FOOD INSECURITY DYNAMICS AND PRODUCTION CHALLENGES AMONG RICE FARMERS IN EKITI STATE, NIGERIA

Olaniyi Oluwatosin Ojo*

Department of Agricultural Science and Technology, Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti.

ABSTRACT

This research empirically explored the determinants of food insecurity dynamics and production challenges faced by rice farmers in Ekiti State, Nigeria. Primary data were gathered through a well-designed questionnaire, and 420 respondents were randomly selected for the study. The data were analyzed using descriptive statistics and Logit regression. The study identified crucial factors significantly influencing food insecurity, including the age of the household head, years of formal education, savings, value of owned livestock, vulnerability status, and incidents of crop loss. In the case of rice production challenges, participants were faced with issues such as inadequate funds, the adverse impacts of climate change, poor road conditions, depressed prices for milled rice, escalating input costs, and a conspicuous absence of storage facilities. To address these challenges and foster sustainable rice farming in Ekiti State, we recommend the implementation of comprehensive policies which include targeted financial support mechanisms for farmers, initiatives to mitigate the impact of climate change on agriculture, infrastructural improvements on road networks, strategies to stabilize and enhance rice prices, measures to alleviate the burden of high input costs, and the development of storage facilities to minimize post-harvest losses.

Keywords: Constraints, Food Insecurity, Dynamics, Production, Logit Regression, Nigeria.

1. INTRODUCTION

After decades of steady decline, the trend in world hunger – as measured by the prevalence of undernourishment – reverted in 2015, remaining virtually unchanged in the past few years at a level slightly below 11 percent. Meanwhile, the number of people who suffer from hunger has slowly increased. As a result, more than 783 million people in the world were still hungry in 2023, underscoring the immense challenge of achieving the Zero Hunger target by 2030 (FAO, 2024). It has been shown that the continent of Africa is not yet on the path to eliminating hunger by 2030 while the prevalence of malnutrition in Africa has risen from 17.6% in 2014 to 19.1% in 2019 (FAO, 2019). Over the years, the question of appropriate food security has remained a critical subject for consideration (Ejikeme, 2017; Osabohien *et al*., 2020a,b). Nigeria, a nation blessed with fertile land and abundant rainfall, grapples with a seemingly contradictory reality of widespread food insecurity, even among its rice farmers, the very people who cultivate this staple crop (Akinwale *et al*., 2020). Small-scale farmers in Nigeria constitute 90% of Nigeria's agricultural output (Ayinde *et al*., 2020) while the majority of such farmers are not able to feed themselves and other relatives due to low productivity.

The low productivity is mainly a result of fragmented land holdings, over-reliance on rain-fed agriculture, and a poor economic base. Furthermore, this food insecurity among farmers extends beyond mere crop yields, encompassing issues of poverty, lack of access to markets, inadequate

storage facilities, and price volatility (Ogundari and Ojo, 2019). Withal, the impact of climate change and environmental degradation cannot be ignored, as unpredictable weather patterns and declining soil fertility threaten harvests and farmer livelihoods (Enete *et al*., 2022). Additionally, the production challenges that hinder rice farmers' ability to achieve food security likewise include access to agricultural inputs like fertilizers and improved seeds, often hampered by affordability and distribution networks (World Bank, 2023). Traditional farming methods with low productivity further exacerbate the issue (Oladele *et al*., 2021).

Moreover, infrastructure limitations such as poor roads and inadequate irrigation systems pose additional hurdles, restricting market access and increasing post-harvest losses (Abdoulaye *et al*., 2021). Inconsistent government policies, land tenure issues, and the activities of insurgent groups significantly disrupt agricultural activities and exacerbate food insecurity (Okoye *et al*., 2022). Understanding these complex interactions is crucial to crafting effective solutions. With a growing population and increasing food insecurity, Nigeria's future prosperity hinges on empowering its rice farmers (FAO, 2023). Delving into the intricacies of this challenge will pave the way for targeted interventions and sustainable solutions that can ensure food security for both farmers and the nation as a whole. Therefore, this study aimed to examine the socioeconomic characteristics of the respondents; decompose the food insecurity status of the respondents; determine factors influencing the food insecurity status of the respondents; and identify production constraints faced by the respondents.

2. METHODOLOGY
2.1 Description of the Area
The research was conducted in Ekiti State, Nigeria, which is positioned in the South-West geopolitical zone. Geographically, it lies between longitudes 7°45′ and 5°45′ East of the Greenwich Meridian and latitudes 7°45′ and 8°05′ North of the equator. Bordered by Kwara, Kogi, and Osun States to the North and West, with Edo State to the East and Ondo State to the South, Ekiti State comprises of sixteen Local Government Areas. The climate is tropical, characterized by distinct rainy (April – October) and dry (November – March) seasons, with temperatures ranging between 21°C and 28°C and high humidity (Omonijo et al., 2023; Oparinde et al., 2023). The ecological features include tropical forests in the South and guinea savannah in the North. Abundant water resources, such as the Ero, Osun, Ose, and Ogbese rivers, contribute to the state's natural endowments. Ekiti is culturally homogeneous, with its residents predominantly speaking a dialect of the Yoruba language known as Ekiti. The primary food crops cultivated in the state include yam, maize, cassava, cocoyam, and rice. Additionally, tree crops like cocoa, kola nut, and oil palm are grown. Livestock, including sheep, goats, pigs, and poultry, are part of the agricultural landscape. The populace is largely engaged in farming, with women involved in food processing, trading, and farming activities. The favorable climate in Ekiti State supports the cultivation of various crops such as maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, and cashews.

