



DETERMINANTS OF RURAL HOUSEHOLDS' INCOME DIVERSIFICATION AMONG SMALLHOLDER MAIZE FARMERS IN DRYLAND AREAS OF NORTHERN NIGERIA

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Abstract

Income diversification among farming households is an important mechanism for effective risk management and coping strategies in rural areas. The study focused on determinants of income diversification among smallholder maize farming households in dryland areas of Northern Nigeria. Stratified, purposive and simple random sampling techniques were used for the study. Primary data were collected from 480 smallholder maize farmers across the three agro-ecological zones of Northern Nigeria. Major income sources identified include aquaculture/fishing, civil service, trading/business, rural artisan and livestock rearing. Beside crop production, livestock rearing and trading were reported as the most prominent source of income among households in the study area. This implies that households in the study area have alternative income sources that can be used to support agricultural production and overall livelihood. Poisson regression estimate revealed that income diversification is significantly influenced by off-farm income, maize output, and access to credit, education and household size. It was also concluded that, diversification of income sources among smallholder farmers is an effective strategy to improve household income thereby reducing food insecurity and poverty level. Farmers should be encouraged to diversify their economic activities to earn more income to be able to maintain their food and non-food expenditure of their households. This can be achieved through creation of enabling socio-economic environment that will generate employment opportunity for farming household. The need to promote household enterprise and maize production commercialization is very essential. These may include encouraging the formation of effective farmers' cooperatives and other farmers' social group. This will help to facilitate knowledge transfer, input and output marketing and distribution, savings mobilization, and farm credit sourcing and supply.

Key words: Income Diversification, Poisson Regression and Drylands Areas

INTRODUCTION

Maize (*Zea mays*) is a cereal crop that is grown widely throughout the world in a range of agro ecological environments. About 50 species exist and consist of different colors, textures and grain shapes and sizes. Maize was introduced into Africa in the 1500s and has since become one of Africa's dominant food crops. Maize is currently produced on nearly 100 million hectares in 125 developing countries and is among the three most widely grown crops in 75 of those countries (FAOSTAT 2010). About 67% of the total maize production in the developing world comes from low and lower middle income countries; hence, maize plays an important role in the livelihoods of millions of poor farmers. They grow maize for food, feed, and income in 24 diverse and mostly rainfed farming systems, accounting for about 90% of the total area. They are often too poor to afford irrigation and are exposed to significant risks of production and income failure.

Income diversification is often referred to as a risk management and coping strategies meant to cushion the effect of economic hardships especially in rural areas. Income diversification can also be seen as an increase in the number of income or the balance

among the different sources of income. When linked to farm and off-farm activities in the rural areas, income diversification is often used to describe expansion in the importance of non-crop and non-farm income. Non-farm income includes both off-farm wage labour and non-farm employment. Adekunle and Shittu (2014) states that most rural households adopt multiple income generating activities in order to manage risk in terms of weather change or other factors, to meet household consumption needs in the face of high transaction costs, to take advantage of positive externalities among activities, and to respond to diseconomies of scale.

Several studies conducted on rural income diversification reported that households in rural areas have potential sources to reduce risk and economic eventualities. The pattern of income distribution has been a major concern in the developing world. This is because high levels of income inequality are likely to create a hostile atmosphere for economic growth and development. Income inequality was the highest among non-farming households and the lowest among farming households, implying that income from non-farm activities contributed most to income

inequality in the study area. The study revealed that the major factor which negatively influenced the choice of farming as a livelihood strategy was household size while factors such as age and land ownership had positive and negative effects on the adoption of the non-farm strategy respectively (Abimbola and Olaniyi, 2014).

Megbowon and Mushunje (2016) examined the pattern of income diversification and investigate the factors that influence income diversification among households in the province. Income diversification has been globally identified as a channel for household in reducing vulnerability to shocks, improve standard of living and reduce government fiscal burden. The study employed descriptive statistics and Poisson regression model to examine determinants of income diversification. The result revealed that households in the Province are not diversified. It revealed that apart from transfers, majority (51.5%) of households in the province obtain income from only one source. Male headed households tend to have more income sources than the female headed households. Regression result indicates age of household head, population group of the head, education attainment of the head, engagement in agriculture, recipient of remittance and number of economic active member of the household were found to be statistically significant in influencing livelihood diversification.

