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PROFITABILITY AND CONSTRAINTS OF RICE FARMING UNDER THE FADAMA III PROJECT IN KEBBI STATE, NIGERIA

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ABSTRACT

This study evaluates how the Fadama III project has affected the profitability of farming rice in Nigeria's Kebbi State. Smallholder farmers encounter major production barriers despite the state's agricultural potential, such as limited access to contemporary inputs, inadequate infrastructure, and climate-related issues. Data was collected from 500 rice farmers, 250 of whom were project beneficiaries and 250 of whom were not, using a multistage sample technique. The data was analyzed using descriptive statistics and farm budget analysis. The results show that compared to non-beneficiaries, Fadama III beneficiaries are slightly older, more educated, and primarily male. Additionally, beneficiaries invest more in important inputs like seeds, fertilizer, and machinery and larger land areas. When compared to non-beneficiaries (3,543.08 kg/ha), this investment produces significantly higher rice yield (5,180.12 kg/ha), increasing revenue and net farm income. The program's strong economic impact is demonstrated by the beneficiaries' average net farm income of ₦248,746.65, which is significantly greater than the non-beneficiaries' ₦143,677.79. Both groups have to contend with production limitations, though, with the most urgent issues being high fuel prices, flooding, and pest infestations. While non-beneficiaries depend more on manual labour, beneficiaries claim better mechanization and cheaper labour expenses. To maintain the benefits of the intervention, the study emphasizes the necessity of better infrastructure, extension services, and easier access to credit. Farm productivity and profitability have increased dramatically under Fadama III, enhancing its contribution to economic growth and poverty alleviation. To optimize long-term gains in Nigeria's rice industry, agricultural policies and intervention initiatives must be strengthened.

Keywords: Profitability, Constraints, Rice Farming, Fadama III Project, Kebbi State

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INTRODUCTION

The Fadama III project, a continuation of Fadama II, has significantly contributed to poverty reduction and economic development (Oyebode & Akinbile, 2021). This impact is particularly evident in Kebbi State, a region with high poverty levels despite its vast agricultural potential. The preceding Fadama II project, implemented across 12 states, including Kebbi, made notable strides in poverty alleviation by targeting vulnerable rural populations. However, the challenge of enhancing agricultural productivity remains a critical factor in addressing poverty. Research has consistently shown a strong link between agricultural growth and poverty reduction, where increased farmers' incomes drive overall economic improvements (Rehman et al., 2016). Fadama III has played a pivotal role in this regard, boosting farmers' incomes and improving agricultural productivity in Kebbi State. The program has been particularly effective in mitigating productivity constraints that hinder agricultural development in the state and the broader North-West region, where deteriorating rural resources and declining agricultural output pose significant challenges (Stanley & Mulugeta, 2022).

In Kebbi State, where agriculture serves as the backbone of the economy, smallholder farmers face numerous obstacles in enhancing their production. Limited access to modern inputs, poor infrastructure, and inadequate storage facilities significantly restrict their ability to maximize output. For these farmers, increasing yields is essential for both household food security and income generation through market sales. However, outdated farming techniques, insufficient irrigation, and limited access to fertilizers and seeds often constrain their productivity (Touch et al., 2024). Despite interventions under the Fadama III project, a significant gap persists between production levels and food needs. Farmers are frequently compelled to sell surplus produce during harvest periods, exposing them to food insecurity during the off-season.

Impact evaluations of Fadama III highlight its positive contributions to crop yields and farm incomes, particularly through initiatives that enhance access to credit, improve infrastructure, and increase the availability of agricultural inputs. Studies suggest that programs like Fadama III play a crucial role in improving rural livelihoods, making them integral to poverty alleviation strategies in regions such as Kebbi State (Jumoke, 2012). Despite Nigeria’s vast agricultural potential, the sector continues to struggle with challenges such as low input usage, desertification, drought, and climate change, all of which are exacerbated by the dominance of rain-fed farming. These factors place severe constraints on food production, necessitating continuous efforts to improve agricultural output as a means of enhancing livelihoods (Oxfam, 2020).