To gather primary data, a field survey was conducted using structured questionnaires and oral interviews to capture respondents' information on food consumption, socioeconomic characteristics, and physical and financial resources.

The study employed a cross-sectional design with data collected from rice farmers as the target population. The sampling process involved three stages: a purposive sampling of rice-producing communities, a random selection of twenty-three communities representing Agricultural

Development Projects zones (ADPs), and the selection of 420 rice farmers based on probability proportionate to size from the ADPs office. Out of 446 questionnaires administered, 420 were correctly filled. Following Yamene, (1967), the following sample size determination was used in this study:

$$n = \frac{N}{1+N(e^2)}$$
(1)

Where, N (1556) is the population size and e are the level of precision (4%), n is the sample size. The proportionality factor used in the selection of the sample for equal representation is stated as:

$$x_i = \frac{n}{N} * No\ of\ registered\ rice\ farmers\ in\ ith\ community$$
(2)

Where, x_i = sample selected from the ith community, n = total sample estimate obtained from Yamane 1967 formula and N= population of registered rice farmers in the study area. The sampling procedure is shown in table one.

Data collected were analysed using descriptive statistics logit regression.

To realize the household food insecurity status objective, firstly, quantities of the commonly consumed food items at the household level in the study area were calculated and converted to calories based on their composition (Oguntona and Akinyele, 1985; Stefan and Pramila, 1998). Resulting calorie values were divided by the respective adult equivalent values of the households, to obtain numbers that are comparable across households of different sizes. The World Health Organization (WHO) considers 2850 kilo calories as the required daily intake for a moderately active adult equivalent (FAO-WHO-UNN, 1985). Food secure households are those whose daily per capita calorie consumed per Adult Equivalent (AE) is greater than or equal to the minimum recommended daily calorie requirement of

2850kcal/day/AE, otherwise household was considered food insecure for this study. Therefore, household food security status assumed a binary choice of 1 for food-insecure households, and 0 otherwise.

Logit Regression Model: The model postulates the log-likelihood that an individual will be food insecure is a function of index Z_i. Z_i is also the inverse of the standard logistic cumulative function of

P_i i.e. $[f] = [F_{zi}]$. where $Z_i = \beta_0 + \beta_1 X_i$ (3)

The logit model is expressed as:

$\ln (f_i/1 - f_i) = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki}.$ (4)

$f^* =$ is unobserved but fi = $\begin{cases} 0\ if & fi^* < 0 \\ 1\ if & fi^* \geq 0 \end{cases}$

Where:

fi = Food insecurity status of ith household

β = Vector of parameters to be estimated

x_i = Explanatory variables

P $(f_i = 1)$ = p $(f_i^* \geq 0) = p(u_i \geq -\beta_1 - \beta_2 X_2 \dots \beta_k X_{ki}$

= f $(\beta_1 + \beta_2 X_{2i} + \cdots + \beta_k X_{ki})$ where f is the cumulative distribution function of u_i. It is assumed that the probability density function of u_i is symmetric and e_i has what is known as a logistic distribution. The probability density function of u_i is given by:

$$(fu_i) = \frac{e^{ui}}{(1+e^{ui})^2}$$
(5)

The cumulative density function of u_i is given as:

$$(fu_i) = \frac{e^{ui}}{((1+e^{ui}))}$$
(6)

From the above it can be readily seen that the probability of being food secure is given by:

$$P(f_i = 1) = P(f_i^* \geq 0) = P(u_i \geq -\beta_1 - \beta_2 X_{2i} - \cdots - \beta_k X_{ki} = F(_1 + \beta_k X_{2i} + \cdots + \beta_k X_{ki}$$
$$= \frac{1-e^{\beta 1 + \beta 2*2i + \cdots \beta kxki}}{1+e^{\beta 1 + \beta 2*21 + \cdots \beta kxki}}$$
(7)

The probability of not being food secure is given by:

$$P(f_1 = 0)\ 1 - p_i = \frac{1-e^{\beta 1 + \beta 2*2i + \cdots \beta kxki}}{1+e^{\beta 1 + \beta 2*21 + \cdots \beta kxki}} = \frac{1}{1+e^{\beta 1 + \beta 2*21 + \cdots \beta kxki}}$$
(8)

Therefore, $\frac{p(f_1=1)}{p(f_1=0)} = e^{\beta 1 + \beta 2 x 2i + \cdots + \beta kxki}$
(9)