Ahmed (2012) examined the determinants of income diversification in rural farming households in Konduga Local Government Area of Borno State. Both descriptive and multiple regression analysis were employed to achieve the objectives of the research. The study reported that most households were involved in income diversification activities such as petty trading, matting and tailoring. Therefore, from policy perspective, the presence of agricultural development institutions in rural areas that would promote access to credit facilities and ultimately increase income should be considered. Another study was conducted on "pattern of income diversification strategies among rural farmers in Nnewi North Local Government Area of Anambra State. By descriptive, Herfindahe Index and Tobit Regression Model, data for this study were analyzed. The herfindahe index result indicates that the farmers gross income was ₦3166,100.00 per annum. Income generate from livelihood activities contributes to 65.23% of the total income while the contribution of non- farm activities contributed substantially to the many household income in Nnewi North Local Government Area of Anambra State. The result got from Tobit regression shows that the model is well fit as confirmed by the pseudo R^2 of 69%. The sample value of the log likelihood ratio of 45.20 is

significant at 1% level of probability. Some constraints of income diversification include; high investment cost, low human capital, risk, credit constraint, lack or inadequate expertise (Amanze, Ezeh and Okoronkwo 2015).

Nse-Nelson, Igwe, and Iroadighiogu, (2016) study income diversification strategies among farm households in Umuahia North Local Government Area of Abia State. Descriptive statistics and regression model were used for data analysis. Findings indicated that majority of the respondents (63%) fall within the age of 41 to 60, 84% were married and 65% were females. Most farm households were involved in income diversification activities such as cultivation of perennial crops, livestock rearing and trading. However, the determinants of income diversification were age and level of education of the household head, number of extension visits, availability of services and return from production. Most households occupation in the study area were agricultural based, nevertheless their willingness to diversify was significantly influenced by their socioeconomics characteristics. The result showed that off farm activities contribute substantially to the many household income increases. Another paper uses the Nigerian nationally representative household level data to examine the factors influencing the decision of farm household to engage in non-farm enterprise (NFE) activities in rural Nigeria. The model was estimated using Tobit regression, and the result shows that NFE participation decision of the household significantly depends on its head's education, household size, community level infrastructures and its distance to market. Unique to this study, we found that households having access to social and financial capital can overcome the NFEs entry barriers. This suggests that for the development of rural entrepreneurship in the country, the farm households need to be provided with basic education, community infrastructures, effective micro-credit and social network (Abdulaziz and Nura 2015).

Adekunle and Shittu (2014) examined the patterns and determinants of livelihood diversification among farm households in Odeda Local Government Area, Ogun state, Nigeria. The level of livelihood diversification was determined using Herfindahl index. The study data were analysed for each households by descriptive and regression (logit) techniques. Evidence from regression analysis shows that income from non-farm sources accounted for 37.1 percent of the farm households' income. Only few (22.9 percent) farm households depended solely on only one source of income which was farming. Households of Divorcee tend to be significantly much diversified than the average of the sample

while increase in education as well as farm income tends to lower the extent of livelihood diversification. Islamic adherent are less likely to have diversified income portfolios than their Christian counterpart. The result shows that low farm income is a critical factor encouraging livelihood diversification in the study area. This study will therefore provide information on factors influencing income diversification with inclusion of primary staple crop (i.e maize) in the study area and other selected variables.

This paper therefore looks into the various sources of income generating activities and the major factors that influence household income diversification in rural areas. The specific objective of this study therefore includes the following:

1. describe the socioeconomic characteristics of smallholder farmers,
2. describe the different sources of income in the study area
3. estimate the determinants of households' income diversification in the study area

METHODOLOGY

The Study Area

The study area covers Sudan Savannah, Northern Guinea Savannah and Southern Guinea Savannah. Sudan Savannah: This vegetation belt is found in the north-west stretching from the Sokoto plains in the west, through the northern sections of the central highland. It spans almost the entire northern states bordering the Niger Republic and covers over one quarter of Nigeria's total area. The low annual rainfall of usually less than 1000 mm and the prolonged dry season (6 – 9 months) sustain fewer trees and shorter grasses than the Guinea savannah. It is characterized by abundant short grasses of 1.5-2m and few stunted trees hardly above 15m. It is by far the most densely human populated zone of northern Nigeria. Thus, the vegetation has undergone severe destruction in the process of clearing land for the cultivation of

important economic crops such as cotton, millet, maize and wheat. This is in addition to devastation due to animal husbandry, especially cattle rearing, which is greatly favoured in this belt because the area is relatively free from tse-tse fly. The trees of the Sudan savannah include the acacia, the shea-butter, baobab and the silk cotton.