Several studies have been conducted at both national and state levels (Ephraim et al., 2007; Jumoke, 2012; Kolapo et al., 2022), yet none have comprehensively assessed the post-project impact of Fadama III on profitability among households in Kebbi State. Recent research has examined various aspects of the program. For example, Ajibola et al. (2020) analyzed its influence on income generation and crop productivity in Kebbi State, confirming substantial improvements in farmer incomes. However, there remains a need for a more in-depth evaluation of the project’s effects on farmers' profitability.
To address this gap, this study aims to:

1. Describe the socioeconomic characteristics of both project beneficiaries and non-beneficiaries in the study area.
2. Assess and compare the profitability of beneficiary and non-beneficiary farmers under the Fadama III project.

METHODOLOGY

The Study Area

The study was conducted in Kebbi State, located in the Sahel Savannah vegetation zone of northwestern Nigeria, between latitudes 10° and 14°N and longitudes 3° and 7°E (Maikasuwa et al., 2023). It shares borders with the Niger and Benin Republics to the west, Sokoto and Zamfara States to the northeast, and Niger State to the south (KARDA, 2018). The state covers approximately 36,229 km², accounting for 3.92% of Nigeria's total land area, with an estimated population of 5,660,444, growing at an annual rate of 3.5% (NBS, 2015).

Kebbi State is predominantly agrarian, benefiting from the fertile Fadama floodplains of the Niger, Rima, and Ka rivers, which provide highly productive alluvial soil suitable for both rain-fed and irrigated farming. Key rain-fed crops cultivated in the state include millet, groundnuts, cowpeas, maize, fonio (acha), and sorghum. During the dry season, irrigation farming along the riverbanks supports the production of vegetables such as spinach, rice, tomatoes, peppers, eggplants, and onions, grown both for subsistence and commercial purposes. Rice farming, in particular, plays a vital role in the state's economy and food security, serving as a major cash crop that provides employment, income, and a staple food source for thousands of households, thereby contributing significantly to economic growth.

Sampling Procedure and Sample Size

A multistage random sampling technique was employed to select respondents from both project beneficiaries and non-beneficiaries in the state. The study's sample population was drawn from the entire state, which is administratively divided into four Agricultural Development Project (ADP) Zones: I, II, III, and IV. In the first stage, a simple random sampling method was used to select 11 Local Government Areas (LGAs) out of the 21 in the state, with 4 LGAs chosen from Zone I, 3 from Zone II, and 2 each from Zones III and IV. In the second stage, 14 Fadama Community Associations (FCAs) were randomly selected from each of the chosen LGAs. The third stage involved the random selection of 83 Fadama User Groups (FUGs) from these FCAs. Finally, in the fourth stage, 250 beneficiary farmers were randomly selected from the identified FUGs. To ensure a balanced comparison, 250 non-beneficiary farmers were selected using the same procedure. However, these non-beneficiaries were specifically chosen as immediate neighbors of the beneficiary farmers, ensuring similarity in socioeconomic, cultural, and climatic characteristics. In total, the study utilized a sample size of 500 farmers, comprising 250 beneficiaries and 250 non-beneficiaries.

Data Collection

The primary data used in the study were collected using a well-structured and pre-tested questionnaire, which was administered to both beneficiaries and non-beneficiaries by the researcher with the support of a team of trained enumerators. Data collection spanned a continuous period of two months and was conducted in Fadama-benefiting villages across the eleven selected LGAs from the 21 benefiting LGAs in the state.

Method of Data Analysis

The study objectives were analyzed using both descriptive statistics and farm budget analysis. Descriptive statistics, including frequency, percentages, and mean, were employed to

describe the socioeconomic characteristics of the farmers and identify constraints to rice production. Farm budget analysis was utilized to assess the profitability of the farmers.

Specification of the Net Farm Income (NFI)

According to Olukosi and Erhabor (2005) and Bose et al. (2015), the farm budget technique is a farm planning and budgeting tool used to determine the profitability of a given enterprise.

