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Full Length Research Paper

Evaluating the Anti-Poverty Potential of Livelihood Strategies among Smallholder Maize (*Zea mays* L.) Farmers in Kaduna State, Nigeria

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Poverty persists among rural smallholder farmers in Nigeria, particularly those dependent on maize cultivation. This study assesses the potential of various livelihood strategies to alleviate poverty among smallholder maize farmers in Kaduna State, Nigeria. Multistage sampling procedure was used to collect data from 405 farmers, which were analyzed using descriptive statistics, the Foster-Greer-Thorbecke (FGT) model, and logistic regression. The analysis revealed that non-farm activities contribute significantly to the income of 38% of farmers. The established relative poverty line at ₦134,253.50 classified households as non-poor, moderately poor, or very poor, with 48% falling into the poor category. Additionally, 63% of households had below-average food energy intake, and 64.8% were classified as poor based on an adjusted dollar-per-day measure. Statistically significant determinants of poverty included crop diversification, livestock, farm labor, remittance, and farm rent. The study concludes that livelihood diversification is a viable strategy for improving economic well-being and reducing poverty among smallholder maize farmers. Empowering farmers through targeted training in income-generating activities such as poultry rearing, vegetable farming, and handicrafts, along with business management skills, is recommended. These initiatives should be supported by agricultural extension services, NGOs, and private organizations to maximize impact.

Keywords: Livelihood diversification, smallholder farmers, maize production, poverty reduction, Nigeria.

INTRODUCTION

Maize (*Zea mays* L.) is crucial for millions in Nigeria, particularly in Kaduna State, a major production area. Smallholder farmers here face challenges such as climate change, market volatility, and land degradation, pushing many into poverty (Ajiboye *et al*., 2018; Obade *et al*., 2019). Livelihood diversification, which involves spreading risk through various income sources, is a promising strategy to enhance income stability and well-

being. However, the effectiveness of such diversification among smallholder maize farmers in Kaduna State remains unclear due to their reliance on monoculture maize production (Abdulraheem *et al*., 2020). Kaduna State's poverty rate stands at 72%, significantly above the national average, with agriculture as the primary income source for rural farmers (Aliyu *et al*., 2016; Oladeji *et al*., 2020). Low maize yields, due to traditional practices and climate challenges, exacerbate food insecurity and malnutrition. Diversification could address these issues, aligning with national goals of economic growth, food security, and sustainable agriculture.

Although Kaduna State's rural economy like most Nigerian States, is traditionally agrarian, only a marginal of rural families derive income solely from farming. Djido and Shiferaw (2018), finds that 82% of rural families in Nigeria diversify their income sources and as much as 69% of the total rural family income in Nigeria is derived from non-farm income. The Nigerian rural families may have ample reasons to diversify their income. Firstly, factors such as unpredictable government policies, poor processing techniques, poor storage facilities, bad road networks and natural disasters which negatively impact on farmers' productivity, drives income diversification in the state. Secondly, Elisha *et al.* (2020), argued that Nigerian farmers generally finds it very difficult to access quality agricultural inputs, such as extension services, herbicides, seeds and seedlings, fertilizer and credit needed to scale up their farm operations. Yet, sufficient access to production inputs and support services is essential to improving agricultural productivity of rural farming households. Thirdly, the Nigerian labour productivity per worker is about three times higher in the non-farm sector than the farm sector and the non-farm sector boast of higher average income than incomes from the farm sector (Djido and Shiferaw, 2018).

It is pertinent to note that the endemic nature of poverty among smallholder maize producing households in Kaduna State and its negative implications over time, despite the physical and human resources endowment and agricultural potentials cannot be overemphasized. The recognition of this as a social problem has compelled the smallholder maize producing households to formulate diversification activities, to contain it at different point in time. This study aims to evaluate the potential of livelihood diversification to alleviate poverty among smallholder maize farmers in Kaduna State. The specific objectives are to identify and describe various diversification activities and assess their impact on poverty status.