Guinea Savannah: The Guinea Savannah, located in the middle of the country, is the most extensive vegetation belt in Nigeria, covering near half of the country. It extends from Ondo, Edo, Anambra and Enugu States in the south, through Oyo State to beyond Zaria in Kaduna State. It is a belt of mixture of trees and tall grasses in the south, with shorter grasses and less trees in the north. This is occasioned by the local climatic conditions of low rainfall and long dry periods. This is in addition to the devastation caused by man through bush clearing for agriculture. This devastation has been observed in the southern part of the Guinea savannah where population density and demand for farm-land are very high. The trees, which are taller and bigger in this area than in the northern part of the Guinea savannah, are easily exploited due to accessibility over the grassland terrain. The term derived savannah is given to its southern portion, which today marks the transition between the two broad groups of vegetation types in Nigeria: the forest in the south and the true savannah in the north. The Guinea savannah, with its typically short trees and tall grasses, is the most luxuriant of the savannah vegetation belts in Nigeria.

Agricultural production is an important economic activity in the study area consisting of both crop and livestock production. Additionally, Maize is an important staple crop in the study area which is used to provide food and income to the farming household. Maize is also used as a source of feed for livestock and also industrial production. Some other crops produced in the study area include rice, sorghum, millet, soybean, cowpea, millet, moringa and other fruits and vegetables crop like tomato, pepper, mango etc.