Mathematically, following the work of Obalola et al. (2017), this is expressed as;

$$NFI = TR - TC \quad (1)$$

Where;

NFI = Net farm income (₦)

TR = Total revenue (₦)

TC = Total cost (₦).

However, Total revenue (TR) is expressed as;

$$TR = Py * Q \quad (2)$$

Where;

Py = Price of output

Q = Quantity of output.

TC is expressed;

$$TC = TVC + TFC \quad (3)$$

Where;

TVC= Total variable cost (₦)

TFC= Total fixed cost (₦)

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

Table 1 presents the socioeconomic characteristics of farmers in the study area, providing insights into the factors influencing agricultural participation and productivity. In Hausa/Fulani households, the father typically serves as the head, responsible for allocating resources and meeting family needs. This patriarchal structure is reflected in the gender distribution of farmers, with men comprising the majority (84.8%) among beneficiaries and 91.6% among non-beneficiaries. The low female participation in agriculture aligns with traditional gender roles, as women in Nigeria often face limited access to inputs and

extension services, leading to lower yields compared to men (World Bank, 2023). The age distribution indicates that most farmers fall within the 28–49 age bracket, accounting for 62% of beneficiaries and 58% of non-beneficiaries. The average age of beneficiaries (45.73 years) is slightly higher than that of non-beneficiaries (43.02 years), suggesting that the program tends to support individuals who are still physically capable of farm work.

Marriage is a significant aspect of social structure in northern Nigeria, often seen as a marker of responsibility and a means of enhancing household labor. The study finds that 89% of beneficiaries and 83.6% of non-beneficiaries are married, reflecting a cultural norm rooted in religion and tradition that fosters community stability and ensures farm labor availability (Ayinde & Obalola, 2017). Household size, another critical determinant of agricultural labor, is influenced by polygamous practices and high fertility rates. Beneficiaries reported an average household size of six, slightly higher than the five recorded for non-beneficiaries. Larger households can provide a stable labor force, reducing farming costs (Tanko & Obalola, 2013). However, they can also exacerbate poverty and food insecurity, especially in agrarian households reliant solely on farming (Ubokudom et al., 2017; Aboaba et al., 2020). Education levels also differ between the two groups. Among beneficiaries, 62% have formal education, while 62.2% of non-beneficiaries have informal education. Landholding size further distinguishes the groups, with beneficiaries cultivating an average of 1.86 hectares compared to 1.21 hectares for non-beneficiaries. Despite this difference, both groups operate on a small scale, aligning with the findings of Tanko and Obalola (2013) regarding Fadama farmers.

Table 1: Socioeconomic characteristics of the beneficiary and non-beneficiary farmers

	Beneficiary		**Non-Beneficiary**	
Variables	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Sex				
Male	212	84.8	229	91.6
Female	38	15.2	21	8.4
Age				
17-27	6	2.4	14	5.6
28-38	52	20.8	62	24.8
39-49	103	41.2	107	32.8
50-60	75	30.0	61	24.4
≥ 61	14	5.6	6	12.4
Mean	45.73		43.02	
Marital status				
Married	222	89.0	209	83.6
Single	20	8.0	37	14.8
Divorced	4	1.0	2	0.8
Widow	5	2.0	2	0.8
Household size				
1 – 5	139	56.0	139	56.0
6 -10	88	35.0	95	38.0
11 – 15	16	6.0	12	4.8
≥ 15	7	3.0	4	1.6
Mean	6.02		5.48	
Education				
Informal Education	95	38.0	156	62.2
Primary Education	32	13.0	13	5.2

Secondary Education	88	35.0	59	23.6
Tertiary Education	35	14.0	22	9.0
Farm size				
≤ 0. 59	48	19.2	47	18.8
0.60 – 1.59	136	54.4	145	58.0
1.60 –2.59	30	12.0	37	14.8
2.60 – 3.59	26	10.4	14	5.6
≥ 3.60	10	4.0	7	2.8
Mean	1.86		1.21	

