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Evaluating The Effects of Fadama III Project on Agricultural Efficiency and Food Security Among Millet Farmers in Kebbi State, Nigeria

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Abstract- This study examines the impact of the Fadama III project on technical efficiency and food security among millet farmers in Kebbi State, Nigeria. A multistage random sampling technique was employed to select 500 respondents, comprising 250 beneficiaries and 250 non-beneficiaries. Data were collected through a structured questionnaire over a two-month period. Descriptive statistics, stochastic frontier production analysis, and food security metrics were used for data analysis. Findings reveal that beneficiary farmers exhibit higher technical efficiency than non-beneficiaries, with mean efficiency scores of 0.793 and 0.660, respectively. The stochastic frontier model indicates that seed, inorganic fertilizer, and labor significantly enhance millet production for beneficiaries, whereas organic fertilizer and labor contribute more to non-beneficiaries' output. Furthermore, inefficiency decreases significantly by education and extension services, highlighting the need of capacity-building programs. According to the food security assessment, which is based on household food expenditure, 71% of beneficiaries were food secure, with only 33% of non-beneficiaries. With a food insecurity incidence of 0.72 compared to 0.29 for beneficiaries, the food insecurity incidence, depth, and severity indices further show that non-beneficiaries are more vulnerable. Notwithstanding these successes, beneficiaries' food insecurity has not completely disappeared as a result of the project, underscoring the necessity for ongoing assistance. Although there are still gaps, the Fadama III project has generally improved food security and agricultural productivity. Its influence can be increased even more by bolstering financing availability, extension services, and better inputs. These findings provide insights for policymakers seeking to design targeted interventions for smallholder farmers in Nigeria and beyond.

I. INTRODUCTION

The agricultural sector plays a critical role in ensuring food security in Nigeria, with staple grains such as maize, sorghum, rice and millet forming the backbone of the national diet. Among these, millet has emerged as an essential staple for many households, particularly in the northern Nigeria. However, domestic production has struggled to keep pace with rising demand. The Food and Agriculture Organization (FAO, 2023) highlights that Nigeria's millet consumption has remained essential due to its adaptability to arid conditions and its role as a staple in many rural households. However, despite its resilience and nutritional benefits, millet production has not kept pace with rising demand, particularly as population growth and changing consumption patterns influence food preferences. This production shortfall has necessitated increased reliance on imports and alternative grains, placing additional pressure on local food systems and exposing vulnerabilities in food security. The continued challenges in millet production underscore the urgency of improving domestic agricultural productivity to enhance self-sufficiency and ensure long-term food security, particularly in regions like Kebbi State, where millet serves as a critical source of sustenance and income for smallholder farmers.

Food security extends beyond food production to include accessibility, affordability, and proper utilization. The World Bank (2020) defines food security as the ability of individuals to access sufficient, safe, and nutritious food to meet their dietary needs and preferences for an active and healthy life. In regions like Kebbi State, where agriculture is the backbone of the economy, production efficiency is central to achieving this goal. The Fadama III Project was introduced across all 21 Local Government Areas (LGAs) in Kebbi State to enhance agricultural productivity and reduce food insecurity by providing farmers with access to modern inputs, improved technologies, and extension services. However, despite these interventions, smallholder farmers continue to face challenges such as limited access to improved seeds, fertilizers, irrigation infrastructure, and mechanization, which hinder their ability to maximize yields and secure year-round food availability.

