Crop Diversification among Rural Farm Households in Kwande Local Government Area of Benue State, Nigeria

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Abstract— *This study analysed crop diversification among rural farm households in Kwande Local Government Area of Benue State, Nigeria. The study drew a sample of 360 rural farm households through a multi-stage sampling technique from 12 communities in four districts of Kwande LGA (Ikyurav-ya, Turan, Nanev and Shangev-ya) and the primary data obtained were analysed using the descriptive statistics, Simpson index and Tobit regression model. Results indicated that an average farm household head was 42.8 years old and had 4.2 years of schooling. Ninety three percent (93 %) of the farm households diversified their cropping activities with 51.7 percent diversified into three or more crops. The Tobit regression results revealed that there were marginal increases in crop diversification with increase in farm size, gender, access to credit, membership of co-operative and educational level but crop diversification decreases as farmers grow older in age and farming experience. Policy implications were drawn for provision of functional social amenities and encouragement of the rural farmers to join cooperative societies for easy access to loans that promote crop diversification and hence improve the standard of living of the rural populace.*

Keywords— *Crop Diversification, Rural populace, Simpson Index, Cropping activities, Household.*

I. INTRODUCTION

Agriculture is an important sector of Nigeria's economy, to the extent that the livelihoods of the majority of the population depends on it and serves as the main source of income for the rural population (FAO, 2012). It accounts for 30.9 % of Gross Domestic Product (GDP) and some 5 % of earning from non-oil exports. There is an agreement throughout literature that Nigeria's large potential in agriculture has not yet been fully exploited (CIA World Fact book, 2012). Thus, if well managed, the sector would potentially contribute to substantial improvements in GDP, employment and tax collections (Food and Agriculture Organization, FAO, 2005). It is in this regard that the Nigerian government positions agricultural sector as one of the driving forces for the anticipated economic growth that is required to reduce poverty (Delgado and Siamwalla, 1999; Delgado and Siamwalla, 1997).

The agricultural sector in Nigeria can be disaggregated into three categories; large, medium and small scale. Large (commercial) farmers cultivate areas of 10 hectares and above and are characterized by extensive mechanization, use of modern technology and management, and the rearing of exotic breeds of livestock. They also rely on extensively hired labour. However, nearly two-third of agricultural land and a large share of the national herd are held by smallholder farmers. The smallholder farmers are classified as either small-scale or medium-scale. The former cultivates land areas of less than 5 hectares, while medium scale farmers are those that cultivate areas between 5 and 10 hectares. The majority of smallholder farmer rely on rain-fed hoe cultivation and the use of unpaid family labour and focus much of their crop production on rice (especially in Kwande Local Government Area). Their production also is characterized by the low use of modern inputs (FAO, 2012; World Bank, 2012).

Following several years of crop failure due to adverse weather conditions and poor prices, the government of Nigeria, through the Ministry of Agriculture introduced a

programme to promote crop diversification. Diversification in agriculture could be classified into the following three categories (Ryan and Spencer, 2001): shift of resources from farm to non-farm activities, shift of resources within agriculture from less profitable crop or enterprise to more profitable crop or enterprise and use of resources in diverse but complimentary activities. Crop diversification strategy belongs to the second category and it involves shifting from less profitable to more profitable crops, changing of variety, cropping system, increasing exports and competitiveness in both domestic and international markets, protecting the environment, and making conditions favourable for combining Agriculture-Fishery-Forestry-Livestock (Pingali and Rosegrant, 1995; Kumar and Chattopadhyay, 2010; Okali, Okpara and Olawoye, 2001). This is a silent revolution within crop production sector. The motives behind this silent revolution are livelihood sustainability through raising the income levels, urbanization expansion, infrastructural development and trade liberalization policies. Households diversify as a strategy for coping with an unexpected shock, or to minimize risk ex-ante by participating in activities that generate imperfectly correlated returns (Kumar and Chattopadhyay, 2010).

The crops considered in the diversification programme included cassava, groundnut, soyabean, sesame (beniseed), sunflower, bambara nuts among others. The programme was implemented with the objective of enhancing income levels, increasing food security and nutrition status of farm households. It was anticipated that this, in turn, would enhance the living standards of farm households, while offering various cropping alternatives to farmers, as opposed to relying on a single crop namely rice. Among the additional advantages to the farm household growing more than one crop is an opportunity to mitigate risks associated with crop-specific failure due to adverse weather conditions, pests and diseases (Ibrahim, Rahman, Envulus and Oyewole, 2009).

