

#### RURAL LIVELIHOODS AND FOOD INSECURITY AMONG FARMING HOUSEHOLDS IN SOUTHWESTERN NIGERIA

#### Yaqoob Abdul Majeed, Muhammad Abdul-Yakeen Rahji, Kabir Kayode Salman and Adeola Oluwakemi Obayelu

Department of Agricultural Economics, Faculty of Agriculture, University of Ibadan.

#### Cite this article:

Yaqoob A.M., Muhammad A.R., Kabir K.S., Adeola O.O. (2022), Rural Livelihoods and Food Insecurity among Farming Households in Southwestern Nigeria. African Journal of Economics and Sustainable Development 5(2), 72-104. DOI: 10.52589/AJESD-NZ7KCMYY.

#### Manuscript History

Received: 29 April 2022 Accepted: 21 May 2022 Published: 5 June 2022

**Copyright** © 2022 The Author(s). This is an Open Access article distributed under the terms of Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0), which permits anyone to share, use, reproduce and redistribute in any medium, provided the original author and source are credited. **ABSTRACT:** Rural livelihoods have been the subject of empirical analysis in development studies because they play important roles in mitigating Food Insecurity (FI). In Nigeria, the incidence of FI is higher among the rural populace, particularly the peasant farming households, than urban households. Previous studies have linked aggregate measure of rural livelihoods to FI with little attention to contributions of specific components to FI. Hence, the influence of rural livelihoods on FI status of farming households was investigated. Primary data were collected from 400 farming households in Osun and Ekiti states of Southwestern Nigeria using semi-structured questionnaire. The result shows that age of household heads was  $51.9\pm11.4$ years, while household size was  $8\pm 2.9$  persons. Households that were Core Food-insecure (CFI), Moderately Food-insecure (MFI) and Non Food-insecure (NFI) were 4.38%, 35.89% and 59.73%, respectively. The probability of being NFI was increased by age (0.0115), Being Married-BM (0.1073), Household Size-HS (0.0166), Post Primary Education-PPE (0.1090), Access to Irrigation-AI (0.1376), rain forest zone (0.1417), and Financial Asset-FA (0.1630), while extension services (-0.0040) and Access to National Grid-ANG (-0.1620) reduced it. Extension services (0.0030), farming experience-FE (0.0052), and ANG (0.1202) increased the probability of being MFI, while age (-0.0085), BM (-0.0706), PPE (-0.0809), HS (-0.0123), AI (-0.1020) and rainforest zone (-0.1051) reduced it. Extension services (0.0011), FE (0.0018), and ANG (0.0419) increased the probability of being CFI, while age (-0.0030), BM (-0.0277), PPE (-0.0282), HS (-0.0043), AI (-0.0356), rain-forest zone (-0.0366) and FA (-0.4210) reduced it. On-farm rural livelihood relative to combined on-farm with off-farm and non-farm, reduced food insecurity among farming households in Southwestern Nigeria.

**KEYWORDS:** Rural Livelihoods, Food-Insecurity, Livelihoods' Assets, Food Consumption Scores



# **INTRODUCTION**

#### **Background to the Study**

Food insecurity is a problem affecting global development efforts for a number of decades. It is often an indication of poverty and it is the most widely used measure of food deprivation. It implies that, sustained access to save, sufficient and nutritious food is restricted by inadequate income or resources as at when needed (FAO, *et al.*, 2019). In 2018, the population of the undernourished people worldwide was about 821million with 29% living in sub-Saharan Africa, while over 2 billion suffering from one or more micronutrient deficiencies (CDC, 2020). Poverty, which is a permanent or temporary state of deprivation caused by inadequate entitlements including income, wealth and access to adequate food is pervasive in Nigeria (World Bank, 2019). In 2018, the World Poverty Clock reported that Nigeria is the capital of the world's poverty suggesting a worst scenario of undernourishment in sub-Saharan Africa.

Food insecurity occurs when individuals or households are faced with limited physical, social or economic access to safe, sufficient and nutritious food for healthy life (Kakwani and Son, 2017). It restricts people's ability to acquire nutritionally adequate and save food in a way that is socially acceptable (USDA, 2019). The physical health and productive life impairment are a consequence of individual or household's inability to have secured access to nutritionally sufficient food (Jones *et al.*, 2013). Food insecurity is a threat to social-political order. The 2007-2008 food riot is a fallout from food price crisis, thus recognizing the fundamental role of food access in social cohesion. Thus, an individual is entitled to improved quality of life that takes into consideration the adequate health and wellbeing of individuals and this right is enshrined in Article 25 of the Universal Declaration of Human rights of 1948. Food insecurity status, which can either be transitory if an individual or household has temporary shortfall of food consumption requirements or chronic if a long term or permanent condition of inadequate food consumption requirement prevails. It often changes over time subject to seasonality or as a result of stochastic shocks including weather events, death or social conflict (FAO *et al.*, 2019).

A major factor with high potential to solve food insecurity issue is the livelihood of the people. It comprises of different assets and activities that enable individuals or households to achieve their means of living (ACF, 2010). Report shows that, the rural area of the developing world is characterized by widespread hunger and poverty, where family farming and smallholder agriculture including animal husbandry, fishing and non-farm participation are the common livelihoods. Thus, rural livelihoods comprise of mainly agriculture with a segment of the population diversifying into non-farm activities in order to pursue their livelihood goals (Davies *et al.*, 2010).

Rising from the problems associated with rural agriculture which include depleting soil fertility, poor infrastructure, weather and climatic vulnerability among others, rural households in developing countries including Nigeria are forced by necessity to deploy strategies such as agricultural intensification, livelihood diversification and migration in attempts to secure their livelihoods (Otaha, 2013; Jemal and Kim, 2014). Diversification is a broad component of rural livelihoods existing at varying levels of the rural economy. It could be viewed as adaptation technique or risk management for agrarian households. Rural households in Nigeria whose livelihoods depend largely on subsistence farming combine or diversify into one or more sources of non-farm income with the aim of achieving positive livelihood outcome (Kassie,



2016). Studies have shown that farming activities on average account for only 40-60% of the livelihoods pursued in South Asia and sub-Saharan Africa (Hilson, 2016). Livelihood and food insecurity are two concepts that are closely linked, while livelihood encompasses the capabilities, assets and activities required for a means of living, food insecurity is just one undesirable outcome resulting from inability of livelihood to ensure secured access to adequate and nutritious food.

# **Statement of the Problem**

Statistics show consistent increase in national production of major food crops in Nigeria for over five years (CBN, 2016). In 2016, the Central Bank of Nigeria also reported increase in crop and livestock production with about 3.5% and 5.99% respectively. According to Olomola, (2015), the staple food production of rice, sorghum, cassava and maize increased by 1.3million MT, 13000MT, 600,000MT and 6.28million MT respectively between 2012 and 2014. Overall, the national food supplies rose by over 20 million MT between 2012 and 2015. In spite of these increases in national food production as well as the rising food imports bill averaged N1.4 trillion between 2011 and 2015 (NBS, 2015), the food insecurity situation in Nigeria is worsening with about 7.1 million people currently at the risk of being faced with chronic food poverty and in need of emergency safety nets and social protection (FAO, 2017). Consequently, the affected population suffers from the problem of undernutrition and inadequate access to nutritious and sufficient food (FAO, 2018).

Statistics show that, the annual population growth rates in Nigeria between 2011 and 2016 averaged 2.7%, while the annual growth rate of agriculture during the same period averaged 4.1% (Olomola, 2018), suggesting that the real issue with food insecurity in Nigeria are concerned with the economic access and per capita real income of households. This is because about two-third of households in the south of the Sahara including Nigeria engage in vulnerable employment in Agriculture (FAO *et al.*, 2015). In the face of persistent and sharp increase in food prices, low demand for wage labor, unemployment, sickness or death of bread-winner, existence of adequate aggregate food supplies does not guarantee food security at the household level (Kakwani and Son, 2017).

Available evidence shows that the population of undernourished in Nigeria increased from 4.7 million (5.9% of the population) in 2008 to 12.9 million (7% of the population) in 2016 indicating an endemic increase in food insecurity (IFPRI-GHI 2016; Olomola, 2018). When compared to urban households, food insecurity is more prevalent among the agrarian people particularly the peasant farming households in Nigeria (Fawehinmi and Adeniyi, 2014) This is because rural agriculture is characterized by drought, unpredicted rainfall pattern, land fragmentation, low level of productivity and high level of peasant farming (Jirstrom *et al.*, 2011).

Several efforts have been made in the past by successive administrations to address food insecurity through the creation of special programmes and projects. These include: National Accelerated Food Production Progamme, (NAFPP) (1973); National Special Programme on Food Security, (NSPFS) (2008); National Food Crisis Response Programme (NFCRP); Food Security Thematic Group (FSTG) (2009). Seven Points Agenda with emphasis on Food Security (2009), Agricultural Transformation Agenda (2011-2015) and more recently Agricultural Promotion Policy (2016-2020). These efforts were met with little success as Nigeria is ranked 103<sup>th</sup> out of 119 countries in the global hunger scores (GHI, 2018).



Sabates-Wheeler *et al.* (2012); Asogwa and Umeh, (2014) attributed the problem of food insecurity to low productivity of the Nigerian agriculture resulting from inadequate technology that characterize the sector. While the need to increase national food supply through productivity initiatives is key to tackling food insecurity problem, diversification of income sources has equally been recognized as a strategy for poverty reduction as well as reducing the extent of vulnerability (Khartum and Roy, 2012). The relevant questions that this study attempted to answer include: To what extent do farming households have access to livelihoods' assets? What choices of livelihoods were pursued by farming households in the study area? To what extent do farming households have on food insecurity status of farming households in Southwestern Nigeria?

# **Objectives of the study**

The main objective of this study was to determine the influence of rural livelihoods on food insecurity status of farming households in Southwestern, Nigeria. The specific objectives of the study attempted to:

- i. Assess the extent of farming households' access to livelihood assets.
- ii. Identify the choice of rural livelihoods pursued by farming households
- iii. Profile food insecurity status of farming households in the study area.
- iv. Determine the influence of rural livelihoods on food insecurity status of farming households in Southwestern Nigeria.