Equation 9 is the ratio in favour of being food insecure. Because the dependent variable is binary and p_i is non-linearly related to X_i and the β_i the ordinary least square (OLS) cannot be used to estimate the parameters (Gujarrati, 1988) instead, the maximum likelihood method is adopted. The marginal effect in the logit model is expressed as:

$$= \partial P\ P \frac{(f_i=1)}{\partial X_{ji}} = F(\beta_1 + \beta_2 X_{2i} + \cdots + \beta_k X k_i)\beta j = \frac{e^{\beta i + \beta 2 X 2i + \cdots + \beta k X ki}}{(1+e^{\beta 1 + \beta 2 X 2i + \cdots + \beta k X ki})^2}\beta j$$
(10)

Definition of variables and measurement

Dependent variable

f = Food insecurity status (1 = food insecure =1;0 otherwise)

Independent variables

$X_1 = Vulnerability\ status$ (1 = vulnerable; 0=otherwise)

$X_2 = Agricultural\ commercialization\ status$ (1 = non-participant; 0 otherwise)

$X_3 = Adult\ equivalence$ (Number)

$X_4 = Mode\ of\ rice\ farm\ cultivation$ (Upland = 1, 0 otherwise)

$X_5 = Ownership\ of\ land$ (Landless =1; 0 otherwise)

$X_6 = $ Years of formal education (Years)

$X_7 = Membership\ of\ agricultural\ production\ group$ (No = 1; 0=otherwise)

$X_8 = $ Age (Years)

$X_9 = Value\ of\ credit\ obtain$ed (Naira)

$X_{10} = Incidence\ of\ illness$ (Yes =1; 0 otherwise)

$X_{12} = Incidence\ of\ crop\ loss$ (Yes =1; 0 otherwise)

$X_{13} = Fulani\ herdsmen\ challenge$ (Yes=1; 0 otherwise)

$X_{14} = Remittance$ (Naira)

$X_{15} = Savings$ (Naira)

$X_{16} = Value\ of\ asset$ (Naira)

$X_{17} = Livestock\ value$ (Naira)

3. RESULTS AND DISCUSSION
3.1 Socioeconomic Attributes of the Respondents

According to the data presented in Table 1, the average age of the surveyed participants was 47.2 years. This suggests that the individuals surveyed were in their active and productive years. Being in this age group is expected to facilitate engagement in income-generating activities, such as agricultural commercialization, which holds the potential to reduce vulnerability to food insecurity. This finding aligns with Ojo (2014), Adegoroye et al. (2021), and Ogunyemi et al. (2022), who similarly observed a significant reduction in food insecurity among those in their productive age. The distribution reveals that 68.4% of the participants were male, indicating a higher representation of male rice farmers in the sample. This finding corresponds with the findings of Babatunde et al. (2008), Olutumise et al. (2022), and Olutumise et al. (2023), suggesting that male farmers are more likely to engage in labor-intensive farming activities compared to their female counterparts. The data also indicates that 58.7% of the respondents were married. Married respondents can pool resources together and engage in income-generating activities, potentially improving their access to adequate food. The average household size among the participants was approximately 7 members, suggesting a fairly large household. While a large household may contribute to a steady labor supply on the farm, it also poses the risk of increased pressure on available resources, potentially resulting in a reduction in per capita food consumption or concerns about food shortages. This finding is consistent with the observations of Ojo (2014) and Olutumise (2023), who noted that large-size households are more vulnerable to food insecurity than smaller ones. The average number of years of formal education for respondents was about 10.5 years, indicating a reasonably educated sample. Education levels attained by respondents can influence livelihood strategies, and access to markets, and enhance overall food security (Ukpe, 2016, Ajayi and Olutumise, 2018). Considering adult equivalence, the results revealed varying sizes among the surveyed respondents, with an average adult equivalence size of 5.9. Larger adult equivalence sizes may pose a threat to vulnerability to food insecurity, as they can exert pressure on available resources. However, they can also serve as a potential labor supply on the respondent's farm, enabling increased output for consumption or sale to earn income. This outcome resonates with Agbola (2014) and Ogunyemi et al. (2022), who associated larger adult equivalence sizes with reduced per capita food consumption.

Table 1: Summary statistics of the Socioeconomic Attributes of the Rice Farmers

Variable	Mean	Standard deviation
Age	47.20	35.20
Sex	0.68	0.29
Marital status	0.59	0.21
Household size	7.00	3.30
Year of schooling	10.53	2.30
Adult equivalent	5.93	3.30

3.2 Respondents' Food Insecurity Decomposition (Spell Approach)
Table 2 presents respondents' distribution by food insecurity decomposition. The distribution showed three food insecurity conditions namely; always food insecure (chronic); sometimes food insecure (transient) and never food insecure. The percentages of respondents (commercialized and non-commercialized) that assumed each of these food insecurity conditions.