It is against this background that this study looked at the nature and determinants of crop diversification in rural Nigeria especially Kwande Local Government Area of Benue State where the Guinea Savannah vegetation and tropical climate allow varieties of crops to be grown.

Objectives of the Study

The broad objective of the study was to analyse crop diversification among rural farm households in Kwande Local Government Area of Benue State, Nigeria.

The specific objectives were to:

i. describe the socio-economic characteristics of farm households' in the study area;
ii. identify the pattern of farm households' crop diversification in the study area;
iii. analyse the determinants of crop diversification among the farm households' in the study area;

II. METHODOLOGY

The Study Area

This study was carried out in Kwande Local Government Area of Benue State. The Local Government was created in 1976 with Adikpo being the Local Government Headquarters. The Local Government is predominantly agrarian and comprises four districts (Ikyurav-ya, Turan, Nanev and Shangev-ya) with 15 council wards. The districts are divided on the basis of their socio-cultural and historical peculiarities.

It covers a geographical land area of 2, 891 square kilometers. It has a population of 248, 697 (NPC, 2006). The Local Government is bounded by several other LGAs. On the West, it is bounded by Vandeikya LGA, Ushongo LGA on the North and Katsina-Ala LGA on the North-West. On the South, it is bounded by Cross River State and in the East by the Republic of Cameroon. Kwande LGA also shares a common border with Takum LGA of Taraba State. The LGA has abundant land estimated to be 391,500 hectares. This represents 7.7 % of the state land mass. Arable land in Kwande LGA is estimated to be 292,300 hectares (BNARDA, 1998). The LGA is predominately rural with an estimated 80 percent of the population engaged in rain-fed subsistence agriculture and is popularly known as the "Ancestral Home of Tiv Nation". Cereal crops like sorghum and maize are produced in abundance. Roots and tubers produced include yam, cassava, sweet potato and cocoyam. Oil seed crops include pigeon pea, soyabeans and groundnuts while tree crops include citrus, mango, oil palm, guava, cashew and paw-paw. Other crops commonly grown include pepper, tomato, ginger, okro etc. Livestock such as goats, pigs and poultry are reared in the Local Government at small- scale and medium scale levels. There are about 40, 000 farm families in the local government (BNARDA, 1998). The weather is marked by a single rainy season (April – October) and dry season (November – March). The mean temperature range is 31 ℃ to 38 ℃. As a result of its mountainous nature and proximity to the Cameroonian range of mountains, Kwande Local Government Area usually has cold weather which makes it very conducive to

traders and investors. The Local Government also has big streams which could adequately take care of agricultural and industrial needs.

Population and Sampling Procedure

The population of this study comprised all rural farm households in Kwande Local Government Area involved in food crop farming. Multi-stage sampling technique was used to select 360 farm household heads used for the study. The first stage involved the purposive selection of four (4) districts based on the population of food crop farmers in the study area. The second stage involved random selection of three (3) farm communities from each of the four districts selected in stage one. The third stage involved the selection of thirty (30) farm households from each of the 12 farm communities selected in stage two.

Data Collection and Analysis

The data collected for this study were analysed using both descriptive and quantitative (inferential) techniques.The quantitative techniques employed in the study were Simpson index and Tobit regression model.

Simpson Index

Simpson index was used to determine the pattern of crop diversification among farm households. The technique has been previously used by Roonnaphai (2005), Bhattacharyya (2008) and Ibrahim *et al*. (2009) in assessing crop diversification among farm households. The Simpson index is presented as follows;

$$I = 1 - \sum_{i=1}^{n} A_i^2$$

$$(1)$$

Where $A_i =$ X_iX_i

$$(2)$$

Where:

$X_i =$ planted area of ithcrop, i = 1, 2, 3 …..6

$A_i =$ proportionate planted area of ith crop in the total planted.

When I shows a value of zero, it means that the farmer is least diversified while a value of one indicates the most (highly) diversified.

The crops planted by farmers in the study area under consideration include; rice, yam, cassava, groundnuts, sorghum and bambara nuts. Most farmers cultivated at least two of these crops (diversified) while those that did not diversify cultivated only one crop.