# LITERATURE REVIEW AND THEORETICAL FRAMEWORK

# Literature Review

A paradigm shift in recent development literature views food insecurity as a livelihoods' failure to ensure access to adequate food at the household rather than agricultural failure to produce sufficient food at the national level (Nwalie, 2017). Although, appropriate agricultural policies might show a reported increase in national food production, food insecurity may be persisting at the household due to inefficient agricultural food system or unfavorable macroeconomic indices such as price fluctuation, unemployment, high foreign exchange rate and inflation. Hence, the need to examine the extent to which the choice of rural livelihoods affects household's economic access to food is critical to solving the food insecurity problem. Furthermore, data obtained through household and food consumption survey, upon which this study is based, are often the most preferred sources of food consumption estimates for most analysts, because they are found to be more reliable and provide accurate information than nationally aggregated data on Food Balance Sheet (Kakwani and Son, 2017).

Previous studies (Ayantoye *et. al.*, 2011; Asogwa and Umeh, 2012; Dzanya *et. al.*, 2015) on food insecurity adopted the cost of calorie index proposed by Greer and Thorbecke (1986) as applied by FAO (2003) to estimate food insecurity threshold. However, maintaining stable health condition also requires adequate intake of calories, protein, vitamins and minerals. Cost of calorie function which they derived exclusively from the inadequacy of calorie requirement does not take into consideration the issue of under-nutrition or malnutrition or quantities of the



nutrients. Oni and Fashogbon, (2013); Asa and Achibong, (2016); Mamman *et.al.* (2016) used food poverty measure proposed by Foster, Greer and Thorbecke (1984) to estimate food insecurity line. But this measure provides estimates of monetary value of food rather than adequacy (or otherwise) of dietary requirements for healthy life. The exceptions to these studies are the studies conducted in Ghana by Mensah (2014) and collaborative 'Report of Food Security Sector Humanitarian Agencies (2015) conducted in the North East, Nigeria. There is a dearth of information or gap in knowledge that this study intended to fill using the Food Consumption Scores (FCS) to assess food insecurity status. In using this measure, the food quantity was not taken into consideration. But it was reported to be positively and significantly correlated with kilocalories consumed per capita per day, asset indices and total monthly household expenditure (Coates *et al.*, 2007).

The methodological debate on livelihood studies reveals that some studies (Roy, 2012; Awoniyi and Salman, 2014) quantified rural livelihoods using the aggregate indexing approach derived from the share of different income sources available to farm households. Although, this approach is widely favoured in the literature for its simplicity and objectivity, the possibility of identifying the specific component that provides higher expected income with lower risk of food insecurity is problematic as the sub-components are averaged into a single index score. More so, relying on estimates obtained from direct use of income or income share could be misleading due to the random nature of income which has the intrinsic to make significant fluctuations in perceived income sources over time. (Barrett *et al.*, 2001). Even if income is not stochastic, measuring income for some activities including farming particularly in developing countries is difficult.

Further, Oni and Fashogbon, (2013); David, (2013) quantified rural livelihoods using the main or single activity variable and adopted the sectorial classification commonly used in national accounting systems to link the household's main activity to corresponding outcome. However, rural livelihoods cannot be analysed based on a single activity component as rural households are often engaged in combinations of activities (Barrett *et al.*, 2001). Mensah, (2014) and Mohammed, (2014) quantified rural livelihoods using a checklists of livelihood activities pursued and stratified households in to 'diversified' (i.e. on-farm + non-farm activities) and non-diversified (on-farm activity only) using Barrett *et al.* (2001) sectorial classification. Although this approach is known for its computational simplicity, the authors failed to empirically account for relative contributions of other livelihood activities to food insecurity. For example, some activities with low entry barriers such as environmental gathering cannot be classified as on-farm or non-farm. Classifying them into non-farm activity could yield a misleading result in view of overwhelming empirical evidence of negative impact of non-farm income strategy on food insecurity.

This study deviates from the previous approaches as it adopted the concept of livelihood strategy to capture the various activities or combinations of livelihood activities pursued by farming households using the income portfolio analysis and activity variables to cluster farming households into mutually exclusive choices of rural livelihoods as the basis for proffering solution to food insecurity problem. Understanding asset endowment at the disposal of rural households and also the choice(s) of livelihoods pursued towards securing their livelihoods could provide useful insights for policy makers on the choice of appropriate and context-specific livelihood intervention programmes that can sustainably mitigate the problem of food insecurity.



#### **Theoretical Framework: Theory of Random Utility**

The intrinsic motives driving household's choice of livelihoods are to maximise utility through predicted earnings from undertaking a specific livelihood (Dearcon and Krishnan, 1996). The random utility is a framework used to analyse a household's choice of livelihoods. According to the theory, utility is an intangible construct laden with sense of feelings by individuals or households but cannot be directly observed (Phaneuf, 2005). Further, it premised that this unobservable utility may be split into two parts: systematic or representational utility (V) and random or unexpected utility ( $\varepsilon_i$ ). This random component emerges due to the unpredictability of the individuals' choices as well as the fact that the characteristics do not cover all of the preferences. Thus, the total utility derived by the *i*<sub>th</sub> household from engaging in a particular livelihood can be explicitly stated as a linear combination of two components: (i) a deterministic part, V<sub>ia</sub>, that accounts for the explained components and (ii) stochastic error term that accounts for unexplained components such as measurement errors.

 $U_{ia} = V_{ia} + \epsilon_{ia} \dots (1)$ 

Given that  $V_{ia}$  is a deterministic component and  $\varepsilon_{ia}$  constitutes the "white noise" component (Thurstone, 1997). The assumption is that, allocation of assets to each activity or group of activities is expected to maximise household's utility derived through the entitlement set. Assets would be allocated by a household such that the value of marginal product across the set of activities are equal or would be completely allocated to a single activity that has higher return. As a result, the likelihood that the utility of a livelihood set 'a,' is greater than the maximum utility of the alternative set *i* is expressed as follow:

 $P(a) = P\left[U_{ia} > Max U_{ji}\right] = P\left[V_{ia} + \varepsilon_i > Max V_{ji} + \varepsilon_j\right] j \neq a.....(2)$ 

The assumption is that, the utility function is a linear combinations in parameters  $X_i$  characteristics of the farming household's head, those of the alternative livelihood set 'a' viewed by  $i_{th}$  household and a random or unexpected component.

 $U_{ia} = \beta^{`} X_{ia} + \epsilon_{ia}....(3)$ 

Where  $\beta'$  is a vector of unknown parameters and  $X_{ia}$  is a vector of observed attributes of the household head as well as livelihoods' choice and  $\varepsilon_{ia}$  is the error term.



# METHODOLOGY

#### **Study Area**

This study was conducted in Southwestern Nigeria. It is one of the six geo-political zones in the country. The South-west consists of six states namely Lagos, Ogun, Oyo, Osun, Ondo and Ekiti State. The zone lies between latitude 600 211<sup>1</sup> and 800 371<sup>1</sup> North (Faleyimu *et al.*, 2010) and longitude 200 311<sup>1</sup> and 600 001<sup>1</sup> East. It shares border with Kogi and Kwara states in the northern part and with Atlantic Ocean in the southern part, Edo and Delta states in the eastern part, while in the western part by the Republic of Benin.

The Southwest has a land area of about 114,271 square kilometres with total population of 27,581,992 (NPC, 2006). The zone houses the Yoruba ethnic group. The zone has a distinct feature of tropical climate marked with dry season between November and March and a wet season between April and October. The average distribution of annual rainfall is 1480mm and a mean monthly temperature range of 18°C-24° C and 30°C-35°C during the rainy and dry seasons respectively. The vegetation cover of the southwestern zone consists of fresh water and mangrove. The crops such as rice, maize, sorghum, cowpea, groundnut, yam, potato, cassava, and soya bean are predominantly grown in the area. The people of the zone also practice fishing, poultry, livestock husbandry and non-farm activities such as trading and wage employment.

#### **Sampling Procedure:**

Multi-stage sampling procedure was used for this study. In the first stage, Osun and Ekiti states were purposively selected from the six states of the Southwestern Nigeria because the two states have the highest poverty ranking and by extension food insecurity (NBS, 2016). The second stage entailed random selection of two out of the three ADP zones in each of the two states making a total of four ADP zones. ADP is known to coordinate agricultural activities in Nigeria. ADP is administratively structured into zones, blocks and cells. Zone has at least four or five Local Government Areas or blocks, while cell consists of numerous villages that are situated in the block. In the third stage, there was a random selection of seven and four blocks respectively from the selected ADP zones of Osun and Ekiti states, making a total of eleven blocks (11 LGAs) in the selected two states. In the last stage, four hundred (400) farming households were randomly chosen from the two states proportionate to the size of the selected villages. The proportionate factor used was given as follows:

 $m_i = \frac{M_i}{M} \ge 400$  ..... (4)

Where  $m_i$  = the number of farming households to be selected from  $i_{th}$  village

 $M_i$  = total number of households in  $i_{th}$  village

M = total number of households in all the selected 46 villages

400 = desired number of households for the survey



However, only three hundred and sixty-five (365) copies of questionnaire with valid information were used in the analysis.

#### Methods of Data Analysis

A number of analytical techniques were presented in this section in order to operationalize the study objectives. These include the descriptive statistics, principal component analysis, income portfolio analysis, food consumption scores, instrumental variable (IV) ordered probit as well as ordered probit model.

#### Principal Component Analysis (PCA)

Following Moser and Felton,(2007) and the works of Jemal and Kim (2015), Principal Component Analysis (PCA) was used to derive a composite score from household's endowment of various binary assets ownership variables as well as assets variables measured on interval and ordinal scales. The eigenvectors of the covariance matrix resulting from maximum likelihood estimation produces the principal components of the data set. The first principal component was used to create the asset score because it contributes the maximum variation to the original data sets.