METHODOLOGY

The study was conducted in Kaduna State, Nigeria, a major maize producer. A multistage sampling approach was employed, stratifying the state into four agricultural zones. Two LGAs were randomly selected from each zone, followed by 30% of villages within each LGA. A total of 405 smallholder maize farmers were selected using the Yamane formula (1967). Primary data were collected through structured questionnaires and interviews with these farmers, focusing on resource endowments, poverty status, and the effects of livelihood diversification on poverty. Data analysis involved a combination of descriptive statistics (frequency, percentages, and ranking) to assess resource endowments and inferential statistics like Logit regression and Foster-Greer-Thorbecke models to analyze poverty and its relationship with diversification.

Foster-Greer-Thorbecke model

The FGT model, based on Foster *et al*. (1984), measures poverty through three indices:

Headcount index (P0): Measures the proportion of the population that is poor, calculated as: $P_o = \frac{NP}{N}$

Where; NP = the number of poor and N = the total population.

Poverty gap index (P1): Measures the average shortfall of the poor from the poverty line, expressed as a percentage. It is calculated as:

$$P_1 = \int_o^{\alpha} [(z - y)/2]^{\alpha} dy \quad (1)$$

Where; (z) is the poverty line and (yi) is the income of the ith individual.

Squared poverty gap (poverty severity)

Measures the severity of poverty, giving more weight to those further below the poverty line.

The poverty line was defined as two-thirds of the mean household expenditure per adult equivalent, based on established measures in development literature (World Bank, 2021). This measures the severity of poverty even more accurately.

Adjusted Dollar per day

The dollar per day has been an acceptable standard for measuring poverty across countries for international comparability. It is defined in terms of the deflated Dollar per day. This process of establishing parity in the acquisitive power of a dollar is called purchasing power parity, or PPP. In this analysis, adjusted measure of the 2021 World Bank purchasing power parity, the 2021 PPP for Nigeria was ₦144.28 to Dollar, which was computed to ₦156.4 naira (PPP) to the dollar, and adopted it for this study.

Logit Regression Model (LRM)

A Logit regression model assessed the effect of livelihood

Table 1. Distribution of Livelihood Strategies among Maize Farmers

Livelihoods Strategy	Frequency	Percentage	Ranking
Food Crops Income	183	45.3	1st
Self-Employment Incomes	97	23.9	2nd
Livestock	57	14.0	3rd
Non-Farm Wages	29	7.2	4th
Farm Wages	17	4.3	5th
Cash Crops Income	11	2.7	6th
Remittance	11	2.6	7th
Total	**405**	**100**	

diversification on poverty status of maize farmers. The dependent variable was poverty status (binary: 1 for non-poor, 0 for poor). The model is represented as:

$$P_i = f(Z) = \log \frac{pi}{1-pi} \Sigma^{n}_{1} \beta_i X_i \quad (2)$$

Pi is the probability of being above or below the poverty line; βi are the coefficients; and Xi were the poverty determinant variables.

The general Logit regression model is explicitly expressed as:

$$Y_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \beta_9 X_9 + \ell_i \quad (3)$$

Where: Y_i = poverty status (poor =0 and non-poor =1), X_1 = crop income (₦), X_2 = livestock owned by the respondents (₦), income from farm labour (₦), X_3 = income from farm labour (₦), X_4 = remittance and gift (₦), X_5 = income from processing of farm produce (₦), X_6 self − employed business (₦), = X_7 = farm rent resources (₦),farm rent resources (₦), X_8 = farm rent resources (₦), X_9 = private organization job (₦), β = vector of maximum likelihood estimates and ℓ_i = independently distributed error term.

RESULT AND DISCUSSION

Livelihood Diversification Activities among Smallholder Maize Farmers

Table 1 reveals that around 40% of households engage in non-farm activities (e.g., education, petty trading), significantly contributing to income generation and poverty alleviation. The breakdown of income sources shows crop production (including food and cash crops - 47.7%) as the most significant source, followed by livestock (14%) and non-farm wage activities (including self-employment and trading - 31.2%) with remittances contributing 2.6%. Therefore, the livelihood diversification into off- and non-farm activities provides substantial additional sources of income for maize farmers, reducing their reliance solely on agriculture.