Tobit regression model

The Tobit model was considered the most appropriate in this study because some farmers that highly diversified in specified period may not diversify during the period covered by the survey because of the prevailing crop price, pressure from farm work, health and many other possible factors. Also, conventional regression methods fail to take into account the qualitative difference between zero and continuous observation. Therefore, Tobit model assumes that all zeros are attributable to standard corner solutions. As such, zero observations are accounted for and the censored regression provides a more accurate estimation.

The Tobit model for the analysis of the determinants of crop diversification takes the following specifications;

$$I_i^* = L_i + i_i \qquad \sim N(O, 2) \qquad (3)$$

$I_i = I_i^*$ if $I_i^* > 0$

Where L_i is the explanatory variable, i is the standard cumulative normal with mean zero and variance 2.

Where I_i = crop diversification (Simpson index values, representing the crop diversification index, where 0 I 1; as provided in crop diversification result.

According to Dougherty (2007), the dependent variable in this kind of model is subject to both the lower bound D_L and upper bound D_U. in the case of both lower and upper bounds, the model can be characterized as;

$I_i^* = 1 + 2L_i + i$

$I = I^*$ for $I^* > I_L$

$I = I_L$ for $I^* I_L$

The model is known as a censored regression model because I^* is unobserved for $I^* < I_L$ or $I^* > I_U$. It is effectively a hybrid between a standard regression model and a binary choice model, and OLS would yield inconsistent estimates if used to fit this model.

The explanatory variables used include;

L_1 = Age of the household head (years)

L_2 = Household size (number of persons)

L_3 = Gender (Male = 1, Female = 0)

L_4 = Farm Experience (Years)

L_5 = Farm size (hectares).

L_6 = Dependency ratio (number of non-working members/total household size)

L_7 = Membership of Cooperative Society (Member = 1, Otherwise = 0)

L_8 = Average distance between land parcel (km)

L_9 = Access to credit (Yes = 1, No = 0)

L_{10} = Nearest to market (km)

L_{11} = Education (years)

L_{12} = Availability of good road (Yes = 1, No = 0).

The i is the model errors which are assumed to be independent N(O, 2) distributed, conditional on Li's.

III. RESULTS AND DISCUSSION

Table 1 presents the description of personal characteristics of farm household heads. A large proportion (43.4 %) of the farm household heads is aged between 31 – 50 years. The mean age of the household heads in the sample was 42. 8 years. This implies that most of the farmers are still in their active ages and thus expected to be productive for available resources. This is against the common reports (DFID, 2004; Okali, *et al.,* 2001) that there are aging rural farm population in Nigeria and that availability of off-farm livelihood options might be necessary to retain youths within the rural farm sector. Majority (70.6 %) of the households are headed by Males. This agreed with the tradition in the North Central part of Nigeria where Males are expected to be the head of the family.

Table 1: Distribution of sampled farm households by personal characteristics

Variables	Frequency	Percentage	Mean
Age of the Household Head (Yrs)			
≤30	78	21.7	
31 – 40	87	24.2	42. 8 years
41 – 50	69	19.2	
51 – 60	66	18.3	
> 60	60	16.6	
Sex of Household Head			
Male	254	70.6	
Female	106	29.4	
Marital status			
Single	87	24.2	
Married	231	64.2	
Divorced	12	3.3	
Widowed	30	8.3	
Educational level (Years)			
No formal education	66	18.3	4.2 years
Primary education	129	35.8	
Secondary education	96	26.7	
Tertiary education	69	19.2	
Primary occupation			
Farming	303	84.2	
Trading	24	6.7	
Civil Service	27	7.5	
Artisanship	6	1.6	
Farm Experience (years)			
1 – 10	75	20.8	
11 – 20	135	37.5	17.6 years
21 – 30	93	25.8	
>30	57	15.8	
Household Size			
1 – 4	90	25.0	
5 – 8	171	47.5	6.2 persons
9 – 12	63	17.5	
>12	36	10.0	

Source: Field Survey data, 2015

Majority (64.2 %) of the household heads are married with an average household size of six members. Spouse and children are important household family labour in traditional farming system. In terms of education, the mean education year of the household heads was 4.2 years with majority (87.7 %) of the sampled household heads having formal education. This finding implies that the rural households may be able to take full advantage of extension services, thus improving their income generation and poverty. Farming was the primary occupation of most (84.2 %) household heads with average farming experience of 17.6 years. This conforms with the claim that Nigeria is an agrarian nation as agriculture was once the main stay of the economy.

Pattern of Rural Farm Household Crop Diversification
Table 2 presents the pattern of rural farm households' crop diversification in the study area. Majority (51.7 %) of the respondents are highly diversified, 41. 7 % moderately diversified while 6.6 % did not diversify.