Production efficiency plays a fundamental role in food security, as it determines the ability of farmers to produce sufficient quantities of food to sustain household consumption and generate income. Smallholder farmers in Kebbi State often struggle with outdated farming techniques and poor access to critical inputs, leading to suboptimal yields (Touch et al., 2024). Although Fadama III sought to address these challenges, many farmers still experience seasonal food insecurity, particularly during the off-season when market dynamics force them to sell excess produce at harvest, leaving them vulnerable to food shortages later in the year (Stanley & Mulugeta, 2022). Furthermore, economic access to food remains a significant barrier, as many rural farmers lack the financial resources to purchase food when their own production is insufficient. While the Fadama III Project has contributed to increased food production through improved agricultural practices, long-term food security requires a holistic approach that integrates sustainable productivity, market accessibility, and efficient resource management. Nigeria's agricultural sector remains vulnerable due to its heavy reliance on rain-fed farming, low adoption of modern inputs, and the adverse effects of climate change, desertification, and drought (FAO, 2023). These challenges exacerbate food insecurity, particularly in rural regions like Kebbi State, where high poverty levels further compound the issue (Daniel & Mulugeta, 2020).

The Fadama III Project was designed to improve agricultural productivity and enhance food security, yet inefficiencies in farm management and resource utilization continue to limit its full impact. Previous studies, such as those by Ephraim et al. (2007), Bello (2009), Jumoke (2012), and Kolapo et al. (2022), have evaluated various aspects of the project, but there remains a gap in understanding its long-term impact on production efficiency and food security. While the project provided beneficiaries with access to improved seeds, fertilizers, and training, constraints such as inadequate irrigation systems, poor storage facilities, and market fluctuations have hindered sustained improvements in food security. Increased agricultural output does not necessarily translate to stable food access, as post-harvest losses, poor farm-to-market infrastructure, and fluctuating food prices continue to affect farmers' economic stability.

Given these concerns, there is a need for a comprehensive evaluation of the Fadama III Project's effectiveness in improving technical efficiency and food security among smallholder farmers in Kebbi State. A more in-depth analysis will provide insights into whether the project has led to sustainable improvements in agricultural productivity and whether these improvements have translated into enhanced food security at both the household and community levels. This study aims to bridge this gap by assessing the impact of Fadama III on production efficiency and food security among beneficiary and non-beneficiary households in Kebbi State.

II. METHODOLOGY

A. The Study Area

The study was carried out in Kebbi State, which is in the Sahel savannah vegetation zone in northwestern Nigeria between latitudes 10^0 and 14^0N and longitudes 3^0-7^0E (Maikasuwa et al., 2023). It is bordered to the west by the Niger and Benin Republics, to the northeast by the Nigerian States of Sokoto and Zamfara, and to the south by Niger State (KARDA, 2018). Its total landmass is approximately 36,229 km^2, which makes up 3.92% of the country's land area, and its estimated population is 5,660,444 at a 3.5% annual growth rate (NBS, 2015).

With the Fadama flood plains of the Niger, Rima, and Ka rivers and their tributaries, as well as fertile alluvial soil ideal for rain-fed and irrigated cultivation, Kebbi is an agrarian state with vast agricultural potential. Millet, groundnuts, cowpeas, maize, fonio (acha), and sorghum are among the crops that are rain-fed. Along the flood plains of these rivers, green crops such as spinach, rice, tomato, pepper, eggplant, and onion are mostly grown under irrigation during the dry season for both personal consumption and commercial purposes. One of the main pillars of Kebbi State's economy and food security is millet farming. For thousands of people, this crop offers jobs, cash, and staple foods. Consequently, it is an important cash crop that supports the state's economic expansion.

B. Sampling Procedure and Sample Size

The respondents were chosen from among the state's project beneficiaries and non-beneficiaries using a multistage random sampling technique. The entire state, which was administratively separated into four Agricultural Development Project Zones (ADP) I, II, III, and IV, makes up the study's sample population. To arrive at eleven LGAs out of 21 throughout the four ADP zones, the first step entailed a simple random selection of 4, 3, 2, and 2 LGAs from Zones I, II, III, and IV, respectively. Fourteen Fadama Community Associations (FCAs) from each of the LGAs were chosen at random in the second stage. From the previously chosen FCAs, 83 Fadama User Groups (FUGs) were then chosen at random. Finally, 250 beneficiary farmers were chosen at random from the FUGs in the fourth stage. The same process was used to choose 250 non-beneficiaries for the research. However, because they have similar socioeconomic, cultural, and climatic characteristics, these non-beneficiaries were the beneficiary farmers' immediate neighbours. The study used a sample size of 500 farmers in total.