Table 2: Respondents' Distribution by Food Insecurity Decomposition (Spell Approach)

Food Insecurity Status	No of Respondents	Percentage
Always Food Insecure (chronic)	NC = 61 C = 53 SUB-TOTAL = 114	14.5 12.6 27.1
Sometimes Food Insecure (transient)	NC = *12 ▪ 25 C = *21 ▪ 44 SUB-TOTAL = 102	2.9 5.9 5.0 10.5 24.3
Never Food Insecured	NC = 53 C = 151 SUB-TOTAL = 204	12.6 36.0 48.6
Total	420	100

Footnote (* = exiting, ▪ = entering)

3.3 Factors Influencing Food Insecurity among Sampled Rice Farming Respondents First Period

The results of the model of factors influencing food insecurity estimated using Logit regression are reported in Table 3. In general, the model performs well. The goodness of fit measure, R^2, is 0.91, indicating that about 91% of variations in the dependent variable are accounted for by the independent variables. Thus, it is sufficiently high for the model using cross-sectional data. Also, Prob > Chi^2 is significant at 1%. The Table presents determinants of food insecurity in round 1 and round 2 of the respondents' survey. In round 1 of the respondents' survey, the following variables significantly determined food insecurity; adult equivalent size, number of years spent to acquire formal education, and agricultural commercialization. Other variables that determined food insecurity in round 1 of the survey were; Fulani herdsmen challenge, savings, and value of livestock possessed. However, in round 2 of the respondent survey, variables such as adult equivalent size, number of years spent to acquire formal education, agricultural commercialization and vulnerability status significantly influenced food insecurity. Other variables that significantly affected food insecurity in round 2 of the survey were membership of the association, loss of crop, and value of assets possessed. Vulnerability status significantly and positively affected food insecurity in the second period of the survey at a 5% level of significance. This implies that vulnerable respondents were more likely to be food insecure than non-vulnerable respondents. This result could be traced to the possibility that vulnerable respondents are at risk of failure to meet the minimum calorie requirement for a healthy life due to their inability to produce enough food. Worse still, they might not have other ways to withstand shortages in agricultural production to meet their daily minimum requirement of food consumption. This finding agrees with Bekele (2012), who found that respondents who are initially vulnerable to food insecurity are likely to be food insecure at a later time. Agricultural commercialization significantly and negatively influenced food insecurity in both rounds at 1% level of significance in both rounds of the survey. This implies that respondents who commercialized were less likely to be food insecure than similar respondents who did not

commercialize. This finding could be due to the possibility that agricultural commercialization has a great potential to ensure sustainable food security and welfare (Pingali, 1997). Ntakyo and Van den Berg (2014) and Malumfashi and Kwara (2013) assert that agricultural commercialization can raise respondent income and at the same time increase the productivity of food crops due to increased use of inputs. Adult equivalence significantly and positively affected food insecurity in both rounds of the respondent survey at 5% and 10% levels of significance in rounds 1 and 2 respectively. This implies that large-size adult equivalent respondents are more likely to be food insecure than similar respondents that had small-size adult equivalent. This may be because large-size adult equivalent respondents exert more pressure on available food resources such that they deplete their store of food at a faster rate than they replenish it. Ahmed (2017) and Zemedu and Mesfin (2014) reported similar results that respondents who have large-size adult equivalence are more likely to be food insecure. A 10% increase in respondents' adult equivalence would lead to 0.1 and 0.08 increases in food insecurity levels in rounds 1 and 2 respectively. The number of years spent in school to acquire formal education significantly and negatively influenced food insecurity in rounds 1 and 2 of the survey at 5% and 1% levels of significance, respectively. This implies that respondents who spent longer years in school to acquire formal education were less likely to be food insecure than similar respondents who spent shorter years in school. This finding may be due to the possibility that with an increase in educational attainment, there is a higher probability of exploiting opportunities to mitigate vulnerability to food insecurity. Weir (1999) and Olutumise et al. (2021) confirm that education increases respondent heads' probability of obtaining access to credit, diversification of income sources and ultimately reduces risks and improves food security. Similarly, Baiyegunhi and Frazer (2011) and Olutumise (2023b) posit that education leads to increased earning potential, better coping with risks and uncertainty, vulnerability reduction, and provision of higher levels of welfare for the respondent. The result is consistent with Ukpe (2016), that are more educated are less likely to be food insecure. A 10% increase in respondents' years spent in school would lead to 0.13 and 0.39 increase in food insecurity level in rounds 1 and 2 respectively.

Membership of the association significantly and negatively influenced food insecurity in round two of the survey at a 1% level of significance. This implies that respondents that were members of association were less likely to be food insecure than respondents that did not belong to association. This finding could be attributed to the possibility that respondents who are members of an association obtain access to important information through their social networks. Members of associations generally have access to information relating to availability of improved farm input at fair prices, they enjoy economy of scale through collective action and get linked to beneficial output markets. This result supports Abdulai (2016) and Oparinde and Olutumise (2022), who found that respondents that are members of association are less likely to be food insecure. Age of the respondents are negative but statistically significant in both rounds, indicating that as the respondent growing older the probability of being food secure is reduced by 4.67% and 15.00% for rounds 1 and 2, respectively. The result is consistent with other studies in the literature. Loss of crop significantly and positively affected food insecurity in the second round of the survey at 1% level of significance. This implies that respondents that lost crops were more likely to be food insecure than respondents that did not lose crop. This result could be associated with the possibility that loss of crop leads to reduced farm produce which may be inadequate for consumption at home. Worse still if the survived portion of the crop is to be sold the income there from may be inadequate to buy sufficient food required by the respondents.