Table 2: Pattern of rural farm households' crop diversification.

Extent of Crop Diversification	Frequency	Percentage (%)
Not Diversified	24	6.6
Moderately diversified	150	41.7
Highly diversified	186	51.7
Total	**360**	**100.0**

Source: Field Survey data, 2015

Those that are highly diversified cultivate at least three crops, those that moderately diversified cultivate at least two crops, while those that did not diversify cultivate only one crop among the six crops studied. Most crop farmers in the study area did not depend on one crop because of risk associated with market price fluctuation, drought, excessive rainfall, fire, climate change etc. This strategy is adopted to ensure secured livelihood. In all, 93.4 % of the farm households diversified their cropping activities.

Determinants of Crop Diversification
Table 3 shows the results of the Tobit regression analysis of the determinants of crop diversification among the farm households with the sigma value and log likelihood function showing that the model is of good fit reasonably at $p < 0.01$. Table 3 revealed that age, household size, farming experience, gender, education, access to credit and membership of cooperative were the main albeit significant factors that determine crop diversification among farming households in the study area. Farming households' crop diversification level significantly increased with gender, farm size, access to credit, education and membership of cooperative; thus confirming that households' crop diversification was driven by larger farm size, higher level of education, and farmers participation in social group. An increase in farm hectarage, educational level of farmer, access to credit and being member of cooperative increase the crop diversification level of the household by 0.37, 0.81, 3.11 and 0.55 respectively. This implies that farmers involved in crop diversification for the following reasons; to ensure secured livelihood for the teeming household members, availability of farmland, awareness of the economic potentials of such practice (education) and easy access to loans.

Table 3: Estimated Tobit regression results on determinants of crop diversification.

Variable	Coefficient	Marginal Effect	T-value
Constant	-2.264	- 1.811	- 1.712
Age	-0.065*	- 0.062*	-1.748
Household size	-0.188**	-0.011	-1.034
Gender	2.449*	0.092*	1.723
Farming Experience	-0.045***	-0.002***	-2.087
Farm Size	0.365*	0.018*	1.354
Dependency ratio	-0.101	-0.096	-0.229
Membership of cooperative	0.553*	0.059*	-1.368
Average distance between land parcel	0.329	0.312	0.658
Access to credit	3.105*	0.117*	1.678
Nearness to market	-0.507	0.024	-1.917
Education	0.810***	0.029***	3.012
Availability of good road	0.352	0.334	0.938

Sigma	0.1645***		
Log likelihood	-83.568		

Source: Field Survey data, 2015
* Statistically significant at 10 %
** Statistically significant at 5 %,
*** Statistically significant at 1 %,

The responses of the farmers' age, household size and farming experience to the level of crop diversification were significantly negative; thus signifying that farm households' crop diversification decreases as the farmers get older in age and farming experience by 0.065 and 0.045. Experience is a function of age. Thus, in many cases the aged farmers are more experienced in farming but less diversified because of old age. There was a significant negative relationship between household size and crop diversification because due to scarcity of land in the study area, an increase in household size tends to affect the farm size available for crop diversification. The marginal effects for significant variables showed that the crop diversification has decreasing effects of 0.062 and 0.002 as the farm household heads grow older in age and farming experience respectively while crop diversification has decreasing marginal effect of 0.011 as the household grows in size. Also, there were marginal increases in crop diversification by 0.092, 0.018, 0.059, 0.117 and 0.029 with an additional increase in gender, farm size, membership of cooperative, access to credit and farmers educational level respectively.

IV.   CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it could be concluded that most farm household heads in the study area are still in their active age. Thus, they are expected to be productive for available resources. Majority of the farmers had formal education and diversified their livelihood and economic activities. The Tobit results revealed that there were marginal increases in crop diversification with increase in farm size, membership of cooperative, access to credit, farmers educational level and gender but decrease with age, farming experience and household size. The policy implications and recommendations from this study include provision of enabling environment for the formation of cooperative societies and encouragement of farmers to join the existing cooperative societies. There is need for government to consider undertaking policies that will improve farmers' access to and control overland such as provision of ranches to avoid conflict between crop farmers and herdsmen. Government should work towards the expansion of infrastructures like road network, marketing and storage facilities which are important preconditions for the diversification of crops and are crucial in ensuring sustainable income and employment among farmers.

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