The livelihood diversification can contribute to poverty reduction by enhancing both income and economic stability, and reducing vulnerability associated with relying solely on farming, which is essential for poverty reduction efforts. This income diversification aligns with previous findings (Oladimeji *et al*., 2015; Abdulazeez *et al*., 2018) and demonstrates its effectiveness in stabilizing income and reducing reliance on agriculture alone for smallholder maize farmers.

The Poverty Status of the Smallholder Maize Farmers

A poverty line of ₦134,253.50 per capita per year was established to assess poverty status (Table 2). Households are classified as non-poor (above the line), moderately poor (between ₦66,792.80 and ₦134,253.50), or very poor (below ₦66,792.80). Analysis revealed that 36.8% of farmers are non-poor, 24.28% are moderately poor, and 39% are very poor. The poverty gap index of 0.2799 indicates an additional 28% of income (₦37,590.98 annually) is needed to lift all poor farmers to the poverty line. This highlights significant income disparity and challenges in meeting basic needs, aligning with findings by Oladele (2019), on similar challenges.

Objective poverty measure (food energy intake)

63% of households have lower-than-average food energy intake, indicating potential food insecurity (Table 3). The poverty line for high-income households is ₦860.40 per day per adult equivalent, with a negative income gap of -166.00. This suggests that households need an additional ₦1.66 per day per adult equivalent for adequate nutrition. The high incidence of food insecurity (63%) underscores the need for strategies to increase income and improve food security. The results are comparable with findings of Akinmulewo *et al.* (2023), on

Table 2. Poverty Status of Maize Farmers

Poverty Category	Estimates	Percentage
Non poor	149	36.80
Moderate Poor	98	24.28
Very poor	158	38.92
FGT Poverty Indices		
Poverty Incidence (P_o)	0.3680	
Poverty Depth (P_1)	0.2799	
Poverty Severity (P_2)	0.5459	
Poverty Lines:		
MPCHI	₦ 200,378.40 Per annum	
2/3*(MPCHI)	₦ 134,253.50 Per annum	
1/3*(MPCHI)	₦ 66,792.80 Per annum	

Source: Field Survey, 2021, MPCHI = mean per capita household income

Table 3. Summary Statistics and Food Security Measures among Households

Variable	
Cost-of-calories equation: lnX=a + bC	
Constant	12.658(289.448)
Slope coefficient	-3.10E-07(-0.957)
FAO recommended daily energy levels (L)	2300kcal
Food insecurity line S: cost of the Minimum Energy requirements per adult Equivalent	
Per day	₦860.397
Per year	₦314,044.9
Head count (H)	
Food secure	150
Food insecure	255
Aggregate income gap (G)	-165.995
Food secure	37%
Food insecure	63%

***P<0.01. Figures in parenthesis are t-values. **Source:** Field Survey, 2021

food nutrition security profile of farming households under Gurara irrigation scheme in Kaduna State, Nigeria.

Human development dimensions of poverty

Adjusted Dollar per day

The result shows that 64.8% of the farmers fall below the Poverty line, while 35.2% of the maize farmers were non- poor based on the adjusted measures of poverty in the study area. This implies that a significant portion of maize farmers in the region are experiencing poverty, highlighting the need for targeted interventions and support to improve their economic well-being and livelihoods. The adjusted poverty measure helps provide a more accurate picture of the poverty situation, considering local economic conditions and purchasing power.

Health indicator

Beyond income limitations, access to healthcare services is another challenge (Table 4). Only 6.8% of households sought consultations within two weeks, with wealthier groups having higher utilization. Similarly, vaccination coverage for children (64.55%) and postnatal care (24.3%) are low, especially among poorer households. This aligns with WHO (2019), on healthcare access challenges in low-income settings.