The intuition in using this procedure is that the livelihoods' asset was considered a latent variable that cannot be observed in the survey. The manifestation of this latent variable was observed only through access to five different categories of livelihoods' assets that include Natural, Physical, Human, Financial and Social assets that are also latent. The PCA-based model of livelihoods' assets is specified as follows:

A.  $S_{l_i}$ = Livelihood Asset-score for i<sup>th</sup> household,  $NA_i$  = Natural asset;  $PA_i$ = Physical asset;  $FA_i$ = Financial asset;  $HA_i$ = Human asset;  $S.A_i$ = Social capital;  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ , and  $\lambda$  are the eigenvectors of the covariance matrix for Natural, Physical, Financial, Human and Social assets respectively. In using the PCA, the idea was to take these j<sup>th</sup> asset indicator variables for each category of asset and find their combinations to produce indices  $Z_1, Z_2, \ldots, Z_j$ , that are not correlated and whose variances decrease from first to the last. The  $Z_i$  produced was the principal components given by:

 $Z_{j} = b_{j1}S_{1} + b_{j2}S_{2} + b_{j3}S_{3} + \ldots + b_{jj}S_{J} \quad \dots \qquad (6)$ 

Where  $b_j^1 = [b_{1j} \dots b_{jj}]$  are vectors of the scoring factors or weights and  $S_1, \dots, S_j$  are vectors of indicator variables for j<sup>th</sup> category of asset. Following Scoones, (1998), the indicator variables used for constructing composite score for each of the asset category were given as follow:



N. A <sub>i</sub> :		Access to Natural asset
N <sub>1</sub>	=	Farm size (ha)
$N_2$	=	Access to forest resources/products (1= yes, 0 otherwise)
N <sub>3</sub>	=	Access to irrigation (1= yes, 0 otherwise)
<b>P</b> . <b>A</b> <sub>i</sub> :		Access to Physical asset
P <sub>1</sub>	=	House ownership (1=yes, 0 otherwise)
P <sub>2</sub>	=	Ownership of vehicle (1=yes, 0 otherwise)
P <sub>3</sub>	=	Access to the tarmac road (1=yes, 0 otherwise)
P <sub>4</sub>	=	Access to the national grid (1=yes, 0 otherwise)
P <sub>5</sub>	=	Distance to the market (km)
<b>F</b> . <b>A</b> <sub>i</sub> :		Access to Financial asset
$F_1$	=	Remittances received (N)
$F_2$	=	Microcredit received (N)
F <sub>3</sub>	=	Number of livestock owned (Tropical livestock units, TLU)
$F_4$	=	Ownership of jewelries (1=yes, 0 otherwise)
H.A <sub>i</sub> :		Access to Human asset
H <sub>1</sub>	=	Labor availability (economically non-active/active household members)
H <sub>2</sub>	=	Distance to the nearest health care centers (km)
H <sub>3</sub>	=	Health status (Normal=1, 0 otherwise)
H <sub>3</sub>	=	Years of formal education of household head
<b>S</b> . <b>A</b> <sub>i</sub> :		Access to and/or ownership of Social assets
S <sub>1</sub>	=	Membership of social organization (1=yes, 0 otherwise)
S <sub>2</sub>	=	Decision making in social organization (1= yes, 0 otherwise)
S <sub>2</sub>	=	Share of income from remittances (N)



A 2-stage factor analysis was used to estimate a composite score of livelihoods' assets for each household. In the first stage, a composite asset score was estimated separately for each category of livelihoods' asset using the iteration technique of principal factor. In the second stage, an aggregate score of livelihoods' assets was computed from the previously (first stage) estimated interacting variables. Formular to compute PCA-based asset score was given as follows:

A.  $S_{lj} = \frac{\sum F_i(X_{ji} - X)}{S_i}$  .....(7)

Where A.  $S_j$  is the value of the  $j_{th}$  household's asset obtained using the PCA technique,  $F_i =$  scoring factor of the weight for the  $i_{th}$  variable in the PCA model,  $X_{ji} = j^{th}$  household value for the  $i_{th}$  variable, X and  $S_i$  are the mean and standard deviation respectively for the  $i_{th}$  variable.

In the first stage, the mean value of PCA-based composite asset score for each category of asset was used to classify households into three different levels of access to livelihoods' assets given as 'high, moderate or low' level. Households with scores above two-third (2/3) of mean asset score were ranked "high", while those with scores above the one-third (1/3) but less or equal two-third (2/3) of the mean asset score were ranked "moderate". Those with scores less than or equal to one-third (1/3) of the mean asset score were ranked low. However, in the second stage of the analysis, this classification was collapsed into only two categories (Low/High) due to the convergence in the data set. Households with composite score that exceeds or equal to the population mean score were ranked "high" while those with score less than the population mean were ranked "low" in terms of access to livelihood assets.

#### **Income Portfolio Analysis**

Income Portfolio Analysis was used to identify the choice of rural livelihoods pursued by farming households. This involved identifying people by income proportion received from various sectors of the rural economy classified by Ellis, (1998) and Barrett *et al.* (2001), as follow:

- A. Farm income: This is the income type obtained from the use of land inherited, purchased, rented or accessed by share tenancy for agricultural activities including crop, livestock, fishery and forestry.
- B. Off-farm income: This is the type of income or wage earned from the use of own labour hired in other farms within the context of Agriculture.
- C. Non-farm income: This includes earnings from non-agricultural sectors such as non-farm employment, transfer income, rents received, rural wage and earnings from distant relations to an agrarian household (Ellis, 2000).

From the foregoing classification and following the works of Kassie *et al.* (2017), farming households were identified and grouped into four mutually exclusive livelihoods' choices as: on-farm (agriculture only); On-farm with off-farm (ONF-OF), on-farm with non-farm (ONF-NF) and on-farm, off-farm and non-farm (ONF-OF-NF) choice of rural livelihoods (Aboud *et al.*, 2001).



# Food Consumption Scores (FCS)

Following the works of Mensah (2014) and collaborative "Report of Food Security Sector Humanitarian Agencies (2015), Food Consumption Scores (FCS) was used because it is shown to be a valid proxy for measuring adequacy or otherwise of dietary requirements including micronutrients using data on household's consumption of different food groups (FANTA, 2006).

Food Consumption Scores (FCS) was estimated by asking the caregiver in a household about the frequency of consumption of each of the eight (8) food groups using 7-day recall. The food groups are: staples-maize, rice, sorghum, yam, cassava, potatoes and millet), pulses -legumes, nuts and seeds- vegetables, fruits, meat and fish, dairy products, sugar and oil. The assigned weights for each food group are: meat, milk and fish = 4; pulses = 3; staples =2; vegetables and fruits =1, sugar and oil =0.5 (WFP, 2007). The frequency of each of the food group consumed was multiplied by a predefined weight and the resulting values are summed to obtain the food consumption score as follow:

 $FCS_{i} = \sum_{fg_{h=1}}^{n=8} w_{fg} f_{fg} \dots (8)$ 

Where FCS<sub>i</sub> is the food consumption score obtained for  $i_{th}$  household;  $w_{fg}$ = weight of  $h_{th}$  food group consumed,  $f_{fg}$ = frequency of  $h_{th}$  food group consumed and n = total number of food groups. Based on these scores, three different cut-off categories representing food insecurity status of individual households were obtained as follow: "poor" conceptualized as core food insecure (y\* $\leq$ 21), "borderline" conceptualized as moderately food insecure (21 < y\*  $\leq$  35) and "acceptable" conceptualized as non-food insecure or food secure (y\*>35) with respect to frequency of food groups (dietary diversity) consumed.

# Instrumental Variable (IV) Ordered Probit Model

The instrumental variable (IV) ordered probit model as proposed by Amemiya (1978) and Newey (1987) and adopted by Maitra and Rao, (2014) was used to analyse the influence of rural livelihoods on food insecurity status of farming households. The choice of this model was premised on its suitability for estimating bi-causal or jointly dependent relationship among economic variables (Greene, 2012). Furthermore, the ordered probit regression is suitable for estimating model with ordinal outcome. Thus, Y which is a proxy variable for the latent Y<sup>\*</sup> is a linear function of selected covariates,  $x_I$ , plus a normally distributed error term.

For  $i_{th}$  rural household, where  $\mu_0 = 0$  and  $u_j=1$  denotes the two food insecurity categories through which the three observed Y values were determined as follows:

 $Y_i^* = Y_i = \begin{cases} 0 & \text{if } y_i^* \le \mu_0, \text{ (None-food insecure)} \\ 1 & \text{if } \mu_0 < y_i^* \le \mu_1 \text{ (moderately food - insecure)} \\ 2 & \text{if } \mu_1 < y_i^* \le \mu_2 & \text{ (Core-food insecure)} \end{cases}$ 

The full specification of the ordered probit model is given as follow:



$$\begin{split} Y_{i}^{*} &= Y_{i} = \beta_{1}X_{1} + \beta_{2}X_{2} + . + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + \beta_{17}X_{17} + \beta_{18}X_{18} + \epsilon_{1i} \ (10) \ \text{Model 1} \\ Y_{i}^{*} &= Y_{i} = \beta_{1}X_{1i} + \beta_{2}X_{2i} + ... + \beta_{13}X_{13i} + \beta_{14}X_{14} + \epsilon_{1i} \ .... \ (11) \ \text{Model 2} \end{split}$$

Where Y<sup>\*</sup> is a row vector of latent, unobservable food consumption scores that determine the observed, Y<sub>i</sub> ordinal outcomes of 2, 1 and 0 for core-food insecure (y<sup>\*</sup>≤21), moderately food insecure (21 < y<sup>\*</sup> ≤ 35) and none-food insecure (y<sup>\*</sup>>35) respectively; X's denote the vector of explanatory variables;  $\beta$  is the associated vector of unknown parameters and  $\varepsilon$  is an independently distributed error term ( $\varepsilon_i \sim \text{iid}: 0, \sigma^2$ ). The explanatory variables following the works of Yishak *et al.* (2014); Maitra and Rao (2014) and Mensah, (2014).

