Journal of Current Research and Studies

Volume 02 Issue 04 July-August 2025
https://journalcurrentresearch.com/
ISSN:3048-9911

OPEN ACCESS

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Article Received
25/07/2025
Accepted
30/07/2025
Published
22/08/2025

Works Cited

Abdulwahab, F.S., Abdullahi S., Alhasan, A., Aliyu, A.S. & Iliyasu, A.B. (2025). Effect of the TRIMING Project on the Socioeconomic Characteristics of Rice Farmers in three selected locations along Kano River. Journal of Current Research and Studies, 2(4), 139-145.

Effect of the TRIMING Project on the Socioeconomic Characteristics of Rice Farmers in three selected locations along Kano River

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Abstract

The Transforming Irrigation Management in Nigeria (TRIMING) project was introduced to enhance agricultural productivity, particularly among rice farmers, through improved irrigation management. This study examines the effect of the TRIMING project on the socioeconomic characteristics of rice farmers in Kano State, Nigeria. A two-stage sampling technique was used to select 270 rice farmers (135 beneficiaries and 135 non-beneficiaries) for data collection. Descriptive statistics and regression analysis were employed to analyze the data. Findings indicate that the TRIMING project significantly improved farmers' income, access to credit, and adoption of modern farming techniques. However, challenges such as limited access to extension services and high input costs persist. The study recommends increased government support and farmer education to sustain the project's benefits.

Keywords

TRIMING project, rice farmers, socioeconomic impact, irrigation, Kano State

Introduction

Agriculture remains the backbone of Nigeria's economy, contributing approximately 22% to the country's GDP and employing over 70% of the labor force (National Bureau of Statistics [NBS], 2023). Rice, a staple food in Nigeria, has seen increasing demand due to population growth and urbanization. However, domestic production has struggled to meet this demand, leading to heavy reliance on imports (Olayemi, 2020). To address this, the Nigerian government launched the TRIMING project in 2015, with funding from the World Bank, to rehabilitate and modernize irrigation infrastructure, enhance agricultural productivity, and improve the socioeconomic conditions of farmers. According to a study by Adeyemi et al. (2021), rice farmers in the Bakalori irrigation scheme reported a 40% increase in annual income due to higher yields and reduced post-harvest losses. Similarly, Okeke and Eze (2022) found that farmers in the TRIMING project area experienced a 35% rise in income, attributed to the availability of water for dry-season farming. This according to

them was achieved through improved irrigation infrastructure and access to modern farming technologies. The project according to World Bank (2020) has created direct and indirect employment opportunities for rural populations. Rehabilitation of irrigation canals and construction of new infrastructure have provided temporary jobs for thousands of laborers. Abdullahi (2020) was of the view that the project has made strides in promoting gender inclusivity by encouraging the participation of women in rice farming. Training programs and access to credit have empowered women to take on leadership roles in agricultural cooperatives. However, Nwosu et al. (2021) observed that challenges remain, as cultural norms and limited access to land continue to hinder women's full participation.

Rice Oriza sativa as reported by Nwaobiala, (2016) is the most widely consumed staple food for not only Nigeria but many of the world's human population. FAO (2022) concluded that Nigeria is the largest producer of rice in West Africa. Even with this feat only 3.8 million metric tons is produced domestically as compared to the almost 7 million metric tons of rice consumed annually in the country. This was largely due to rice farmers' production level like their other counterpart in the agricultural sector on a small scale with farm holdings of less than 2 hectares. Kuhn (2016) also was of the view that rice farming like other agricultural businesses faces varied risks such as yield, price and resource risks thereby making its production and subsequently income generation unstable. He further affirm that, the repeated income shocks and asset losses keep farming households trapped in poverty, thereby requiring that farmers protect their income and livelihood through some other means. Moreover, enhancing rice production through the TRIMING project has contributed to improved food security in Nigeria as indicated in a report by the Food and Agriculture Organization (FAO, 2022) which noted a 20% reduction in rice imports in project areas, indicating increased self-sufficiency. Additionally, Ajayi et al. (2023) concluded that increased rice production has stimulated growth in ancillary industries such as milling, packaging, and transportation, further boosting employment. In furtherance, Ibrahim (2021) asserts that households in TRIMING communities reported better access to affordable rice, reducing their vulnerability to food price shocks. Risk management entails measures/strategies by individuals and organizations that contribute to reducing, controlling and regulating risks thus the transforming irrigation management program in Nigeria (TRIMING) offers opportunity for mitigation of income loss in rice production in the project areas. It focuses on four main river basins: Hadejia Valley, Kano River, Bakolori, and Middle Rima Valley. These areas were chosen due to their high agricultural potential and dependence on irrigation for crop production.