C. Data Collection

The primary data for the study were generated through a well-structured and pre-tested questionnaire administered on the beneficiaries and non-beneficiaries by the researcher with the assistance of a team of trained enumerators. The data was collected over a continuous period of two months from the Fadama benefiting villages across the eleven selected LGAs out of the benefiting 21 LGAs of the state.

D. Method of Data Analysis

Both descriptive and inferential statistics were used in analyzing the study objectives. Descriptive statistics such as frequency, percentages and mean were used to describe the socioeconomic characteristics of the beneficiary and non-beneficiary farmers. Stochastic frontier production and the household food expenditure were used for estimating the technical efficiency and food security status of the farmers.

E. Specification of the Models

i. Stochastic production frontier models

Following Battese and Coelli (1995) and modifying the empirical specifications used by Danso-Abbeam and Baiyegunhi (2020), the specifications are specified as;

Cobb-Douglas production function

$$\ln Y_i^s = \ln\beta_0^s + \beta_1^s \ln X_1 + \beta_2^s \ln X_2 + \beta_3^s \ln X_3 + \beta_4^s \ln X_4 + \beta_5^s \ln X_5 + \beta_6^s \ln X_6 + v_i^s - u_i^s \quad (1)$$

Where,

Y_i^s = Output (kg) (Rice, Millet or Cowpea),

X_1 = Farm size (ha),

X_2 = Seed quantity (kg),

X_3= Inorganic fertilizer (kg)

X_4= Organic fertilizer (kg),

X_5 = Labour (family and hired) (man-day),

X_6 = Agrochemical (ltr),

In = Natural logarithm

The inefficiency effects, U_i is assumed to be a function of explanatory variables and is specified as:

$$U_i = \delta_0 + \delta_1 E_1 + \delta_2 E_2 + \delta_3 E_3 + \delta_4 E_4 + \delta_5 E_5 + \delta_6 E_6 + \delta_7 E_7 + w_i \quad (2)$$

Where,

U_i = Inefficiency effect of the i^{th} farm

E_1 = Age of farmer (years)

E_2 = Sex (dummy; 1 if male, 0, otherwise)

E_3 = Household size (number of people)

E_4 = Level of education (no of years spent in school)

E_5 = Extension contacts (no of visits)

E_6 = Access to credit (dummy; 1 if accessed; 0, otherwise)

E_7 = Farming experience (years)

δ_0, δ_1 to δ_7 = Parameters to be estimated

w_i = error term

ii. Food security index (household food expenditure approach)
The food security status of the Fadama III beneficiary and non-beneficiary was achieved by determining their households' expenditure on food, from which the per-capita household expenditure was estimated. The food security index was determined by dividing the per-capita food expenditure of the ith household by the two-third mean per capita food expenditure of all households. Estimate from the food security index was used to classify households as food secure or food insecure based on the position they fall. This is expressed as:

$$Z_i = \frac{per\ capita\ food\ expenditure\ of\ the\ ith\ household}{\frac{2}{3} per\ capita\ food\ expenditure\ of\ all\ households} \quad (3)$$

Where,
Z_i represents Food Security Index of ith household.

A household is regarded as food secure when its per-capita monthly food expenditure is above or equal to the two-third mean per capita monthly food expenditure. Conversely, when the per-capita food expenditure of a household falls below the two-third mean per capita monthly food expenditure of all the households sampled, the household is said to be food insecure. However, the amount of expenditure required by different households based on household composition with respect to age and sex was calculated. This was achieved by dividing the household expenditure by the household size to get the per-capita expenditure.