Source: Field Survey, 2016

Costs and returns on rice enterprise

The result in Table 2 highlights the economic dynamics of rice production among beneficiaries and non-beneficiaries in the study area. Beneficiaries spent more on critical inputs such as seeds and inorganic fertilizers, reflecting enhanced access to resources and improved farming techniques. For instance, beneficiaries allocated ₦8,492.96 to seeds (6.06% of total cost) and ₦33,330.58 to fertilizers (23.77%), surpassing the ₦5,018.80 (3.99%) and ₦24,114.44 (19.19%) spent by non-beneficiaries, respectively. This disparity underscores the positive influence of agricultural intervention programs in enhancing resource availability. Similar findings were reported by Afolami and Adeoye (2020), who linked increased input adoption to higher yields in Nigerian rice farming. Beneficiaries also demonstrated greater mechanization and input utilization, as evidenced by their higher expenditure on fuel and lubricants (₦24,114.94, 17.19%) compared to non-beneficiaries (₦12,822.48, 10.20%). Mechanization, though costly, reduces reliance on manual labour and enhances efficiency. Interestingly, non-beneficiaries incurred higher labour costs (₦67,011.06, 53.32%) compared to beneficiaries (₦53,654.40, 38.26%), highlighting a reliance on traditional labour-intensive methods. By contrast, beneficiaries' reduced labour costs suggest improved labour efficiency through mechanization.

Apart from the primary input costs, beneficiaries also had a slightly lower expenditure on organic fertilizers (₦3,840.08, 2.737%) compared to non-beneficiaries (₦4,289.84, 3.41%), although this difference was not statistically significant. Beneficiaries, however, spent more on agrochemicals (₦8,308.80, 5.92%) than non-beneficiaries (₦6,052.00, 4.82%), which indicates that improved pest and weed management practices were more widely adopted among beneficiaries. Additionally, the total variable cost was significantly higher for beneficiaries (₦131,741.54) compared to non-beneficiaries (₦116,893.42), demonstrating a greater investment in production.

Fixed costs also differed between the two groups, with beneficiaries incurring higher depreciation costs for essential equipment such as hoes (₦1,800.00) and sickles (₦1,050.00) compared to non-beneficiaries (₦1,200.00 and ₦400.00, respectively). Conversely, non-beneficiaries had slightly higher depreciation on threshing boards (₦1,100.00) and spraying cans (₦873.69) compared to beneficiaries (₦900.00 and ₦761.69, respectively). The total fixed cost for beneficiaries (₦8,511.69) was significantly higher than for non-beneficiaries (₦6,373.69), which suggests that beneficiaries invested more in durable farm assets, likely due to better financial support and access to credit through intervention programs.

Despite their higher costs, beneficiaries achieved substantially better outcomes. Their average rice yield (5,180.12 kg/ha) and revenue (₦362,608.40) far outstripped those of non-beneficiaries (3,543.08 kg/ha and ₦248,015.60). The differences, significant at the 1% level of probability, affirm the effectiveness of interventions in improving productivity. The revenue from rice residue also followed a similar pattern, with beneficiaries earning

₦26,392.70 compared to ₦21,344.50 for non-beneficiaries, highlighting the importance of utilizing all production components for maximum returns. Consequently, the total revenue generated by beneficiaries was significantly higher at ₦389,000.10 compared to ₦269,360.10 for non-beneficiaries. These higher revenues translated into a significantly higher net farm income for beneficiaries (₦248,746.65) compared to non-beneficiaries (₦143,677.79). The significant differences in net farm income ($p < 0.01$) emphasize the economic advantages of enhanced farming support programs.