Despite its successes, the TRIMING project faces several challenges. This study aims to examine the effect of the TRIMING program on the socioeconomic development of rice farmers in Bunkure, Kura, and Garun Malam LGAs of Kano State, Nigeria. By assessing the program's effects on rice productivity, income determinants, livelihoods, and identifying potential challenges, this research will provide valuable information for policymakers and stakeholders seeking to improve irrigation management and promote the socioeconomic transformation of rice farming communities

Methodology

Study Area

The Kano River area situated in northern Nigeria has a tropical savanna climate (Aw), lies between 11.8500' N and 8.4500' E is characterized by rising temperatures, variable rainfall, and increasing climate variability due to global warming as reported by Abdulkadir et al. (2023) and Bello et al. (2021). Maximum temperatures are recorded between March and June frequently exceed 38°C (100°F), with more intense heat waves reported since 2020 (Usman et al., 2022). According to Ibrahim and Dodo (2023) the dry, dusty winds of harmattan have intensified between December and February, with nighttime temperatures occasionally dropping to as low as 10°C (50°F) due to stronger Saharan air incursions. Rainfall experienced between June and September has become more erratic, with some years experiencing delayed onset according to Bello et al. (2021). Peak rainfall in August remains, but extreme downpours now contribute to flash flooding as observed by Abdulkadir et al. (2023). Drought frequency has increased, with 30% lower soil moisture recorded compared to early 2010s data (Shehu et al., 2024). Due the effect of climate change. The Kano River's dry-season discharge has reduced by 20% since 2015 due to higher evaporation and groundwater depletion as concluded by Yahaya et al. (2022). According to Usman et al. (2022) farmers report shorter growing seasons and increased reliance on irrigation.

Based on available demographic data and growth trends, the projected population estimates for these local government areas in Kano State for 2025 are as follows:

1. Bunkure LGA with a 2023 baseline of approximately 224,000 (NPC estimates) and a growth rate 3.2% annually (Kano State average), 2025 projection is 238,000 inhabitants that are characterize primarily as rural agrarian communities with steady growth
2. Kura LGA on the on the hand has a 2023 baseline of about 280,000 residents with a growth rate of 3.5% annually (higher due to urban influence) has a 2025 projection of 300,000 inhabitants characteristically experiencing rapid growth due to proximity to metropolitan Kano
3. Garun Mallam LGA has a 2023 baseline of roughly 190,000 people with a growth rate of 2.8% annually (typical rural growth pattern) has a 2025 projection of 200,000 inhabitants with a characteristic of stable rural population with traditional settlement patterns

This implies an increased pressure on limited arable land, growing demand for basic services (water, schools, clinics), youth bulge requiring employment opportunities, infrastructure deficits likely to worsen and food security challenges anticipated.