Using the Foster, Greer and Thorbecke index to measure food security, the study further estimated other indices such as food insecurity gap (FIG), headcount ratio (HCR) and severity of food insecurity among households;

$$F = \frac{1}{M} \sum_{i=1}^{M} G_i\,, \quad where\ G_i = \frac{(G-R)^{\propto}}{G} \qquad (4)$$

Where
F = Food security index
G = Food security line (2/3 of the mean per capita food expenditure)
R = Per-capita food expenditure in increasing order for all households (₦)
q = number of households below food security line (#)
n = total number of households in the population (#)
α = the aversion parameter which takes values of 0, 1 or 2.

When α = 0, Fα is the head count index measuring the incidence of food insecurity, which means the proportion of food insecure people from the total population.

When α = 1, F1 is the food insecurity gap, measuring the depth of food insecurity. That is, on the average, how far the food insecure households are from the food security line
When α = 2, F2 is the severity of insecurity among households. This means the depth of food insecurity and inequality among the poor.

III. RESULTS AND DISCUSSION

A. 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). 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

B. Maximum likelihood estimates of stochastic production function (technical efficiency and inefficiency) for millet production

The findings from the Maximum Likelihood Estimates of the Stochastic Production Function for millet production in Kebbi State reveal significant insights into production efficiency among Fadama III beneficiaries, non-beneficiaries, and the pooled group (Table 2). The sigma square values for all groups (beneficiary: 0.2239; non-beneficiary: 0.2117; pooled: 0.2129) indicate consistency and reliability of the model in explaining variability in production. The relevance of the sigma squared is consistent with the findings of Azumah et al. (2019). Gamma values for the pooled results (0.9350) and beneficiaries (0.8651) suggest a high proportion of inefficiency effects relative to total production variability. Log-likelihood values (-135.23, -145.38, and -265.46, respectively) confirm model fit across groups.

For Fadama III beneficiaries, seed input positively influences millet production (coefficient = 0.0204; $p<0.05$), affirming its role in increasing yields. Similarly, inorganic fertilizer and labour contributes positively and significantly (coefficient = 0.0127; 0.0022; $p<0.01$; $p<0.05$, respectively) to efficiency. This is in contrast to the findings of Anang et al. (2016)

but confirms those of Azumah et al. (2019), and Okoh et al. (2021) who reported a positive relationship between these inputs use and output. The findings underscore the critical role of inputs like seeds, fertilizers, and labour in boosting millet production, particularly for beneficiaries of Fadama III.

Among non-beneficiaries, organic fertilizer and labour significantly influence output (coefficient = 0.0940; 0.0049; $p<0.01$, respectively), underscoring reliance on traditional practices. This is in tandem with the works of Osanyinlusi and Adenegan (2016), Opata et al. (2018). The pooled results reveal that farm size positively impacts production efficiency (coefficient = 0.2351; $p<0.01$), while organic fertilizer remains negatively significant (coefficient = -0.1111; $p<0.01$), suggesting issues with its application across all groups.

On the inefficiency effect, for beneficiaries, education significantly reduces inefficiency (coefficient = -0.0684; $p<0.01$), indicating that training and extension services, as facilitated by Fadama III, enhance productivity. This is corroborated by Nwachukwu et al. (2016) and Binuyo et al. (2016), who found improved literacy levels critical for optimizing program benefits. In the pooled data, extension contact significantly reduces inefficiency (coefficient = -0.1689; $p<0.01$), affirming that access to advisory services plays a pivotal role. Interestingly, in the pooled results, sex (coefficient = -0.4810; $p<0.1$) suggests that male farmers are relatively more efficient, though this is marginal. Credit access positively influences efficiency (coefficient = 0.7152; $p<0.05$), highlighting the importance of financial inclusion.

