beneficiaries. Beneficiaries incurred a total production cost of ₦360,000/ha compared with ₦396,800/ha for non-beneficiaries, largely due to lower variable input costs resulting from subsidized and bulk-procured inputs provided through the scheme. They also recorded higher output (5,200 kg/ha versus 4,300 kg/ha) and slightly better selling prices (₦320/kg versus ₦315/kg), generating higher total revenue of ₦1,664,000/ha. The 20.9% yield advantage aligns with findings

from the WRL/USAID programme, which attributed productivity gains to improved farming practices and access to quality inputs (Suleiman & Sani, 2024). Beneficiaries realized a gross margin of ₦1,344,000 and net farm income of ₦1,304,000, compared with ₦999,900 and ₦957,700, respectively, for non-beneficiaries. Similarly, the return per naira invested (3.62 versus 2.41) and benefit-cost ratio (4.62) were substantially higher among beneficiaries, demonstrating superior economic performance and investment efficiency. These findings indicate that participation in the WACOT Outgrower Scheme significantly reduced production costs while enhancing productivity, profitability, and market returns through improved access to inputs, extension services, and market linkages. This supports the findings of Inuwa et al. (2011), who reported that contract farming arrangements substantially improve the profitability of rice enterprises compared with independent smallholder production.

Table: 2 Average Cost and Returns per Hectare of WACOT Outgrower Scheme Beneficiary and Non-Beneficiary Smallholder Rice Farmers

Variables	Beneficiaries	Non-Beneficiaries	Mean Difference
A. Revenue			
Average Output (kg/ha)	5,200	4,300	900
Average Selling Price (₦/kg)	320	315	5
Total Revenue (TR)	1,664,000	1,354,500	309,500

B. Variable Cost

Land Preparation	52,500	58,000	-5,500
Seed Cost	18,200	22,500	- 4,300
Fertilizer	74,800	81,400	- 6,600
Agrochemicals	24,500	27,300	- 2,800
Labour Cost	86,700	94,500	- 7,800
Irrigation/Water Cost	16,300	18,000	- 1,700
Transportation	12,600	14,200	- 1,600
Processing/Threshing	25,400	28,100	- 2,700
Miscellaneous Expenses	9,000	10,600	- 1,600
Total Variable Cost (TVC)	320,000	354,600	-34,600

C. Fixed Cost

Depreciation on Farm Tools	11,500	10,800	700
Rent on Land	20,000	22,000	- 2,000
Interest on Capital	8,500	9,400	-900
Total Fixed Cost (TFC)	40,000	42,200	- 2,200
Total Cost (TC)	360,000	396,800	- 36,800

D. Profitability Indicators

Gross Margin (TR – TVC)	1,344,000	999,900	344,100
Net Farm Income (TR – TC)	1,304,000	957,700	346,300
Return per Naira Invested	3.62	2.41	1.21
Benefit-Cost Ratio (BCR)	4.62	3.41	1.21

Source: Field Survey, 2026.

Conclusion

The study concludes that the WACOT Out-Grower Scheme has made a significant contribution to improving the socio-economic conditions and economic performance of smallholder rice farmers in the study area. The findings show that both beneficiaries and non-beneficiaries are predominantly economically active, married, and smallholder farmers whose livelihoods depend largely on rice production. However, beneficiaries generally possessed more favourable socio-economic characteristics, including higher educational attainment, larger farm sizes, greater farming experience, and better access to institutional support, which enhanced their participation in contract farming and adoption of improved production technologies. Although male farmers dominated rice production, reflecting existing socio-cultural and land tenure systems, the low participation of women highlights the need for more gender-inclusive interventions.

The study further demonstrates that the WACOT Out-Grower Scheme strengthened farmers' access to irrigation facilities, extension services, Good Agronomic Practices (GAP), Yield Enhancement Techniques (YET), and quality production inputs. These institutional supports enabled beneficiaries to reduce production risks, improve technical efficiency, and increase productivity compared with non-beneficiaries. Secure land tenure and accumulated farming experience also enhanced farmers' willingness to invest in improved technologies and participate effectively in contractual farming arrangements.

Economic analysis confirms that participation in the scheme substantially improved farm profitability. Beneficiaries incurred

lower production costs due to subsidized and bulk-procured inputs while achieving higher yields, better market prices, and greater total revenue. Consequently, they realized higher gross margins, net farm income, return on investment, and benefit-cost ratios than non-beneficiaries. These findings indicate that the scheme effectively enhances productivity, reduces production costs, improves market access, and strengthens the livelihoods of participating farmers.

Overall, the study establishes that contract farming under the WACOT Out-Grower Scheme serves as an effective mechanism for promoting agricultural commercialization, technology adoption, and rural economic development among smallholder rice farmers. Expanding farmers' access to quality inputs, extension services, irrigation infrastructure, financial support, and inclusive participation, particularly for women and resource-poor farmers, would further increase the scheme's impact on rice productivity, profitability, food security, and sustainable agricultural development in Kebbi State and Nigeria at large.

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