#### **Demographic and Socio-economic**

X <sub>1i</sub>	=	Age of the household head (years)				
X <sub>2i</sub>	=	Gender of the household head (1=male, 0 otherwise)				
X <sub>3i</sub>	=	Marital status of the household head, (1= married; 0 otherwise)				
$X_{4i}$	=	Post primary education (1= post primary education, 0 otherwise)				
X <sub>5i</sub>	=	Household size				
X <sub>6i</sub>	=	Dependent ratio (non-working /working members of household)				
Econo	Economic (Production/Exchange)					
X <sub>7i</sub>	=	Farming experience of Household head (years)				
X <sub>8i</sub>	=	Primary occupation of Household head (1= farming, 0 otherwise)				
X <sub>9i</sub>	=	Access to irrigation (1= yes, 0 otherwise)				
X <sub>10i</sub>	=	Agro-ecological zone (1= Rain forest, 0 otherwise)				
X <sub>11i</sub>	=	Rural livelihoods (1= on-farm, 2= on- farm + off-farm,				
		3= on-farm+ non-farm, 4= on-farm +off-farm+ non-farm).				
Institutional/Resilience Influence						

X <sub>12i</sub>	=	Frequency of contacts with extension agents in a year
X <sub>13i</sub>	=	Access to National Grid (electricity)
X <sub>14i</sub>	=	Aggregate Asset score (PCA-based)
X <sub>15i</sub>	=	Natural Asset score (PCA-based)
X <sub>16i</sub>	=	Physical Asset score (PCA-based)



X <sub>17i</sub>	=	Human Asset score	(PCA-based)
X <sub>18i</sub>	=	Financial Asset score	(PCA-based)
X <sub>19i</sub>	=	Social Asset score	(PCA-based)

#### **Endogeneity Issue in Food Insecurity Model**

Supposing the dependent variable Y<sup>\*</sup> and independent variable X<sub>14i</sub> in equation (11) were assumed to be jointly determined such that asset variable, X<sub>14i</sub> can also be influenced by food insecurity, Y<sup>\*</sup>, there will be endogeneity problem, (i.e.  $E(\epsilon_i X_{14i} \neq 0; E(\epsilon_{1i} \epsilon_{2j} \neq 0 \text{ for } i \neq j)$  (Greene, 2012). This implies that, ordered probit model will not produce consistent estimates of  $\beta_i$  parameters using maximum likelihood (ML) method. However, to obtain consistent estimates of  $\beta_i$  parameters from the maximum likelihood procedure, a vector  $z_i$  containing the relevant instrumental variables such that  $E(\epsilon_i z_i) = 0$  and  $E(\epsilon_{1i} \epsilon_{2j} = 0 \text{ for } i \neq j)$ , was required. The full specification of the simultaneous equation model, taking into consideration the assumption that underlies the endogeneity of X<sub>14i</sub>(asset score) is given as:

$$Y_{1} = \beta_{1}X_{1i} + \beta_{2}X_{2i} + \dots + \beta_{13}X_{13i} + \beta_{14}X_{14i} + \varepsilon_{1i}.....(12)$$
  
$$X_{14} = \beta_{1}X_{1i} + \beta_{2}X_{2i} + \dots + \beta_{14}X_{14i} + \beta_{15}X_{15i} + \beta_{16}X_{16i} + \varepsilon_{2j}.....(13)$$

Where  $Y_1$  and  $X_{14}$  are endogenous variables representing food insecurity status and asset score respectively. With the exception of these two endogenous variables ( $Y_1$  and  $X_{14}$ ), other variables specified in the simultaneous equations model were strictly exogenous. The structural equation was given by Equation (12), while the reduced form equation (13) mainly expresses the variation in strictly exogenous variables only, including a vector  $z_i$  consisting of instrumental variables,  $X_{15i}$  (per capita expenditure on farm inputs),  $X_{16i}$  (ownership of livestock) and  $X_{17i}$  (access to credit) that were excluded from the structural equation. This was done to produce the unique estimates for the coefficients of the structural and reduce-form equations. There is a difficulty in making use of Full Information Maximum Likelihood (FIML) estimation technique because it requires rigorous computational procedure and is timedemanding especially when it comes to ordered choice model. However, Stata user-written "cmp" (Roodman, 2009) has the routine to conveniently estimate this model.

#### **RESULTS AND DISCUSSION**

#### Distribution of Respondents based on Socio-Economic Characteristics

Table 4.1 shows the distribution of the respondents based on the socio-economic factors. The result shows that majority of the sampled population were male (81.4%), married (90.7%), had 6-10 members of household (61.1%). Also, majority (60%) of the respondents were between the ages of 36 and 55 years, while 7.40% aged 35 years or less. The mean age of the sampled population was about 52 years suggesting downward trend in the ability of the respondents to effectively carry out labour-intensive rural agriculture. There was high level of literacy as



90.9% of the respondents completed at least primary education, while only 9.04% had no formal education. The mean years of formal education was approximately 10 years. The high literacy level suggests the ease with which farming households adopt innovations and improved technologies.

The primary occupation for most of the respondents was farming (78.6%), with an average sixteen (16) years of experience. This suggests that most of the respondents were likely to benefit from improved productivity and earning capacity. Majority of the respondents belonged to at least one local level institution (74.5%), had access to at least a source of microcredit (74.5%). Considering the mean monthly income of the respondents, the results from table 4.1 show that one-quarter (25.5%) of the respondents earned above N60,000 monthly, while 35.6% earned at most N30,000 monthly and 38.63% earned between N30,001 and N60,000 monthly. The mean monthly income in the study area was N57, 422.30.

# Distribution of Respondents by Access to Livelihoods' Assets

The results as presented in the table 4.2 shows that 52.8%, 32.6% and 14.5% had high, moderate and low levels of access to natural asset respectively. This implies that, above average of the sampled population relied on natural asset for their livelihoods. Inadequate tenure rights to natural resources, coupled with extreme weather events and environmental degradation often result in poverty and hunger. For physical asset, majority (63.2%) of the respondents were highly endowed, while 13.1% and 23.6% had moderate and low levels of access to physical asset respectively. Seng (2015) reported that access to physical asset enhances or supports the capability of individuals or households to undertake productive activities in order to earn their means of living including income and food.

Further, majority (77.8%) of the respondents were highly endowed with human asset, while about 13.2% and 9.0% were moderately and poorly (low) endowed. The high possession of human assets among the respondents was likely to strengthen their productive capacity for improved well-being including access to adequate food. However, for financial asset, it was shown that, majority (60%) of the respondents were poorly (low) endowed with financial assets, while 2.7% and 37.3% were moderately and highly endowed respectively. The implication is that, the ability of the most respondents to achieve a successful livelihood might be affected. For social assets, the results from table 4.2 revealed that, majority (72.6%) of the respondents were highly endowed with social asset, while 6.58% and 20.82% were moderately and poorly endowed respectively. Lim *et al.* (2015) reported that social asset enhances human resilience that has the capability to reduce the risk of falling further into income and food poverty.

From the aggregate point of view, the results from table 4.3 show that 66.6% of the respondents were poorly endowed with aggregate livelihoods' assets compared to 33.4% of the respondents with high level of access to aggregate livelihoods' assets suggesting that majority of the respondents lacked the capabilities to pursue a successful livelihood. This finding notwithstanding the high level of household's access to most of the other asset categories previously discussed, it underscores the importance of access to financial asset irrespective of access to natural, physical, social or human asset.



Table 4.1: Distribution of Respo	ndents by Socio-e	conomic Characte	eristics
Characteristics	Frequency	Percent	
Gender of Household			
head			
Male	297	81.37	
Female	68	18.63	
Age of Household head			
≤35	27	7.40	
36-45	98	26.85	
46-55	20	32.87	
56-65	72	19.73	
>65	48	13.15	
Mean	51.92	(11.38)	
Marital status			
Married	331	90.68	
Single	14	3.84	
Widowed	17	4.66	
Divorced	3	0.82	
Household size			
1-5	87	3.84	
6-10	223	61.10	
11-15	47	12.88	
>15	8	2.99	
Mean	8	3	
Education			
No formal education	33	9.04	
Primary	94	25.75	
Secondary	123	33.75	
Tertiary	115	31.51	
Primary Occupation	207	50.62	
Farming	287	78.63	
Non-farming	78	21.37	
Farming Experience	150	11 61	
≤10 11.20	152	41.64	
11-20	114	31.23	
>20	99	27.13	
Mean	16.76	(10.57)	
Access to credit	02	25.50	
No	93	25.50	
Yes	272	74.52	
Organization			
membership	02	25 50	
INO Na se	93	25.50	
Its Monthly in some	212	14.52	
vioniniy income	50	15 90	
≥30,000 20,001,60,000	58 02	15.89	
50,001-00,000 > 60,000	93 214	23.3U 59.62	
>00,000 Maan	214 57 400 20	38.03 (50.226.4)	
Ivicali	57,422.30	(39,230.4)	

Source: Author's computation from field survey, 2019. Values in parenthesis are standard deviation



Assets categories	Frequency	Percent	Endowment Status
Natural	53	14.52	Low
	119	32.60	Moderate
	193	52.88	High
Physical	86	23.56	Low
	48	13.15	Moderate
	231	63.29	High
Human	33	9.04	Low
	48	13.15	Moderate
	284	77.81	High
Financial	219	60.00	Low
	10	2.74	Moderate
	136	37.26	High
Social	76	20.82	Low
	24	6.58	Moderate
	265	72.60	High

# Table 4.2:Distribution of Respondents by Access to Livelihoods' Assets(Disaggregated)

Source: Author's computation from field survey, 2019

#### Table 4.3: Distribution of Respondents by Access to Livelihoods' assets (Aggregated)

Asset score interval	Frequency	Percent (%)	Endowment status
<16,229.09	243	66.58	Low
≥ 16,229.9	122	33.42	High
Mean asset score Standard deviation	16,22 26,264	9.09 4.55	

Source: Author's computation from field survey, 2019



## **Distribution of Respondents by Rural Livelihoods' Choices**

The results as presented in table 4.4 revealed that four mutually exclusive choices of rural livelihoods were identified in the survey. The least-pursued choice of rural livelihoods was "on-farm" (Agriculture) consisting of 3.56% of the respondents. This was the modal choice of livelihoods pursued. The inability of most respondents to commercialise their production through investment in improved technologies that provide them with competitive advantage might be responsible for crowding-out majority of the respondents from this livelihoods choice. About 17.8% and 9.7% pursued ONF-OF and ONF-NF rural livelihoods' choices respectively, while majority (58.9%) of the respondents pursued the most-diversified choice of rural livelihoods involving ONF-OF-NF combination.

Livelihood activities	Livelihoods' choice	Frequency (n=365)	
Percent (%)			
Production of food and cash crops:	On-farm		
Livestock and fisheries/aquaculture	(Agriculture)	13	3.56
Production of food and cash crops,			
Livestock and fisheries/aquaculture; Agricultural wage labour.	On-farm +		
Environmental gathering and rent	Off-farm	65	17.81
Production of food and cash crops,			
Livestock and fisheries/aquaculture;	On-farm		
Salaried job (Private & Government),	+		
Trading, Craft & Artisans, Transfers,	Non-farm		
Remittances and pension		72	19.73
Production of food and cash crops,			
Livestock and fisheries/aquaculture;	On-farm		
Agricultural wage labour, Environmental	+		
Gathering and rent of farm land;	Off-farm	215	58.90
Salaried job (Private & Government);	+		
Trading, Craft & Artisans, Transfers,	Non-farm		
Remittances and pension			
	2010		

#### Table 4.4: Categorisation of Respondents by Rural Livelihoods' Choices

Source: Author's computation from field survey, 2019



#### **Distribution of Respondents by Food Insecurity Status**

Table 4.6 presents the distribution of the respondents by food insecurity categories. The results show that considerable number of the studied population were food insecure with 4.38% and 35.89% were core and moderately food insecure respectively, while about 59.73% of the respondents were non-food insecure (food secure).