Table 2: Maximum likelihood estimates of stochastic production function (technical efficiency and inefficiency) for millet enterprise

	Beneficiary		Non-Beneficiary		Pooled	
Variables	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Production Model						
Constant	7.9276***	36.19	6.4453***	7.14	8.5406***	38.64
Farm size	0.0417	0.66	-0.2117	-1.44	0.2351***	3.83
Seeds	0.0204**	2.40	-0.0042	-0.15	0.0256*	1.66
Inorganic fertilizer	0.0127***	2.90	0.0197	1.06	0.0138	1.46
Organic fertilizer	-0.0239	-0.76	0.0940***	2.88	-0.1111***	-3.74
Labour	0.0022**	2.41	0.0049***	3.42	0.0102	1.23
Inefficiency Model						
Constant	-2.9926***	-15.66	285.4246	0.83	592.4136***	2.39
Age	0.0049	0.28	-0.0138	-1.01	-0.0165*	-1.85
Sex	0.2590	0.32	-0.5682	-1.49	-0.4810*	-1.70
Household size	-0.0886	-1.63	0.0207	0.57	0.0004	0.02
Education	-0.0684***	-2.59	0.0129	0.83	0.0270**	2.39
Extension contact	-0.0193	-0.20	-0.0432	-0.48	-0.1689***	-3.21
Access to credit	0.1429	0.16	0.4419	1.15	0.7152**	2.26
Farming experience	0.0158	1.14	-0.0198*	-1.92	-0.0034	-0.52
Diagnostic statistics						
Sigma square	0.2239***	10.46	0.2117***	7.99	0.2129***	11.45
Gamma	0.8651***	18.036	0.7049***	12.41	0.9350***	17.71
Log-likelihood	-135.2347		-145.3823		-265.4648	
N	250		250		500	

Source: Field Survey, 2016
***P< 0.01, **p< 0.05, *p< 0.1

C. Technical efficiency (TE) of the millet farmers in the study area

The Table 3 shows the distribution of technical efficiency (TE) for beneficiary, non-beneficiary and the pooled millet farmers in the study area. These efficiency scores help assess how well the farmers are utilizing their resources to maximize output. A significant proportion of beneficiary farmers (47.2%) fall within the high- technical efficiency (TE) category of 0.81-0.90. This indicates that the majority of beneficiary farmers are operating near their maximum production potential, with only slight inefficiencies in their operations. The mean TE score for beneficiaries is 0.793, suggesting a high level of technical efficiency overall. On the other hand, non-beneficiaries display a more uneven distribution, with only 17.6% of farmers achieving TE scores above 0.81. Their mean TE score is lower (0.660), which suggests that non-beneficiaries are less efficient in utilizing their resources to maximize output. These findings highlight the positive impact of the Fadama III project, which appears to have enhanced the technical efficiency of its beneficiaries, likely through improved access to technology, training, and other resources.

Table 3: Distribution of the beneficiary and non-beneficiary millet farmers by technical efficiency

	Beneficiary		Non-Beneficiary		Pooled	
Efficiency distribution	TE		TE		TE	
	F	%	F	%	F	%
≤0.50	7	2.80	70	28.00	98	19.60
0.51-0.60	1	0.40	19	7.60	42	8.40
0.61-0.70	25	10.00	27	10.80	114	22.80
0.71-0.80	85	34.00	84	33.60	113	22.60
0.81-0.90	118	47.20	44	17.60	120	24.00
>0.90	14	5.60	6	2.40	13	2.60
Total	250	100.00	250	100.00	500	100.00
Mean	0.793		0.636		0.656	
Minimum	0.403		0.142		0.141	
Maximum	0.956		0.937		0.953	

Source: Field Survey, 2016
Note: TE is Technical efficiency
F and % denotes frequency and percentages, respectively

For the pooled farmers, 24% of them achieved TE scores between 0.81-0.90, which suggests that a substantial proportion of farmers are operating near their maximum production potential. However, 19.6% of farmers had TE scores ≤0.50, indicating that a notable portion of the farmers are experiencing significant inefficiencies in resource use. The mean TE score is 0.656, which indicates a moderate level of efficiency in the use of resources for millet production. These results align with other studies which report variability in technical efficiency, with some farmers able to achieve near-optimal performance while others struggle to make efficient use of their resources (Aboaba, 2020).