This result is in line with Mesfin (2014), who found that respondents that suffered loss of crops are more likely to be food insecure. Fulani herdsmen challenge significantly and positively influenced food insecurity only in the first round of the survey at 10% level of significance. This implies that respondents threatened by Fulani herdsmen challenge were more likely to be food insecure than respondents not threatened by Fulani herdsmen challenge. This finding might be possible because of the counter-productivity activities of the Fulani herdsmen on farms. Respondents threatened by Fulani herdsmen suffered colossal loss/damage of crops, got maimed, killed or kidnapped for ransom. Some respondents have become absentee farmers due to fear of insecurity occasioned by Fulani herdsmen terrorism. This oppressive posture of the Fulani herdsmen had caused a shortage of food supply making prices of food escalate. The soaring prices of food items had reduced the purchasing power of consumers generally and specifically the victims of Fulani herdsmen counter-productive activities. This result agrees with Oluwatayo (2007), who found that respondents that are exposed to shock are more likely to be poor. Savings significantly and negatively affected food insecurity only in the first round of the survey at 1% level of significance. This implies that respondents that saved money were less likely to be food insecure than respondents that did not save money. This result could be attributed to the possibility that respondents can draw from the money they have saved to carryout productive income – generating activities. The proceeds of such investment can be used to purchase food if the proceed was not used to produce food for home consumption. Also, savings can play a great role in respondents' food consumption smoothening. A 10% increase in respondents' savings would lead to 8.93e-06 decrease in food insecurity level in round 1. Value of livestock possessed significantly and negatively influenced food insecurity in the first round of the survey at 1% level of significance. This implies that respondents that possessed high – value livestock were less likely to be food insecure than respondents that possessed relatively low-value livestock. This result could be linked to the possibility that livestock could be slaughtered and consumed as food or sold off to earn income to buy food not home-produced. This result is in line with Ntakyo and van den berg (2019), who found that respondents that owned livestock are more food secured. A 10% increase in respondents' livestock value would lead to 2.87e-05 decrease in food insecurity level in round 1.

Table 3: Maximum Likelihood Estimates of Logit Regression for Determining Factors Influencing Food Insecurity

Variable	Food insecurity (1ˢᵗ period)	Food insecurity (2ⁿᵈ

	Coefficient (Std. error)	Marginal Effect	Coefficient (Std. error)	Marginal Effect
			period)	
Vulnerability status			8.095*** (3.091)	0.209
Agricultural Commercialization	-0.336*** (0.112)	-0.006	-0.054*** (0.063)	-0.001
Adult Equivalence (household size)	0.581** (0.214)	0.010	0.323* (0.195)	0.008
Mode of Rice Farming	-0.514 (1.514)	-0.009	-1.301 (0.993)	0.034
Ownership of Land	-0.371 (0.756)	-0.006	-0.158 (0.556)	-0.004
Years in School	-0.817** (0.337)	-0.013	-1.521*** (0.281)	-0.039
Membership of Agricultural Related Association	-0.789 (1.553)	-0.013	-4.364*** (1.449)	-0.387
Age	-4.667*** (4.719)	-0.079	-15.001*** (4.233)	-0.387
Value of Credit Obtained	-4.14e-05 (3.87e-05)	-7.03e-07	-2.99e-05 (2.14e-05)	-7.71e-07
Incidence of Illness	1.2894 (1.246)	0.022	-0.887 (0.853)	-0.023
Incidence of Crop loss	1.313 (1.241)	0.022	3.967*** (1.172)	0.102
Challenge of Fulani Herdsmen	2.303* (1.266)	0.039	1.233 (0.833)	-0.032
Remittance	-5.94e-04 (4.39e-04)	-1.01e-05	-1.10e-04 (1.26e-04)	-2.83e-06
Savings	-5.27e-05*** (1.58e-05)	-8.93e-07	-1.09e-06 (9.54e-06)	-2.81e-08
Value of Asset	-2.11e-04 (2.14e-05)	-3.58e-06	-9.42e-04 (2.23e-04)	-2.43e-05
Livestock Value	-1.69e-04*** (5.83e-04)	-2.87e-06	-3.38e-06 (6.37e-06)	-8.71e-08
Constant	-14.664 (9.254)		-40.606 (8.504)	
Number of Observation	420		420	
Log likelihood	-23.778		-37.700	

Prob > chi^2	0.0000	0.0000
Pseudo R^2	0.913	0.869

Note: Coefficients followed by *, **, and *** indicate significance at the 10%, 5% and 1% levels respectively