Table 2: Average costs and returns for the rice enterprise in naira per hectare

	Beneficiary			Non-Beneficiary			
	Input quantity	Amount (₦)	Percentage	Input quantity	Amount (₦)	Percentage	t-value
Cost Component							
Variable Cost							
Seeds (kg)	54	8492.96	6.06	48	5018.80	3.99	5.201***
Inorganic Fertilizer (kg)	259	33330.58	23.77	163	24114.44	19.19	8.854***
Organic Fertilizer (kg)	3837	3840.08	2.737	4161	4,289.84	3.41	-1.572
Labour (no of manday)	89	53654.40	38.26	112	67011.06	53.32	3.444***
Agrochemicals (ltrs)	5.7	8308.80	5.92	4.1	6052.00	4.82	4.050***
Fuel/Lubricants (ltrs)	146	24114.94	17.19	78	12822.48	10.20	7.028***
Total Variable Cost		131741.54			116893.42		2.234**
Fixed Costs							
Depreciation on hoe		1800.00	1.28		1200.00	0.96	1.67*
Depreciation on cutlass		1200.00	0.86		800.00	0.64	1.88*
Depreciation on threshing board		900.00	0.64		1100.00	0.88	2.42**
Depreciation on sickle		1050.00	0.75		400.00	0.32	4.23***
Depreciation on spraying can		761.69	0.54		873.69	0.69	2.15**
Depreciation on water pump		2100.00	1.50		1400.00	1.11	1.34
Depreciation on hoses and sprinklers		700.00	0.50		600.00	0.47	1.12
Total Fixed Cost		8511.69			6,373.69		2.463**
Total Cost		140253.45	100.00		125682.31		2.503**
Revenue Component							
Rice Output		5180.12			3543.08		7.594***
Price per Unit of Rice Output		70			70		
Revenue from Rice		362608.40			248015.60		7.594***
Residue Output		1055.67			853.78		2.696***
Price per Unit of Residue Output		25			25		
Total Revenue		389000.10			269360.10		7.732***
Net Farm Income		248746.65			143677.79		6.93***

Source: Field survey, 2016

*, **, *** represents 10%, 5% and 1% significance levels, respectively

Production Constraints Under Fadama III Project

The bottlenecks to production were identified among the rice farmers in the study area and the results presented in Figure 1.

Figure 1 indicates the distribution of constraints among beneficiary and non-beneficiary rice farmers, highlighting the most frequently reported issues. Notably, the most frequent challenge faced by both groups was the high cost of petrol, which affected 86% of beneficiary farmers and 65% of non-beneficiaries, amounting to a total of 380 reports. Flooding emerged as the second most common constraint, with 74% of beneficiaries and 48% of non-beneficiaries affected, aggregating to 355 responses. Pest and disease attacks ranked third, with 68% of beneficiaries and 70% of non-beneficiaries reporting it, totaling 340 responses. Other significant challenges included a lack of extension advice, reported by 62% of beneficiaries and 68% of non-beneficiaries, totaling 324 responses, and a lack of credit, which affected 52% of beneficiaries and 68% of non-beneficiaries, with a total of 298 responses. The high cost of fertilizers also garnered attention, affecting 34% of beneficiaries and 69% of non-beneficiaries, with a total of 273 reports.

Non-availability of improved seeds was another concern, with 32% of beneficiaries and 65% of non-beneficiaries citing this issue, totaling 230 responses. The high cost of labour was reported by 45% of beneficiaries and 58% of non-beneficiaries, leading to 263 total reports. Meanwhile, inadequate water supply was identified by 28% of both groups, resulting in 140 total responses. Constraints like inadequate storage, shortage of tractor services, and non-availability of land were less frequent, with each factor having a lower percentage across both groups, resulting in smaller total responses. Specifically, inadequate storage and non-availability of land were each reported by 28% of beneficiaries, with a total of 140 responses. Shortages of tractor services were reported by 26% of beneficiaries, amounting to a total of 121 responses.