Food Consumption Scores (FCS)	Frequency	Percentage	Food insecurity Status
y*≤21	16	4.38	Core food-insecure
21 <y*≤35< td=""><td>131</td><td>35.89</td><td>Moderately food-</td></y*≤35<>	131	35.89	Moderately food-
	18	59.73	liisecure
y* >35			Non-food insecure

#### Table 4.5Categorization of Households by Food Insecurity Status

Source: Author's computation from field survey, 2019.

#### Food Insecurity Profile of the Respondents by Socio-economic characteristics

The classification of households into core, moderate and non-food insecure categories was done in order to link the differences in food insecurity status to household's profile as shown in table 4.7. It was revealed that, the percentage of the food insecure were found to be higher among households headed by female with 7.4% and 42.7% were core and moderately food insecure respectively, compared with male-headed households with 3.7% and 34.3% were core and moderately food insecure respectively. FAO, (2015) corroborated this finding, reporting that in rural Nigeria, food insecurity is more prevalent among the women and children, thus implying widespread malnutrition among the vulnerable group. The relatively younger household heads of 45 years of age or less were the age group with the highest percentage of food insecure with about 10.4% and 40.8% were core and moderately food insecure respectively, while the lowest percentage of the food insecure was found among households who were older than 65 years of age with 14.6% experienced moderate food insecurity and no one experienced core-food insecurity. The possible reason is that, older household heads of above 65 years were more likely to have the least dependence ratio as most of their children would have grown up and likely to be found in the active productive age with the ability to adequately cater for the needs of their parents. Also, it was shown that, the married among the respondents were more food insecure with 4.5% and 37.5% were core and moderately food insecure, compared to their counterparts that were not married with 2.9% and 20.6% were core and moderately food insecure respectively.

Household heads who had household size of at most 5 members (8.1% for core and 43.7% for moderately food insecure) were less food insecured, compared to their counterparts with household size of above 5 members (8.8% for core and 80.4% for moderately food insecure). Higher educational attainment was found to be associated with less incidence of food insecurity as 2.5% and 32.8% of the respondents with post primary education were core and moderately



food insecured respectively, compared to their counterparts with no formal education (with 3.0% and 39.4% were core and moderately food insecure respectively). Osunmakinde, (2016) reported similar findings. Household heads with no access to credit were more food-insecure with 6.6% and 36.6% of the respondents were core and moderately food-insecure, compared to their counterparts who had access to at least a source of microcredit with 34.4% experienced moderate food insecurity and none was core food insecure. This finding is consistent with Keynesian capital and growth theories and also underscore the critical role that access to credit plays in driving the expenditure decision, aggregate demand and as well as in determining the overall level of output, income and access to food. Food insecurity was also found to be more prevalent among household heads who were not members of any social organization with 1.3% and 40.5% were core and moderately food insecure respectively, compared to their counterparts who were members of social organization with 5.24 and 34.6% were core and moderately food insecure respectively.

The prevalence of food insecurity was found to be higher among household heads that resided in savannah or derived savanna agro-ecological zone with 5.1% and 42.1% were core and moderately food insecure respectively, compared to their counterparts who resided in rain forest agro-ecological zone with 1.5% and 8.8% were core and moderately food insecure respectively. The inverse relationship between membership of social organization and food insecurity status of the households also corroborates the existing literature on the role of social capital.

In terms of access to livelihoods' assets, household heads who were highly ranked in terms of access to livelihoods' assets were less food insecure with 1.64% and 27.05% were core and moderately food insecure respectively, compared to their counterparts with poor access (i.e. low) to livelihoods' assets (with 5.76% and 40.33% were core and moderately food insecure respectively). This implies that, with assets, individuals and households have the capacity to build their resilience to mitigate various adversities when faced with shocks and stresses (Kassie *et al.*, 2016). With respect to the choice of livelihoods, results show that the least percentage of food insecure households was found among those who derived their livelihoods exclusively from on-farm activities (ONF livelihoods' choice) with 21.43% were moderately food insecure was found among those who diversified into off-farm and non-farm activities (ONF-OF-NF) with 5.6% and 41.9% were core and moderately food insecure respectively. The foregoing suggests that livelihood diversification in the study area was survival-led or distress driven.

#### **Endogeneity of Asset Score in Food Insecurity Model**

Table 4.7 presents the result of IV-ordered probit estimation of food insecurity model. The results show that the overall fitness of the model, as shown by the log likelihood estimate of 4332.905 and Chi<sup>2</sup> value of 464.67 was statistically significant thus implying a good fit of data.



Volume 5, Issue 2, 2022 (pp. 72-104)

Variables	Core Food Insecurity	Moderately Food Insecure	Core Food Insecure
Sex	2 70	24.24	c1.07
Male	3.70	34.34	61.95
Female	1.35	42.65	50.00
Age			
0-45	10.4	40.8	48.80
46-65	1.56	38.02	60.42
>65	0.00	14.58	85.42
Marital status			
Married	1 53	37 16	58.01
Not married	2.04	20.50	76.47
Not married	2.74	20.39	/0.4/
Household size			
1-5	8.05	43.68	48.28
6-10	8.83	80.39	10.78
> 10	0.00	75.00	25.00
Education			
Non-formal	3.03	39.39	57.58
Primarv	9.57	42.56	47.87
Post Primary	2.52	32.77	64.71
Credit			
No	6 58	36.63	56 79
Ves	0.00	34.43	65 57
Social membershi	n	57.75	05.57
No	1 27	40 51	58 23
Yes	5.24	34.62	60.14
Agro-ecological zo	ones		
Rain forest	1.47	8.82	89.71
Others	5.05	42.09	52.86
Asset Status			
Low	5.76	40.33	53.91
High	1.64	27.05	71.31
Livelihoods' Chai	re l		
ONF	0.00	21.43	78 57
ONE-OE	0.00	21.43	39.06
ONF-NF	5.56	25.00	68.06
ONF-OF-NF	5.58	41.86	52.56

# Table 4.6: Food Insecurity Profile of Farming Households in Rural Southwestern Nigeria

Source: Author's computation from field survey, 2019. ONF = On-farm, ONF-OF= On-farm with off-farm, ONF-NF= On-farm with non-farm, ONF-OF-NF= On-farm with off-farm and non-farm.



Furthermore, the coefficient of anthrho ( $\rho$ ) statistics is 0.0705 and not significant, implying the acceptance of null hypothesis of exogeneity (no endogeneity) of the asset variable, X<sub>14</sub>.

However, in the absence of direct method for conducting post estimation test involving identification and validity of the instruments in models such as IV-Ordered probit, further attempt was made to analyse the food insecurity,  $(y^*)$  model using the 2-stage least square estimation (with instrumental variable) procedure. The 2-stage least-square estimation of over-identified equation also enables this study to check the consistency or otherwise of IV-ordered probit result.

The result as presented in table 4.8 revealed that, the overall fitness of the model as shown by the  $\text{Chi}^2$  value of 133.21 was statistically significant indicating a good fit. Furthermore, tables 4.9 and 4.10 present the post estimation results of the 2-statge least square. The result from table 4.9 revealed that the critical values of Sargon and Basmann statistics indicated by  $\text{Chi}^2$  values of 3.7500 and 3.5917 respectively were not significant implying that the null hypothesis of no correlation between the instruments and the error term was accepted indicating that the selected instruments were valid. Furthermore, table 4.10 presents the results of Durbin-Hu-Hausman test. The results revealed that, the critical values of Wu-Hausman and Durbin Watson statistics indicated by  $\text{Chi}^2$  values of 0.6883 and 0.7225 respectively were not significant, implying the acceptance of null hypothesis of no endogeneity in the model. This test confirmed that the asset score was indeed exogenous.

Variable	Coefficients	Z-value	Variable	Coefficients	Z-value
Stage 1			Stage 2		
Food insecurity			Asset score		
status					
Age	0.0413	3.94***	Age	150.6132	1.17
Gender	0.0606	0.29	Sex	- 721.1459	-0.24
Marital status	0.4118	$2.60^{***}$	Marital status	-1856.7730	-0.89
Post pry	0.5083	$2.99^{***}$	Post pry	5581.8890	$2.37^{**}$
education			education		
Household size	0.0523	$1.59^{*}$	Household size	1371.7510	$3.00^{**}$
Primary	-0.0278	-0.14	Primary	9184.1970	3.27***
occupation			occupation		
Farming	-0.0297	-2.95***	Farming	209.1861	$1.61^{*}$
experience			experience		
Dependent ratio	0.0129	0.35	Dependent ratio	-1854.5000	-4.20***
Irrigation	0.4246	$1.92^{**}$	Irrigation	2274.9220	0.72
Extension	-0.0183	-3.10***	Extension	-146.2126	$1.60^{*}$
contact	-0.6574	-3.70***	contact	4808.658	1.99**
National grid			National grid		
i. Livelihoods'			i. Livelihood		
choice			strategy		

 Table 4.7: Result of IV-Ordered Probit Estimation (FIML) of Food Insecurity (simultaneous equation) Model

African Journal of Economics and Sustainable Development

ISSN: 2689-5080

Volume 5, Issue 2, 2022 (pp. 72-104)



ONF-OF	-0.3134	-0.73	ONF-OF	-5386.7210	-0.93
ONF-NF	-0.4634	-1.09	ONF-NF	4946.5810	0.87
ONF-OF-NF	-0.7704	1.94	ONF-OF-NF	-156.2226	-0.03
Asset score	0.0199	3.82***	Expenditure on	0.2300	5.08***
			Access to credit	25725.04	11 18***
Model			Livestock	2188.436	0.95
summary			ownership		
No of	365		Constant	-2561.75	-2.95***
observation:					ale ale
Wald $Chi^2(34)$	464.67		Cut_1_1	-0.2384	2.69**
$Prob. > Chi^2$	0.0000		Cut_1_2	1.7342	$265.91^{***}$
Log likelihood	-4332.905		Atanhrho_12	-0.0705	-0.50
2			rho_12	-0.0704	

Source: Author's computation from field survey, 2019. \*\*\*, \*\* and \* indicate 1%, 5% and 10 levels of significance. Instrumented variable: Asset score. Instruments: Per capita expenditure on agricultural inputs, access to credit and livestock ownership. Constant term was not reported for food insecurity equation in Stata. Thus, two cuts-off values are reported. ONF-OF= On-farm + off-farm livelihood; ONF-NF = On-farm + Non-farm livelihood; ONF-OF-NF = On-farm + off-farm + non-farm livelihood.