Source: Author's computation from field survey 2018

3.4 Production Challenges Faced by Sampled Respondents

Table 4 presents respondents' distribution by their production challenge. The distribution showed that the respondents face challenges by all the items on the Table. The first on the list of their challenges is inadequate farmland. Inadequate farmland is a serious threat to agricultural commercialization because it requires a large expanse of land. The reality of ownership of farmland in Nigeria is that it is usually fragmented and the size that an average farmer can own is limited. This could be linked partly to the nature of acquisition of land in Nigeria, which is usually by inheritance and the topography. These features do not encourage agricultural commercialization hence respondents' potential to make more money to acquire adequate food is limited. In terms of constrained access to credit, the important roles being played by credit in agricultural production had been copiously documented in literature. However, farmers have limited access or do not have access at all to credit due to a number of factors. These include collateral security, high level of risk associated with agricultural production, scattered plots, and long gestation period of agricultural business and so on. These factors have limited farmers' access to credit the result of which is manifested in farmers' inability to practise agricultural commercialization. This was also noticed by Olutumise and Oparinde (2022), Oparinde and Olutumise (2022) and Olutumise (2023b). With respect to Fulani herdsmen challenge, farming respondents have been thrown into confusion, panic and traumatic condition due to the threat posed by Fulani herdsmen counter-productive activities in recent times. Fulani herdsmen have assumed a dangerous dimension by resorting to kidnapping, armed robbery, maiming, killing and destruction of farmlands by the indiscriminate grazing of their cattle. These oppressive and destructive activities of the Fulani herdsmen have generated much heat across some geo-political zones of Nigeria (Southwest, Southeast and North central). The ripple effect of the Fulani herdsmen nefarious activities is felt in terms of reduced food production (food scarcity) and attendant soaring prices of food items which has aggravated the existing food insecurity condition of Nigerians. Another challenge reported by the sampled respondent was climate change especially late onset of rain. For more than a decade now world stakeholder has been pre-occupied by how to mitigate the adverse effect of climate change considering the scale of loss associated with its menace. The adverse effect of climate change can be very costly in term of crop failure, reduced. Farm produce which translates to inadequate food and decreased income for the victims. Again, the challenge posed by poor/bad condition of roads linking farms to the nearest market was reported by the sampled respondents. Poor condition of roads linking farms to market where farm produce could be sold to earn competitive/fear prices had been the bane of participating in agricultural commercialization in Nigeria. As long as the condition of farm-market road remain bad, farming respondent will continue to practise subsistence agriculture which lack the potential to generate marketable surplus needed to exit food insecurity. Among the challenges reported by the sampled respondent was low price of rice. The role of good remunerative prices for farm produce cannot be over emphasised. Price serves as an incentive for motivating producers to engage in production. Sampled respondent's complaint about price of

rice might be linked to the preference of consumers for imported rice and the stiff competition faced by local rice producers. As long as these factors prevail, rice farming respondents will continue to receive low price for their rice which will eventually discourage them from engaging in commercialization. The consequence of not engaging in commercialization is inability to generate marketable surplus which may compromise respondents' food security because they will have to pay more to buy limited food that is available. Also sampled respondents complained that inputs prices were high. Farm inputs include credit, farmland, improved seeds, labour and agrochemicals and so on. If the prices of these inputs that are crucial to generation of marketable surplus are not affordable, farmers may not be able to produce as much as they wished. Therefore, respondents may not earn income adequate to buy required food to stay food secure. Lack of storage facilities was among the list of challenges faced by sampled respondents. Storage facilities such as silo, play a great role in reducing post-harvest loss and in encouraging delayed sale of grains to earn better remunerative price after a period of glut. Persistent lack of storage facilities will discourage rice farming respondents from commercializing their enterprise. Consequently, they would be unable to generate marketable surplus that could be sold to earn more income for buying more food needed to make them stay food secure. The findings of this study were similar to the results of other researchers in the area (e.g., Adegoroye et al., 2023; Oladoyin et al., 2023; Oparinde et al., 2023).

Table 4: Distribution of Respondents by Production General Challenges Faced by them

Challenges	Frequency	Percentage
Inadequate Farmland	201	74.7
Constrained Access to Credit	269	100.0
Fulani Herdsmen	167	62.1
Climate Change	257	95.5
Poor condition of road	242	90
Low price of milled rice	216	80.3
High input prices	212	78.8
Lack of storage facilities	227	84.4

Note: Multiple Response

4. CONCLUSION AND RECOMMENDATIONS

In spite of the government's concerted efforts to address food security challenges in Nigeria through various alleviation programs and strategies, the persistence of food insecurity remains a pressing issue. The urgency of tackling this challenge is underscored, particularly in light of the Sustainable Development Goals (SDGs), where the elimination of hunger is a paramount mandate. Understanding the intricate dynamics of food insecurity at the household level in Nigeria is imperative for devising effective solutions. The empirical findings from this study highlight critical determinants of food insecurity, including the age of the household head, years

of formal education, savings, value of livestock owned, vulnerability status, and crop loss incidents. To comprehensively address these issues and enhance food security, the following policy recommendations are suggested:

i. Government should implement initiatives that focus on improving formal education opportunities, especially for households with lower levels of education. This can empower individuals to explore diverse livelihood strategies and contribute to long-term food security.

ii. Financial support programs aimed at providing farmers with access to adequate funds should be established. This can help alleviate challenges related to inadequate funds, high input prices, and enhance overall agricultural productivity.

iii. Develop and implement strategies to help farmers adapt to the challenges posed by climate change. This may include promoting resilient agricultural practices, providing climate-smart technologies, and offering training on climate-resilient farming techniques.

iv. Infrastructure development, particularly in rural areas where agricultural activities are prevalent should be focused by the government. Improving road conditions and addressing transportation challenges can facilitate the efficient movement of agricultural products, reducing post-harvest losses and enhancing market access.

v. Storage facilities for agricultural produce to mitigate losses should be made available by the government. This can contribute to better food preservation and availability, especially during challenging periods.