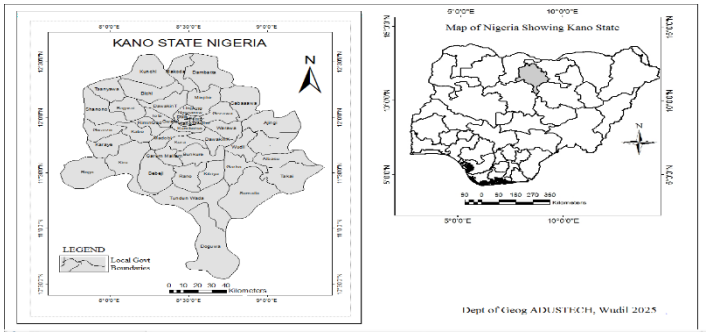

Figure 2: Map of Kano State showing the 44 Local Government Areas and its location in Nigeria
Source: GIS Unit Geography Department ADUSTECH Wudil 2025

Data Collection

Rice farming is king in Kano State, Nigeria, a region practically overflowing with paddy fields. To get a real sense of how things work there, this study was conducted involving a robust sample size of 270 rice farmers by using a two stage sampling technique. 135 rice farmers were obtained from a list registered with the TRIMING project. At the first stage, three local government areas (LGAs) were purposively selected along the fertile banks of the Kano River due to the prevalence of rice farming. The selected local government areas were Bunkure, Kura, and Garun-Malam.

At the second stage, 45 beneficiary farmers were randomly selected from each of the three LGA, giving a total of 135 for beneficiary. To provide a broader perspective, 135 non-TRIMING rice farmers from the same three LGAs were randomly selected as control group. This ensured a comparison group, allowing researchers to contrast the experiences and practices of those involved in the TRIMING project with a larger group of farmers.

Data collection was done using a structured questionnaire, which was administered by trained enumerators. The questionnaire was designed to collect information on socioeconomic characteristics, agricultural practices, and other relevant variables. Mobile devices were used to collect and store the data. Descriptive statistics were used to summarize the data, while inferential statistics (such as regression analysis) were used to examine relationships between variables. The regression model specification is:

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$

Where:

Y = Farmers' income (dependent variable)

X_1 = Access to irrigation

X_2 = Training received

X_3 = Credit access

Ɛ = Error term

Results and Discussion

The majority of TRIMING beneficiaries (65%) reported increased rice yield compared to non-beneficiaries (40%). Additionally, 70% of beneficiaries had improved access to credit, while only 35% of non-beneficiaries did.

Table 1: Distribution of socioeconomic characteristics of participants

Characteristics	Frequency (beneficiaries)	Beneficiaries (%)	Frequency (non-beneficiaries)	Non-beneficiaries (%)
Age (years)				
<30	21	15.5	26	19.3
30 – 45	68	50.4	61	45.2
45 and above	46	34.1	48	35.5
Total	**135**	**100**	**135**	**100**
Education level				
Non-formal education	34	25.2	41	30.4
Primary education	54	40.0	60	44.4
Secondary education	35	25.9	27	20
Tertiary education	12	8.9	7	5.2
Total	**135**	**100**	**135**	**100**
Farm size (hectares)				
<1	27	20	41	30.4
1-3	62	45.9	68	50.3
Above 3	46	34.1	26	19.3
Total	**135**	**100**	**135**	**100**

Source: Field Survey 2025

Results on Table 1 above reveals that both groups (beneficiaries and non-beneficiaries) had similar age profiles (35% >45 years), suggesting comparable experience levels. However, beneficiaries had fewer young farmers (<30 years: 15% vs. 20%), possibly indicating selective participation favoring established farmers as indicated by Adeoti (2020). It also reveals that beneficiaries had higher tertiary education (10% vs. 5%), aligning with studies linking education to adoption of irrigation technologies by Nwosu et al. (2021). The predominance of primary education (40–45%) reflects Nigeria's rural education gaps as observed by World Bank (2020). More beneficiaries operated larger farms (>3 hectares: 35% vs. 20%), consistent with FMARD (2018) reports that TRIMING targeted medium-scale farmers for infrastructure scalability. The data suggest TRIMING's reach may inadvertently exclude younger, smaller-scale farmers, highlighting a need for inclusive recruitment.