Insecurity model			
Food insecurity scores	Coefficient	Z-value	
Age	0.1219	$1.69^{*}$	
	(0.0718)		
Gender	-0.0083	0.005	
	(1.6590)		
Marital Status	2.3705	$2.05^{**}$	
	(1.1545)		
Post primary education	4.7797	3.64***	
	(1.3142)		
Household size	0.5130	$2.04^{**}$	
	(0.2513)		
Primary occupation	-0.0762	-0.05	
	(1.6048)		
Farming Experience	-0.0094	-0.13	
	(0.0707)		
Dependent ratio	-0.2354	-0.89	
	(0.2642)		
Irrigation	5.0587	$2.92^{**}$	
	(1.7333)		
Extension contact	-0.2334	-4.88***	
	(0.0478)		

 Table 4.8: Result of 2 stage least-square (instrumental variable) Estimation of Food

 Insecurity model

African Journal of Economics and Sustainable Development ISSN: 2689-5080

Volume 5, Issue 2, 2022 (pp. 72-104)



National grid	-2.7487		-2.06**
	(1.3346)		
Agro-ecological zone	0.4681		0.27
	(1.7183)		
Asset score	0.1643		4.13***
	(0.0398)		
On-farm + off-farm	-1.4369		-0.45
	(3.1773)		
On-farm + non-farm	-0.7657		-0.25
	(3.1228)		
On-farm + off-farm+ non-	-5.2571		-1.80*
farm	(2.9205)		
Constant	28.8646		5.99***
	(4.8168)		
Model	. ,		
Summary	365		
No of observation:			
	133.21	Prob. > $Chi^2$ :	
Wald Chi <sup>2</sup> (6):	0.0000		
R-square:	0.2903		
•			
Root MSE:	10.336		

**Source:** Author's computation from field survey, 2019. \*, \*\* and \*\*\* indicate levels of significance at 10%, 5% and 1 % respectively. **Instrumented:** Asset score. **Instruments:** Age, sex, marital status, post primary education, household size, primary occupation, farming experience, dependent ratio, irrigation, extension contact, national grid, agro-ecological zone, i. Livelihood strategy, per capita expenditure on agricultural inputs, livestock ownership and access to credit.

#### Table 4.9: Test of Validity of the Instruments

 $H_0$  = Instruments are valid

Statistics	Critical values	P-values
Sargon, Chi <sup>2</sup> (2)	3.7500	0.1534
Basmann, Chi <sup>2</sup> (2)	3.5917	0.1660

Source: Author's computation from field survey, 2019.



## Table 4.10: Result of Hausman Test of Endogeneity

 $H_0 = Exogenous of asset score (i.e. no endogeneity in the model)$ 

Statistics	Critical values	P-values	
Durbin (score), $Chi^2(1)$	0.7226	0.3953	
Wu-Hausman, F(1, 347)	0.6883	0.4073	
	$C = \frac{1}{10} + \frac{1}{10} = \frac{1}{10} + \frac{1}{$		

Source: Author's Computation from Field Survey, 2019.

The results of further tests involving the validity of the selected instrumental variables as well as their explanatory strength and correlation with the error terms were presented in the appendix section. The results of the two tests involving the correlation of the selected instruments with the error terms and that of the endogeneity confirmed that the estimates obtained from single equation ordered probit model were indeed unbiased, consistent and efficient and that the use of IV-ordered-probit model in the absence of endogenous variable produce consistent but not efficient estimates (Greene, 2012).

#### Influence of Rural Livelihoods on Food Insecurity Status

Ordered probit model was estimated in order to determine the food insecurity influence of socio-economic characteristics, assets and rural livelihoods of farming households. The result as presented in table 4.11 revealed that, the overall fitness of the model as shown by the log likelihood estimate of 220.62 and the LR statistics indicated by Chi<sup>2</sup> value of 152.01 was statistically significant at less than 1%. This indicates that the model adequately fits the data. The test for multicollinearity involving Variance Inflation Factor (VIF) was presented in the Appendix. The VIF for all the specified independent variables ranged from 1.24 to 7.05 with an average of 2.46. Since the average VIF value is less than 10, this implies that that there is no serious concern for multicollinearity in the specified models.

Focusing on key variables of interest, the results from table 4.12 revealed that, out of the five categories of livelihoods' assets specified in model 1, financial-asset score was the only category that had significant influence on food insecurity status. The probable reason is that financial asset drives other asset types (e.g. natural, physical, human, and social assets) particularly for farm and non-farm activities such that, the outcomes obtained including income and food *inter alia*, depend on the intensity of committing financial asset to the activities. As expected, the coefficient of financial-asset score is positive and significantly influences food insecurity status. The estimates of marginal effect show that an increase in financial-asset scores by a unit increases the probability of food security experiences by 16.3%, while the probabilities of moderate and core food insecurity experiences were reduced by 12.1% and 42.1% respectively. Unmesh and Narayanan, (2015); Kasim *et al.*, (2017) reported similar findings. Access to financial asset including credit, household valuables such as jewelry, livestock and remittances tends to increase the aggregate demand of farming households for factor inputs and consequently increase their output level, income and thus access to adequate and nutritious food.



The influence of on-farm with off-farm (ONF-OF) and that of on-farm with non-farm (ONF-NF) livelihoods on food insecurity status of the respondents were not significant. These findings are contrary to Jemal and Kim, (2014); and Yishak *et al.* (2014), but consistent with Martin and Lorenzem, (2016) who argued that "distress-push" diversification prevails in low resilient agro-ecological zone characterised with high risk of droughts, flooding and land degradation. This finding implies that, the low productivity arising from low- resilient agricultural environments coupled with farmers' poor resource-base was likely to force the respondents to strive for improved earnings by participating in low rewarding non-farm activities, thus resulting in a more stable but lower income with attendant consequence of food insecurity.

The coefficient of combined on-farm, off-farm and non-farm (ONF-OF-NF) livelihood, relative to ONF was negative and significantly influences food insecurity status. The marginal effects estimates show that the choice of combined ONF-OF-NF rural livelihoods decreases the likelihood of food security (non-food insecure) experience by 20.8% and it increases the probability of moderate and core food insecurity experiences by 16.9% and 3.9% respectively. This finding implies that combined ONF-OF-NF livelihood was driven by a necessity brought about by negative conditions that compel the respondents to combine different activities as a form of adaptation to survive (McClananhan and Wamukota, 2010). This finding is however contrary to Asmelash, (2014); Yishak *et al.* (2014).

Contrary to the expectation, the coefficient of age was positive and significantly influences food insecurity status. The estimates of marginal effect show that an increase in age of the respondents by a year increases the likelihood of food security (non-food insecurity) experience by 1.2%, but it reduces the likelihood of moderate and core food insecurity experiences by 0.9% and 0.3% respectively. This finding could be attributed to the effect of error correction mechanism over the years in farming and agricultural practices that has translated into improved farm productivity in the form of better yield, enhanced income and increased access to adequate and nutritious food. This finding is consistent with Fekadu and Mequanent, (2010) but inconsistent with Oni and Salman, (2011).

The influence of marital status on food insecurity status was significant. The marginal effect estimates show that being married increases the likelihood of food security (non-food insecurity) experience by 10.7%, while it reduces the probability of household's experience of moderate and core-food insecurity by 8% and 2.8% respectively. This finding is inconsistent with a priori expectation, Adepoju and Adejare, (2010); Oni and Fasogbon, (2013). The possible reason is that, agriculture which is a major occupational source for people in rural Africa including Nigeria (World Bank, 2008) is subsistent and depends majorly on family labour. Hence, Married household heads were more likely to spend less on labour input thereby resulting in higher productivity and improved access to adequate food. As expected, post primary educational attainment of household heads had significant influence on food insecurity status. The estimate of marginal effect shows that an increase in the level of post primary educational attainment increases the likelihood of food security (non-food secured) experience by 10.9%, while it reduces the probability of household's experience of moderate and core-food insecurity by 8.1% and 2.8% respectively. This finding is consistent with Adepoju and Adejare, (2013) and Mensah, (2014). The implication is that access to post primary education enhances the human capacity of household heads in terms of better access to innovative and improved production technologies, including access to e- extension and communication services that together enhance their productivity, income and access to adequate and nutritious food.



The influence of household size on food insecurity status was significant. The marginal effects estimates showed that a member increase in household size increases the likelihood of household's experience of food security (non-food insecure) by 1.7%, but it decreases the likelihood of household's experience of moderate and core-food insecurity by 1.2% and 0.4% respectively. This is contrary to the prior expectation and inconsistent with Asmelash, (2014); Jemal and Kim, (2014). The possible reason is that the traditional farming practices in most developing nations including Nigeria depend heavily on family labour. Hence, the incentive to increase farm size was driven by large family size and its attendant reduction in labour input cost. Consequently, the efficiency with which the labour inputs were allocated has the potential to guarantee enhanced income that determine food insecurity status.

The coefficient of farming experience negatively and significantly influences food insecurity status. The marginal effect estimates show that an increase in farming experience by a year reduces the probability of moderate and non-food insecurity (food security) experiences by 0.5% and 0.7% respectively, while it increases the likelihood of core-food insecurity experience by 0.2%. Although this finding is contrary to the prior expectation, it revealed important information that suggests that farming experience, productivity and food insecurity are not linearly related. The possible reason is that, theoretically, years of farming experience cannot permanently increase productivity. It may at first set of years of farming experience increases productivity; productivity tends to decline at a stage when diminishing return to extra years of farming experience set in.

The influence of irrigation access on food insecurity status was significant. The marginal effect estimates show that access to irrigation facilities increases the likelihood of food security (non-food insecure) experience by 13.8%, and it decreases the likelihood of moderate and core-food insecurity experiences by 10.2% and 3.6% respectively. This finding is consistent with *a priori* expectation, Oni and Fashogbon, (2013) and Jemal and Kim, (2014). It can be deduced that access to irrigation extends the production cycle of farming households beyond the conventional reach of rain-fed agriculture. Studies have also found that rain-fed agriculture is less productive, compared to irrigated agriculture.