REFERENCES

Adegoroye, A., Olutumise, A.I., and Aturamu, O.A. (2021). Determinants of Food Security Status and Coping Strategies to Food Insecurity among Rural Crop Farming Households in Ondo State, Nigeria. European Journal of Nutrition & Food Safety, 13(7), 39-50.

Adegoroye, A., Olubunmi-Ajayi, T. S., Akinbola, A. E., & Oguntuase, D. T. (2023). Socioeconomic and performance of agripreneurs: A case study of dried melon value chain in Owo local government of Ondo State, Nigeria. International Journal of Management & Entrepreneurship Research, 5(12), 851-862.

Abdulai, A.N. (2016). Impact of Conservation Agriculture Technology on Household Welfare in Zambia. Agricultural Economics 47. Pp13.

Abdoulaye, T., Sanders, J. H., & Saito, K. (2021). Infrastructure and agricultural productivity in sub-Saharan Africa: Investment priorities for the next decade. Agricultural Economics, 52(4), 619-640.

Adesanoye, A.O. and Okunmadewa, F.Y. (2007). Households' vulnerability to poverty in Ibadan metropolis, Oyo state, Nigeria. Pakistan Journal of social sciences 4(1): 120-128

Agbola, P.O. (2014). Factors Influencing Food Insecurity among Small Farmers in Nigeria. African Journal of Agricultural Research 9(27). Pp2104-2110.

Ahmed, T.(2017). Impacts of Agricultural commercialization on smallholder farmers in Southwestern region of Bangladesh. International Journal of Economics and Research &92): 33-40

Ajayi, C.O. and Olutumise, A.I. (2018). Determinants of Food Security and Technical Efficiency of Cassava Farmers in Ondo State, Nigeria. International Food and Agribusiness Management Review, 21(7): 915 – 928.

Akinwale, A. Y., Adewumi, M. O., & Adebayo, A. A. (2020). Food insecurity in Nigeria: A review of the conceptual, methodological and empirical considerations. International Journal of Agricultural Management and Extension, 8(2), 158-170.

Ayinde, I. A., Otekunrin, O. A., and Akinbode, S. O. (2020). Food security in Nigeria: impetus for growth and development. J. Agric. Econ. 6, 808–820. doi: 10.6084/M9.FIGSHARE.12949352.

Babatunde,R.O., Omotesho,O.A., Olorunsanya,E.O. & Owotoki,G.M. (2008). Determinants of vulnerability to food insecurity: A gender-based analysis of farming households in Nigeria. Indian Journal of Agricultural Economics, 63(1).

Baiyegunhi, L.J.S and Fraser, G.C.G., (2011). Vulnerability and Poverty Dynamics in Rural Areas of Easter Cape Province, South Africa. GJDS 8(2); 84-100.

Ejikeme, J. O., Ojiako, J. C., Onwuzuligbo, C., and Uand Ezeh, F. C. (2017). Enhancing food security in Anambra state, Nigeria using remote sensing data. Environ. Rev. 6, 27–44. Available online at: http://erjournal.net/index.php/erjournal/article/viewFile/33/pdf4

Enete, O. A., Onyeagoro, V. N., & Chukwukelu, P. I. (2022). Climate change and agricultural productivity in Nigeria: Impacts and adaptation strategies. Journal of Agriculture and Science, 12(8), 75-85.

FAO (2019). The State of Food and Agriculture 2019. Moving Forward on Food Loss and Waste Reduction. Rome. Available online at: www.fao.org/3/ca6030en/ca6030en.pdf.

FAO (2023). The State of Food Security and Nutrition in the World 2023. Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization (2024). Hunger and food insecurity. https://www.fao.org/hunger/en/.

Kibirige, D. (2016). Smallholder commercialization of maize and social capital in eastern cape province of south Africa. International Journal of Economics, commerce and management 4(9): 235-252

Mesfin, W. (2014). Analysis of Households Vulnerability and Food Insecurity in Amhara Regional State of Ethiopia: Using Value at Risk Analysis. Ethiopia Journal of Economics 23(2). 37-78.

Ntakyo, P and Van dan Ber, M (2019). Effect of Market Production on Rural Household Food Consumption: Evidence from Uganda. Research Report Wageninigen University, Netherlands, 22pp. Retrieved from https://doi.org/10.107/s12571- 00959-2

Ogundari, K., & Ojo, S. O. (2019). Determinants of food insecurity among farming households in South-Western Nigeria. International Journal of Food and Agricultural Economics, 7(4), 202-209.