Food Security Status of the Beneficiary and Non-Beneficiary Farmers

The household food expenditure approach where the food security line was calculated using two-third of mean per capita food expenditure (MPCFE) for Fadama III beneficiary and non-beneficiary farmers' households which stood at ₦ 24,080 per month was adopted in analyzing the food security status of the farmers and the results was presented in Table 4.

Table 4: Distribution of fadama III beneficiary and non-beneficiary households by their food security status through mean per capita food expenditure (MPCFE)

Description of Items	Beneficiary		Non-Beneficiary		Total
	Food Secure	Food Insecure	Food Secure	Food Insecure	
Average Household Size	6		5		
Number of Households	178	72	83	167	250
Percentage of Households	71	29	33	67	100
HH Food Exp. (₦)	9,030,000		5,603,400		
HH Total Exp. (₦)	17,037,736		13,838,500		
Percentage of HH Food Exp.	53		71		
MPCF Exp. For the HH	36,120				
2/3 MPCFE (Food security line)	24,080				

Source: Field Survey, 2016

Consequently, based on the determined food security line, majority (71%) of the Fadama III project beneficiaries were reported to be food secured against the 33% of the non-beneficiary farmers. This implies that 29% of the beneficiaries were food insecure when compared with the 67% of the non-beneficiaries which is quite large. In essence, by implication, this result revealed that beneficiaries of the program were more food secured than the non-beneficiaries in the study area. This is in consonant with the findings of Jumoke (2012) who reported that the beneficiary of the Fadama II project were food secure.

Incidence, depth and severity of food insecurity

The incidence of food insecurity of the beneficiaries and non-beneficiaries of Fadama III project were 0.29 and 0.72, respectively as presented in Table 5. The results implied that the proportion of farmers' households whose per capita food expenditure fell below food security line among the beneficiaries was 29% and 72% for the non-beneficiaries in the study area. The food insecurity gap index (food insecurity depth) which is the distance of the per capita food expenditure of food insecure households from food security line for the beneficiaries and non-beneficiaries farmers were 0.21 and 0.65, respectively. This implies that the beneficiaries and non-beneficiaries would need to mobilize additional 21% and 65% of their food insecurity lines to respectively move out of food insecure status.

In addition, the squared food insecurity gap index (severity) for the beneficiary and non-beneficiary farmers was 0.044 and 0.423, respectively. This implies that the severity of food insecurity was 4.4 and 42.3, respectively for the beneficiary and non-beneficiary farmers. The result further established the role of Fadama III Project in reducing food insecurity in the study area. This was evident with a lower index of the incidence, depth and severity among the beneficiaries of the project. However, the outcome revealed that Fadama III project could not completely lift the beneficiaries out of food insecurity status but it had succeeded in narrowing the insecurity gap and severity due to its impact when compared to the status of the non-beneficiaries. The finding conforms to the submission of Kolapo et al. (2022).

Table 5: Incidence, depth and severity of food insecurity among beneficiaries and non-beneficiary farmers

Categories		Incidence (F0)	Depth (F1)	Severity (F2)
Beneficiary	250	0.29	0.21	0.044
Non-Beneficiary	250	0.72	0.65	0.423

Source: Field Survey, 2016

CONCLUSION

The findings on technical efficiency and food security underscore the impact of the Fadama III project in improving millet production among beneficiaries. Higher efficiency scores among beneficiaries suggest that access to improved inputs, extension services, and financial support enhances productivity. Food security indicators further reinforce this conclusion, as 71% of beneficiaries were food secure compared to only 33% of non-beneficiaries. The lower incidence, depth, and severity of food insecurity among beneficiaries highlight the program's positive role in reducing vulnerability. However, challenges persist, as some beneficiaries remain food insecure. Future interventions should focus on bridging inefficiency gaps and ensuring broader access to agricultural resources to achieve sustained food security.

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