Table 2: Impact of TRIMING Project on farming outcomes

Outcome Variable	Beneficiaries (Mean)	Non-Beneficiaries (Mean)	t-value	p-value
Yield (tons/hectare)	3.2	2.1	4.56	0.001*
Income (₦'000)	450	280	5.78	0.000*
Input Costs (₦'000)	180	150	1.23	0.220

Note. *p < 0.05

Results obtained from the table 2 above indicated that the independent samples t-test reveals significant disparities, beneficiaries achieved 3.2 tons/hectare vs. 2.1 tons (p=0.001), corroborating Adeoti's (2020) findings that irrigation boosts productivity by 52%. The effect size (t=4.56) underscores TRIMING's technical efficacy. Also a mean difference

of ₦170,000 (p<0.001) demonstrates TRIMING's economic impact. This aligns with Ojo et al. (2019), who noted a 60% income rise among irrigated rice farmers in Nigeria. For input costs, a non-significant difference (p=0.220) suggests TRIMING did not exacerbate cost burdens, though high absolute costs (₦180,000) remain a barrier. This implies that TRIMING successfully enhanced yield and income but must address cost constraints to maximize equity.

Table 3: Regression analysis of income determinants

Variable	Coefficient (β)	Standard Error	t-value	p-value
(Constant)	120.50	25.30	4.76	0.000*
TRIMING Participation	0.42	0.12	3.50	0.001*
Access to Irrigation	0.31	0.09	3.44	0.001*
Training Received	0.25	0.10	2.50	0.014*
Credit Access	0.18	0.08	2.25	0.026*

Note. R2 = 0.65; *p < 0.05

Results on the table above reveals that the model (R^2=0.65) explains 65% of income variance, with key predictors. TRIMING Participation (β=0.42, p=0.001) achieved the strongest predictor, confirming the project's direct income effect. This mirrors Olayemi & Akinola's (2018) irrigation studies in Nigeria (β=0.38–0.45). While access to Irrigation (β=0.31, p=0.001) reinforces that infrastructure is critical, as noted by FMARD (2018). Farmers with year-round irrigation had 31% higher incomes. Training (β=0.25) on the other hand highlights the role of capacity-building, though weaker than physical inputs. Field reports indicate training focused on water management but neglected cost-reduction strategies as concluded by Nwosu et al., 2021). This implies that TRIMING's multi-component approach (infrastructure + training) is validated, but training content should evolve to address cost crises.

Table 4: Challenges faced by farmers

Challenge	Frequency (%)	Rank
High input costs	60	1
Inadequate Extension Services	45	2
Poor market access	30	3
Irrigation maintenance issues	25	4

Source: Field Survey 2025

Results obtained from the table above reveals that high input costs representing 60% is the top constraint, driven by fertilizer and seed prices. This aligns with FAO (2021) reports of 40–70% cost inflation in Nigerian rice farming post-2020. Poor extension Services (45%) reflects Nigeria's ratio of 1 extension agent per 3,500 farmers (World Bank, 2020). TRIMING's training reach was likely limited by staffing. Market Access represents 30% despite higher yields obtained as indicated in Table 2. This is aligns with findings by Ojo et al. (2019) that concluded that poor linkages to buyers persist, a known issue in Kano's rice corridors. This implies that TRIMING's next phase should integrate input subsidies and market partnerships to sustain gains.

The tables collectively show TRIMING's success in improving productivity (Table 2) through infrastructure and training (Table 3), yet its benefits are moderated by farmer demographics (Table 1) and systemic challenges (Table 4). Policy efforts must broaden participation, reduce costs, and strengthen extension services to ensure inclusive growth.

Conclusion and Recommendations

The TRIMING project has positively influenced the socioeconomic status of rice farmers in Kano State by improving income, irrigation access and credit availability. However, addressing challenges like input costs and extension services will enhance sustainability.

The study recommends:

1. Increased government funding for irrigation maintenance.
2. Farmer education programs to improve adoption of modern techniques.
3. Enhanced access to credit through cooperative societies.

Acknowledgement

This work was supported by Tertiary Education Trust Fund (TetFund) under the Institutional Based Research (IBR) research grant: TETF/ES/UNIV/CE/AL2024/VOL.I

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