The coefficient of frequency of extension contacts is negative and significantly influences the food insecurity status. The marginal effect estimates show that the frequency of contacts with extension agents decreases the likelihood of food security (non-food security) experience by 0.4%, while the probabilities of moderate and core-food insecurity experiences were increased by 0.3% and 0.1% respectively. This finding is inconsistent with prior expectation and Asogwa and Umeh, (2012). The possible reason is that access to extension services is a necessary condition but not sufficient to achieve improved productivity, particularly when the respondents were late adopters or even laggards (non-adopters) of improved technologies. Furthermore, access to national grid/electricity negatively and significantly influences the food insecurity status of the respondents. The marginal effects estimates show that access to national grid/electricity reduces the likelihood of food security (non-food insecurity) experience by 16.2%, while the probability of moderate and core food insecurity experiences were increased by 12% and 4.2% respectively. This finding is inconsistent with a priori expectation. This may be attributed to the fact that that access to national grid does not automatically translate into improved living condition including secured access to food. In the face of erratic or persistent collapse of national grid, no gainful investment or enterprise can thrive. This finding suggests that, lack of effective service delivery and its attendant poor power supply are capable of restricting the ability of farming households to secure improved livelihood from diversifying into rural non-farm activities.

ISSN: 2689-5080



# Volume 5, Issue 2, 2022 (pp. 72-104)

Table 4.18: Influence of Rural Livelihoods on Food Insecurit	v Status of Farming	g Households in Southwestern Nigeria

	Mod	lel 1 (with disaggre	egated livelihood as	sset)	Μ	lodel 2 (with agg	regate livelihood	asset)
Variables		$\partial Pr(Y=2)$	$\partial Pr(Y=1)$	$\partial \Pr(\mathbf{Y} = 0)$		$\partial Pr(Y=2)$	$\partial \Pr(\mathbf{Y}=1)$	$\partial \Pr(\mathbf{Y} = 0)$
		ðХ	9X	δX		<u> </u>	δX	δX
Food Insecurity	Coefficien	Core-food	Moderately-food	Non-food	Coefficient	Core-food	Moderately-	Non-food
status	t	insecure	insecure	insecure		insecure	food insecure	insecure
Age	0.0417	-0.0030(3.28)***	-0.0085(-4.08)***	0.0115(4.19)***	0.0417	-0.003(3.38)***	0.8712(4.23)***	0.0117(4.37)***
Sex	0.0644	-0.0046 (-0.30)	-0.0131(-0.30)	0.0177 (0.30)	0.0547	-0.0039 (-0.27)	-0.0113(-0.27)	0.0152 (0.27)
Marital status	0.3913	0.0277(-2.27)**	-0.0796(-2.51)***	0.1073(2.53)***	0.4053	-0.0291(2.33)**	-0.0835(2.60)**	0.1126 (2.62)**
Post Pry education	0.3977	-0.0282(-1.40)*	-0.0809 (-1.43)*	$0.1090(1.44)^{*}$	0.5228	-	-0.1077(3.14)**	0.1452(3.21)***
						0.0375(2.78)***		
Household size	0.0604	-0.0043(-1.74)**	-0.0123 (-1.84)**	0.0166 (1.84)**	0.0550	-0.0039 (1.62)*	-0.0113 (1.70)*	$0.0153(1.70)^{*}$
Primary occupation	0.0709	-0.0050 (-0.39)	-0.0144 (-0.39)	0.0194 (0.39)	0.0012	-0.0008 (-0.01)	-0.0002 (-0.01)	0.0003 (0.01)
Farming Experience	-0.0257	$0.0018(2.28)^{**}$	$0.0052(2.53)^{***}$	-0.007(2.55)***	-0.0210	0.0022 (2.62)***	0.0062(3.05)***	-0.0083(3.07)**
Dependent ratio	-0.0060	0.0004 (0.17)	0.0012 (0.17)	-0.0016 (-0.17)	0.0071	-0.0507 (-0.20)	-0.0015 (-0.20)	0.0020 (0.20)
Irrigation	0.5018	-0.0356(-2.05)**	-0.1020 (-2.18)***	0.1376(2.20)****	0.4320	-0.3099 (-1.87)*	-0.0890(1.96)**	0.1200 (1.97)**
Extension contact	-0.0149	0.0011 (2.16)**	0.0030 (2.33)**	-0.004(2.36)***	-0.0182	0.1307(2.70)****	0.3756(3.13)***	-0.005(3.17)****
National grid	-0.5912	0.0419 (2.76)***	0.1202 (3.23)***	-0.162(3.27)***	-0.6499	0.0466 (3.07)***	0.1339(3.73)***	-0.180(3.81)***
Agro-ecological	0.5167	-0.0366(-1.76)**	-0.1051(-1.90)**	0.1417(1.90)**	0.5404	-0.0388(-	-0.1114(2.10)**	$0.1505(2.10)^{**}$
zone						1.91)**		
Natural asset score	-0.0599	0.0039 (1.01)	0.0114 (1.04)	-0.0153(-1.04)	-	-	-	-
Physical asset score	-0.0599	0.0039 (1.01)	0.0114 (1.04)	-0.0153 (-1.04)	-	-	-	-
Human capital score	0.0206	-0.0015(-0.44)	-0.0042(-0.45)	0.0057 (0.45)	-	-	-	-
Financial asset score	0.5940	-0.4210(3.56)***	-0.1210(-4.82)***	0.1630(4.96)***		-	-	-
Social asset score	-0.1311	0.0093(0.98)	0.0267(0.99)	-0.0360(-0.99)	-	-	-	-
Aggregate asset score	-	-	-	-	0.0183	-0.0131(3.40)**	-0.3770(4.54)**	5.0900(4.63)***

African Journal of Economics and Sustainable Development ISSN: 2689-5080					5			
Volume 5, Issue 2, 202	2 (pp. 72-10-	4)		www.abj	ournals.org			
ONF-OF livelihood ONF-NF ONF-OF-NF Model summary No of observation:	-0.3992 -0.4895 -0.7858 365	0.0143 (1.02) 0.0190 (1.34) 0.0393 (2.86)***	0.0864(0.94) 0.1063 (1.16) $0.1691 (1.96)^*$	-0.1007(-0.96) -0.1252(-1.20) -0.2085(2.15)**	-0.3289 -0.4508 -0.7718	0.0117(0.85) 0.0178 (1.25) 0.0402(2.86)*** Model summary	0.0719(0.78) 0.0990 (1.09) 0.1678(1.96)* 365	-0.1048(-0.80) -0.1169(-1.13) -0.2081(16)**
LR $Chi^2(20)$ Pseudo $R^2$ : Log likelihood :	: 152.01 0.2562 220.6246	Prob. : 0.0000				Observation: LR Chi <sup>2</sup> (20) : Pseudo R <sup>2</sup> : Log likelihood :	152.01 0.2562 -220.62462	Prob. :0.0000

**Source:** Author's computation from field survey, 2019. \*\*\*, \*\* and \* indicate 1%, 5% and 10% levels of significance respectively. Values in parenthesis are Z-values. ONF-OF = On-farm + off-farm livelihood; ONF-NF = On-farm + Non-farm livelihood; ONF-OF-NF = On-farm + off-farm + non-farm livelihood.



## **Conclusion of the Study**

The main focus of this study was to determine the influence of rural livelihoods on food insecurity status of farming households in Southwestern Nigeria. Based on the analysis from the descriptive and inferential statistics, the study found that most of the respondents were male and smallholder farming household heads with average farm size of about 3ha. Majority of the respondents were poorly endowed with financial asset. The choice of combined on-farm, off-farm and non-farm was the most pursued livelihood among the respondents in rural southwestern Nigeria. It was found that about 4.38% and 35.40% of the sampled population experienced core and moderate food insecurity respectively, while 59.73% were non-food insecure (food secure). The prevalence of food insecurity was found to be higher among female-headed households among the asset-poor and most livelihood-diversified households. Therefore, on-farm rural livelihood relative to combined on-farm with off-farm and non-farm, reduced food insecurity among farming households in Southwestern Nigeria.

#### **Policy Implication of the Study**

- i. Access to financial asset was found to significantly reduce the probability of being food insecure. This finding necessitate the need for improved and inclusive access to financial asset by farming households in the Southwestern Nigeria through credit facility.
- ii. Household size was found to negatively and significantly influence the probability of being food insecure thus implying the labour intensive farming system in Southwestern Nigeria. Thus, any policy aimed at substituting labour for improved technology is plausible.
- iii. Access to irrigation was found to have significant positive influence on the probability of food insecurity experience. This implies that improved awareness and investment in irrigated agriculture has the potential to enhance the productivity of rural agriculture.
- iv. Post primary education is a significant variable that has significant negative influence on probability of being food insecure. This finding offers useful insights for policy makers on targeting and selection of potential beneficiaries for intervention programme.
- v. Being resident in derived savanna or savanna agro-ecological zone increases the risk of being vulnerable to food insecurity. Social protection policy that is designed to enhance the rural livelihoods should give special consideration to the people of these zones.
- vi. Specialisation in on-farm (agriculture) livelihood was found to significantly reduce the probability of food insecurity experience. This implies that, if commercialised, agriculture has the potential to lift people out of food poverty.



#### REFERENCES

- Aboud, A., Bezuneh, M. and Barrett, C.B 2001. Income diversification, poverty traps and policy
  - shocks in Côte d'Ivoire and Kenya. Food Policy, 26: 367-384.
- Action Contre La faim International 2010. Food Security and Livelihood Assessment:
- A Practical Guide for Field Workers. New York: ACF International.
- Adepoju, A.O and Adejare, K.A. 2013. Food Insecurity Status of Rural Households during the post planting Season in Nigeria. *Journal of Agriculture and Sustainability*, 4.1:16-35.
- Asogwa, B. C. and Umeh, J. C. 2012. Food insecurity determinants among rural farm households in Nigeria. *Proceedings in International Conference on Ecology*, *Agriculture and Chemical Engineering* (ICEACS 2012), Phuket (Thailand), December 18-19. Retrieved June, 15, 2020, from <u>https://prscentre.org/images/extraimages/43.132025.pdf</u>
- Amemiya, T. 1978. The estimation of a Simultaneous Equation Generalized Probit Model, *Econometrical*, 46: 1193-1205
- Asa, U.A and Archibong, E.M. 2016. Social Capital and Food Security among Rural Farming Households in Akwa Ibom State, Nigeria. *Journal of Advances in Social sciences*-
- Asmalesh, M. 2014. Rural Household Food security Status and its Determinants: The Case of Laelaymychew Woreda, Central Zone of Tigrai, *Ethiopia. Journal of Agricultural Extension and Rural Development*, 6.5: 162-167.
- Awoniyi, A. O. and Salman, K.K. 2011. Non-farm Income Diversification and Welfare
- Status of Rural Households in South West Zone of Nigeria. *Agricultural productivity and food security in Africa conference*, Addis Ababa, November1-3. Retrieved May, 16, 2018, from

https://addis2011.ifpri.info/files/2011/10/paper\_4A\_Awoniyi\_Olabisi\_Alaba.pdf [Google Scholar]