Effects of Livelihood Diversification Activities on Poverty Status among Maize Farmers

The Logit model results in Table 5 shows that the model was well fitted with the likelihood ratio test was -164.651, which is statistically significant at 1% level of probability. This implies that all the variables included in the Logit

Table 4. Healthcare Consultation by Service Provider and by Quintile

Healthcare Consultation	Quintile 1	2	3	4	5	Sex Male	Female	Total
Yes	2.7	4.45	6.18	7.34	11.67	6.5	7.2	6.84
No	97.3	95.55	93.82	92.66	88.33	93.5	92.8	93.16
Total	100	100	100	100	100	100	100	100
First Consultation								
Traditional Healer	9.24	7.93	6.21	4.2	5.31	6.95	4.8	5.85
Doctor	27.96	34.19	40.43	45.9	57.96	46	50.9	46.5
Dentist	1.5	1.38	2.11	1.92	1.89	1.86	1.83	1.84
Nurse	13.26	14.3	14.62	11.89	9.96	11.5	12.5	12.00
Medical Assistant	20.34	18.99	18.42	15.23	7.51	13.5	13.8	13.60
Midwife	0.87	0.23	0.95	1.37	0.79	0.98	0.05	0.89
Pharmacist	11.8	14.43	13.06	13.75	13.68	14.3	13.42	14.10
Attendant	0	0.29	0.45	0.25	0.1	0.1	0.2	0.20
Spiritualist	0	0.54	0.66	0.39	0.38	0.38	0.5	0.40
Others	15.03	7.72	3.09	5.1	2.42	4.43	2	4.62
Total	100	100	100	100	100	100	100	100
Vaccination of Children								
Yes	49.56	56.64	64.73	72.68	80.42	64.38	64.73	64.55
No	50.44	43.36	35.27	27.32	19.58	35.62	35.27	35.45
Total	100	100	100	100	100	100	100	100
Postnatal Consultation								
Yes	16.6	15.3	22.5	28.3	35.4	-	-	24.30
No	82.4	84.7	77.5	71.7	64.6	-	-	75.70
Total	100	100	100	100	100		-	100

Source: Field Survey, 2021

Table 5. Effects of Livelihood Diversification Activities on Poverty Status among Maize Farmers

Poverty	Odds ratio	Std. Err.	Z-value	VIF
Crop income (other)	1.00002***	3.94E-06	5.14	1.10
Livestock	1.00002***	1.84E-07	2.52	1.67
Farm labour	1.000059***	1.41E-05	4.2	2.71
Remittance	0.999947***	1.31E-05	-4.04	3.54
Processing of farm produce	0.999999	1.36E-06	-0.41	1.94
Self-employed business	1.000002	1.27E-06	1.52	1.04
Farm rent resources	1.000041*	2.17E-05	1.91	1.63
Government job income	0.999999	1.69E-06	-0.71	1.01
Private Organization Job	1.000001	3.28E-06	0.34	1.33
Constant	0.192917	0.051126	-6.21	-
Number of observations	405			
LR $chi^2(9)$	231.59			
Prob>chi^2	0.0000			
Log likelihood	-164.651			
Pseudo R^2	0.4129			

Note * =** significant at 1%, ** = 5%, and * = 10%, **Source**: Field Survey, 2021

model are jointly significant in the model. In addition, all predictors in the regression model have the variance inflation factors (VIFs) less than 10, indicating a lack of multicollinearity.

Analysis confirms that diversifying income sources significantly reduces poverty among these farmers (Table 5). Crop diversification and owning livestock have the strongest positive effects, increasing the likelihood of

escaping poverty by 0.002% for each unit increase in the activity. This emphasizes the benefits of income diversification and resilience against economic shocks. Engaging in farm labor (0.0059% increase) and renting farmland (0.0041% increase) also contribute positively, highlighting the importance of resource utilization. Interestingly, remittances show a negative impact on poverty reduction. This requires further investigation to understand how remittance inflows can be better integrated into poverty alleviation strategies for these farmers.

CONCLUSION AND RECOMMENDATIONS

The major determinants of effects of livelihood diversification activities on poverty status among maize farmers include diversifying income sources, crop diversification, owning livestock, engaging in farm labor, and renting farmland. Livelihood diversification is key to reducing poverty among smallholder maize farmers. Promoting diversified income-generating activities and providing targeted training can enhance financial security and reduce poverty. Empowering farmers through skills development in agriculture and business management is essential for sustainable poverty alleviation.

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