Ogunyemi, A. I., Olutumise, A. I. and Adegoroye, A. (2022). The extent of Vulnerability to Food Insecurity and Household Coping Strategies: Case of Yam Farmers in Ekiti State, Nigeria. Turkish Journal of Agriculture-Food Science and Technology, 10(10), 1921-1928.

Okoye, C. U., Okoye, P. U., & Egbogu, I. I. (2022). Insurgency and food insecurity in Nigeria: A critical review of the literature. American Journal of Social Issues & Humanities, 12(2), 329-335.

Oladele, O. I., Ajayi, B. T., & Afolayan, S. O. (2021). Adoption of modern rice production technologies in Kwara State, Nigeria: Determinants and constraints. Heliyon, 7(12), e09029.

Oladoyin, O. P., Adegoroye , A., Akinbola, A. E., and Borokini, E. A. (2023). Unlocking the Economic Potentials of Leafy Vegetable: A Case Study of Farmers in Akoko South West Local Government Area of Ondo State, Nigeria. *Asian Journal of Research in Agriculture and Forestry*, 9(4), 327–336. https://doi.org/10.9734/ajraf/2023/v9i4262

Olanrewaju, E. (2015). Agricultural commercialization: Effect on food security among smallholder farming households in southwestern Nigeria. International Journal of science and Research, 5(11): 1265-1269

Olutumise, A.I., Abiodun, T.C. and Ekundayo, B.P. (2021). Diversification of Livelihood and Food Security Nexus among Rural Households in Ondo State, Nigeria. Journal of Rural Economics and Development (JRED), 23(1): 23 - 32.

Olutumise, A. I., Ijigbade, J. O., & Aturamu, O. A. (2022). Marketers' Conduct and Profitability as a Response to Sustainable Livelihood: The Example of Bush Mango Kernels (Irvingia spp.) in Ondo State, Nigeria. Small-scale Forestry, 1-18.

Olutumise, A. I., & Oparinde, L. O. (2022). Climate Information and Health Variables as Determinants of Technical Efficiency: Insight from Food Crop Farmers. International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EES), 12(3).

Olutumise, A. I., Bankole, A. S., Olutumise, B. O., & Aturamu, O. A. (2023). Gender differential in allocative efficiency of oil palm processors in Southwest, Nigeria. Kasetsart Journal of Social Sciences, 44(2), 327-336.

Olutumise, A. I. (2023a). Impact of credit on the climate adaptation utilization among food crop farmers in Southwest, Nigeria: application of endogenous treatment Poisson regression model. Agricultural and Food Economics, 11(1), 7.

Olutumise, A. I. (2023b). Intensity of adaptations to heat stress in poultry farms: A behavioural analysis of farmers in Ondo state, Nigeria. Journal of Thermal Biology, 103614.

Oluwatayo, I.B. (2007). Determinant of vulnerability among rural households in Ekiti State, Nigeria.

Omonijo, A.G., Olutumise, A.I., & Olabimpe, O.T. (2023). Agro-climatic zonation based on rainfall distribution over Ondo State, Southwest, Nigeria. Journal of Meteorology and Climate Science, 22(1), 195-224.

Oparinde, L. O., & Olutumise, A. I. (2022). Impact of credit constraints on aquaculture production and risk exposure in Ondo State, Nigeria. Journal of Applied Aquaculture, 34(1), 79-96.

Oparinde, L.O., Olutumise, A.I. and Adegoroye, A. (2023). Does Agroforestry Technology Adoption Affect Income Inequality among Arable Crop Farmers in Southwest, Nigeria? A Gender Perspective. Sarhad Journal of Agriculture, Vol.39, Iss. 4, Pages 848-860.

Osabohien, R. O., Ohalete, M. P., and Osabuohien, E. (2020a). Population poverty inequality nexus and social protection in Africa. Soc. Indic. Res. 151, 575–598. doi: 10.1007/s11205-020-02381-0.

Osabohien, R., et al. (2020b). Accountability in agricultural governance and food security in Nigeria. Braz. J. Food Technol. 23, 1–12. doi: 10.1590/1981-6723.08919.

Pingali P. L. (1997). From Subsistence to Commercial Production Systems: The Transformation of Asian Agriculture. American Journal of Agricultural Economics, 79 (May 1997): 628 - 634

Ukpe, O.U. (2016). Effects of Access to Microcredit on the Food Security status of crop farm households in Niger-Delta, Nigeria. PhD Thesis, University of Nigeria, Nssuka.

World Bank (2023). Nigeria Economic Update: Securing Nigeria's Future and Avoiding the Middle-Income Trap. World Bank. https://www.worldbank.org/en/news/press-release/2023/12/13/turning-the-corner-time-to-move-from-reforms-to-results

Yamane, T., (1967). Statistics: An Introductory Analysis, 2nd Edition, New York: Haper and Row.

Zemedu, L. and Mesfin, W. (2014). Smallholders' Vulnerability to Food Insecurity and Coping Strategies: In the face of climate change, East Hararghe, Ethiopia. Journal of Economics and Sustainable Development. 5(24): 86-100.