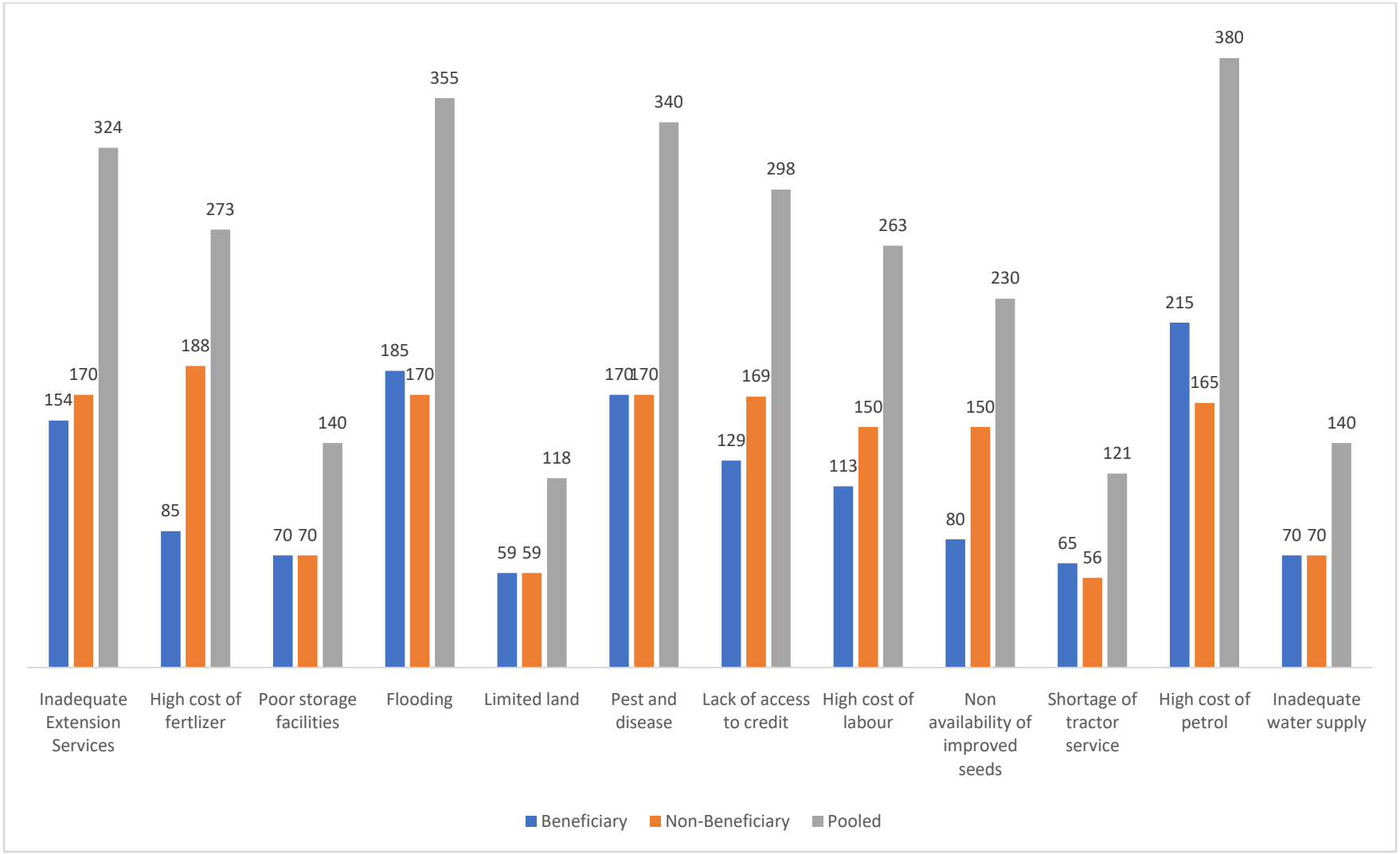


Figure 1: Constraints to rice production under Fadama farming as identified by farmers
Note: Multiple response allowed

Conclusion

Rice farming in northern Nigeria is shaped by patriarchal structures, with male dominance in decision-making. Beneficiaries are older, favouring experienced farmers. Marriage and household size influence labour and productivity, while education enhances farming knowledge, underscoring its role in improving agricultural practices and economic outcomes. The economic analysis of rice production reveals that beneficiaries, supported by intervention programs, exhibit higher investment in critical inputs, mechanization, and agrochemicals, leading to superior yields and profitability. The substantial difference in net farm income underscores the effectiveness of such programs in enhancing productivity and economic well-being. However, persistent constraints such as high fuel costs, flooding, pest infestations, and limited access to credit and extension services remain significant challenges for both groups. Addressing these barriers through targeted policies and infrastructural improvements will be essential in sustaining the positive impacts of agricultural interventions and ensuring long-term growth in Nigeria's rice sector.

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