- Ayantoye, K., Yusuf, S.A and Omonona, B.T 2011. Food Insecurity Dynamics and its Correlates among Rural Farming Households in South-Western, Nigeria. *International Journal of Agricultural Economics and Rural Development*, 4.1:1-13
- Barrett, C. B., Bezuneh, M., and Aboud, A. 2001. Income diversification, poverty traps and Policy shocks in Côte d'Ivoire and Kenya. *Food Policy* 26: 367–384.
- Bongole, A.J. 2016. Determinants of Farm and Non-Farm Activities amongst Rural Households:

Evidence from Kahama District in Tanzania. *Journal of Economics and Sustainable Development*, 7.4:1-8. Retrieved March 17, 2018 from <u>www.iiste.org</u>

- CBN 2016. Central Bank of Nigeria Annual Report 2016 p.170-171. Abuja CBN. <u>https://www.cbn.gov.ng/out/2016/publication/report/rsd/centralbank</u> of Nigeria Annual economic report-pdf.
- CDC 2020. Voluntary Guidelines on the Responsible Governance of Tenure of Land,
- Fisheries and Forests in the Context of National Food Security. Retrieved July, 4, 2021, from <u>http://www.fao.org/cfs/home/activities/vggt/en/</u>
- Coates, J., Rogers, B.L., Webb, P., Maxwell, D., Houser, R. and McDonald C. 2007.
- Diet Diversity Study. Final report to the World Food Programme. Medford,
- MA: Friedman School of Nutrition Science and Policy, Tufts University.

Dzanya, J. Christe M., Fazey, I and Hyde, T. 2015. The Role of Social Capital in Rural Households Food Security: The Case Study of Dowa and Lilongwe Districts in Central

African Journal of Economics and Sustainable Development ISSN: 2689-5080



Volume 5, Issue 2, 2022 (pp. 72-104)

Malawi. Journal of Agricultural Sciences, 7:12

Ellis, F. 1998. Household strategies and rural livelihood diversification. *The Journal of Development Studies* 35.1: 1-38.

Ellis, F. 2000. *Rural Livelihood and Diversity in Developing Countries*. United Kingdom: Oxford University Press.

Fawehinmi, O. A. and Adeniyi, R.O 2014. Gender dimensions of food security status of households In Oyo State, Nigeria, *Global Journal of Human Science*, 14.1:7-15. Fawehinmi, O. A. and Adeniyi, R.O 2014. Gender dimensions of food security status of households In Oyo State, Nigeria, *Global Journal of Human Science*, 14.1: 7-15

FANTA 2006. Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (Version 2). Washington DC: Food and Nutrition Technical Assistance Project.

FAO, IFAD and WFP 2015. The State of Food insecurity in the World. Meeting the 2015 International Hunger Targets: taking stock of uneven progress. Rome.

FAO, 2017. Food Security and Nutrition Situation in Sahel and West Africa. Retrieved

Aug. 15, 2018, from <u>reliefweb.int/report/Nigeria/food-security-and-nutrition situation-in</u> <u>sahel-and west-africa-march-may-2017</u>

FAO, IFAD, UNICEF, WFP and WHO 2019. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. FAO 2003. *Storage and Processing of Root and Tuber in the Tropics*. FAO of the United Nations: Rome: 6 – 24.

Greer, J. and Thorbecke, E. 1986. A methodology for measuring food poverty applied to Kenya. *Journal of Development Economics*, 24.1: 59-74.

Greene, W. 2012. Econometric Analysis, New Jersey, USA: Prentice Hall PTR

Hilson, G. 2016: Farming, small-scale mining and rural livelihoods in Sub-Saharan Africa: A critical overview. *The Extractive Industries and Society*, 3: 547–563.

IFPPRI 2017. *Global Hunger Index 2016*. Washington: International Food and Policy Research Institute. Retrieved from <u>www.ifpri.org/publication/2016-global-hunger-index</u>.

Jemal, A. and Kim, K. 2014. Determinants of Household Food Security in Rural

Ethiopia: An Empirical Analysis. Journal of Rural Development 37.2:129-157

Jirstrom, M., Anderson A, Djurfeldt G. 2011. Smallholders caught in poverty-

Flickering signs of agricultural dynamism- in African Smallholders. London: Food crops, Markets and policy

Jemal, A. and Kim, K. 2014. Determinants of Household Food Security in Rural Ethiopia: An Empirical Analysis. *Journal of Rural Development* 37.2:129-157

Ethiopia: An Empirical Analysis. Journal of Rural Development 37.2:129-157

Jones, A.D., Ngure, F.M., Pelto, G. and Young, S.L.2013. What Are We Assessing

When We Measure Food Security? A Compedium and Review of Current

Metrics. Advances in Nutrition 4: 481-503

Kakwani, N. and Son, H.H. 2017. Measuring Food Insecurity: Global Estimates.

*Discussion Paper Series* 2010-2016. Manila: Philippine Institute for Development Studies. <u>http://www.evs.usda.gov/topics/food-nutrition-assistane/food-security-in-the-</u>Us/definitions-of-food-insecurity.aspx

Kassie, G. W. 2017. Agroforestry and farm income diversification: Synergy or tradeoff? The case of Ethiopia. Environmental Systems Research, 6.8. Retrieved from <u>https://link.springer.com/article/10.1186/</u>

Khartun, D. and Roy, B.C.2012. Rural livelihood diversification in West Bengal: Determinants

African Journal of Economics and Sustainable Development ISSN: 2689-5080





http://ageconsearch.umn.edu/bitstream/126049/2/12-Dilrub.pdf

- Maitra, C. and Prasada-Rao, D.S. 2014. An Empirical Investigation into Measurement
- and Determinants of Food Security in Slums of Kolkata. Discussion Paper No.523,
- Retrieved from <u>http://www.uq.edu.au/economics/school-of-economics-discussion-paper-</u>
- Mensah, C. 2014. The Impact of Livelihood Diversification on Food security among
- Farm Households in Northern Ghana: A case study of Bole District. Diss. Development Studies, Institute for Social development. University of Western Cape
- Moser, C. and Felton, A. 2007. The Construction of an Asset Index: Measuring Asset Accumulation in Ecuador. Global Economy and Development: The bookings
- Institution Massachusetts, Washington D.C, USA: Chronic research Centre, 1-23.
- Muhamed R. and Muhamed B. 2014. Livelihood and Food Security in Rural Area. A
- case of Jommueya area, Omdurman Province, Khartoum State. Journal of Applied and Industrial Sciences, 2.2: 75-84.
- Mamman, B.F, Wudi, A.H and Haliru, M. 2016. Socio-economic Factors and Income
- DiversificationAffecting Food security Status of Farming Households in Jigawa State, Nigeria. A Contributed Paper to the Proceedings of I<sup>st</sup> International Conference on Dry land, Bayero University Kano, 109:114.
- Napoli, M., De Muro, P., and Mazziotta, M. 2011. Towards food insecurity
- Multidimensional Index (FIMI). Diss. Human Development and Food Security. University of Degla.
- NPC 2006: Nigeria's National Census. NPC, Abuja. Retrieved from www.nationalpopulation.gov.ng
- NBS 2015. Transforming Nigeria's Agricultural value Chain: A case study of the
- Cocoa and Dairy industries. http://www.nigerianstat.gov.ng/library
- Nwalie, M. 2017. The paradox of food insecurity in Nigeria (2011-2017). *African Journal of Agriculture and Food security* 4.5: 202-208. Retrieved from http://www.internationalsjournals.org.
- Newey, W.K. 1987. Efficient estimation of limited dependent variable models with Endogenous Explanatory variables. *Journal of Econometrics* 36: 231-250
- Oni, O.A., Salman, K.K and Idowu B.O 2011. Social Capital Dimension among
- Farming Households in Ogun State, Nigeria. Journal of American Science, 7.8: 776-783
- Oni, O.A. and Fashogbon, A. E 2013. Food Poverty and Livelihood Issues in Rural
- Nigeria. African Journal of Agricultural and Resource Economics, 8.2: 108-135
- Olomola A.S. 2015. Smoothening Trends of Food Prices in Nigeria: Political Economy
- and Policy Vistas. *Paper Presented at the 29th Conference of the International Association of Agricultural Economists*, University of Milan, Italy.
- Olomola, A.S. and Nwafor, M. 2018. Nigeria Agriculture Sector Performance Review.
- Report for the Nigeria 2017 Agriculture Joint Sector Review
- Osunmakinde, M.A.2016. Effect of Rural Infrastructure on Livelihood Choices and Household Welfare in South-Western Nigeria. A Second Seminar Paper
  - Presented at the Department of Agricultural Economics, University of Ibadan.

- Scoones, I. 1998. Sustainable rural livelihoods: A framework for analysis. IDS *Working Paper*. *No*.72. Brighton: Institute of Development Studies.
- Thurstone, L. 1927. A law of Comparative Judgment. Psychological Review 34:273-286.

Phaneuf D. J., Smith V. K. 2005. Chapter 15 Recreation Demand Models. *Handbook of Environmental Economics* 2: 671-761

African Journal of Economics and Sustainable Development ISSN: 2689-5080



Volume 5, Issue 2, 2022 (pp. 72-104)

Aug. 15, 2018, from <u>reliefweb.int/report/Nigeria/food-security-and-nutrition situation-in</u> <u>Sahel-and west-africa-march-may-2017</u>

FAO. Retrieved Feb. 15, 2019 from https://www.fao.org/3/a-i4646e pdf

Rome, FAO. Retrieved Sep. 9, 2021 from <u>www.fao.org/publications</u> USDA 2019. Definition of Food Insecurity. Retrieved Nov. 23, 2021 from

http://www.evs.usda.gov/topics/food-nutrition-assistane/food-security-in-theus/definitions-of-food-insecurity.aspx

WFP, 2007. Food Consumption Analysis: calculation and use of the Food Consumption Score in food consumption and food security analysis. Technical Guidance Sheet. Rome. <u>Google Scholar</u>

Yishak, G., Gezahegan, A. Tesfaye, L. and Dawit, A.2014. Livelihood Strategies and Food Security of Rural Households in Wolaita zone, Southern Ethiopia.

Developing Country Studies 4.14:1-14.