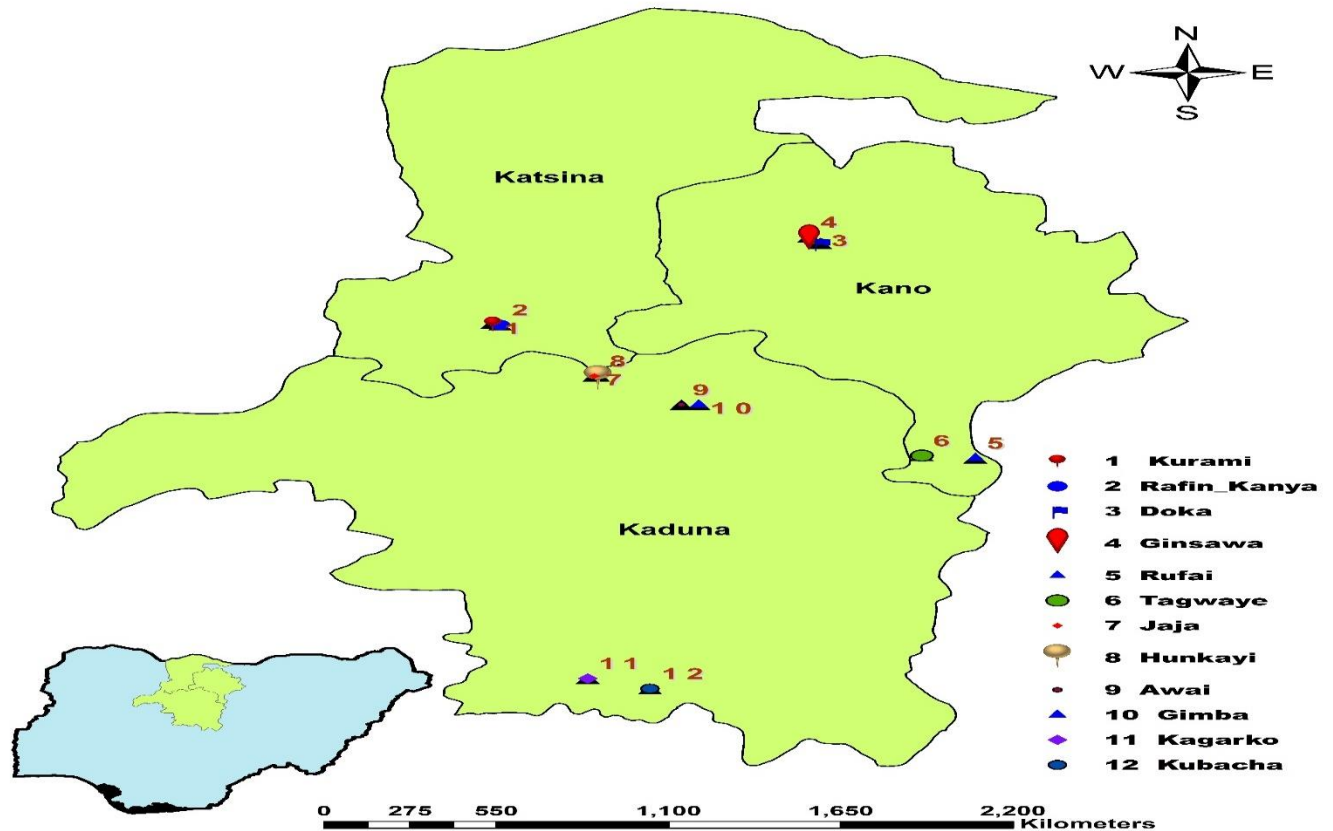


Figure 1: Map of the Study Area

Data Collection Method

Primary data were used for this research. The primary data were obtained from maize producers across the three agro-ecological zones. Structured questionnaire were used as instrument of data collection. The researcher was actively involved in the data collection exercise with the assistance of trained enumerators. Information collected covers socioeconomic characteristics of maize farmers in the study area, different sources of income in rural areas, household food consumption, food and non-food expenditure among others.

Sampling Techniques

The population of the study area constitutes the total maize farmers within the three agro-ecological zones (i.e Sudan savannah, Northern Guinea Savannah and Southern Guinea Savannah) in the dryland areas of Northern Nigeria. Multistage sampling techniques were used for the study. The first step involved the use of stratified sampling technique to consider the three (3) agro-ecological zones due to their distinctive variability in terms of climatic and other environmental conditions affecting agricultural

production in different ways. Secondly, purposive sampling techniques were used to consider Two (2) Local Government Areas (LGAs) from each of the agro-ecological zones due to their importance and intensity of maize production in the study area. The Local Governments Selected includes Bakori, and Tofa from Sudan Savannah, Kudan and Soba from Northern Guinea Savannah and lastly Doguwa and Kagarko from Southern Guinea Savannah. This gives a total of Six (6) local Government Areas for the study. Thirdly, two maize farming communities were purposefully selected from each of the LGAs based on their importance in maize production. This gives a total of eighteen (12) communities (Figure 1) for the study. Preliminary survey was conducted across the selected communities in which estimated sample frame (population) of maize farmers were established, amounting to 4803 from the 12 selected communities. Using RAO-SOFT sample size calculator, Proportionate random sampling were used to draw the estimated farmers from each community, thus making **480** smallholder maize farmers as sample size for the study.

Table 1: Summary of Sampling Procedure

| S/N | States | LGAs | Communities | Sample frame | Sample size | Total |
|----------|----------------|----------|-------------|--------------|-------------|------------|
| 1 | Sudan Savannah | Bakori | Kurami | 344 | 34 | 154 |
| | | | R/Kanya | 334 | 34 | |
| | | Tofa | Doka | 460 | 46 | |
| | | | Ginsawa | 400 | 40 | |
| 2 | N/G Savannah | Kudan | Jaja | 360 | 36 | 166 |
| | | | Kunkuyi | 340 | 34 | |
| | | Soba | Gimba | 480 | 48 | |
| | | | Awai | 482 | 48 | |
| 3 | S/ G Savannah | Doguwa | Rufai | 442 | 44 | 160 |
| | | | Tagwaye | 360 | 36 | |
| | | Kagarko | Kubacha | 420 | 42 | |
| | | | Kagarko | 380 | 38 | |
| Σ | 3 | 6 | 12 | 4803 | 480 | 480 |

Source: Preliminary Survey, 2016

Poisson Regression Model

Application of poisson regression model has been popular especially for continuous count dependent variables. Babatunde and Qaim (2009), Senadza (2012) and Vimfall (2015) examined the determinants of rural income diversification in Nigeria and Ghana respectively. The studies proxy income diversification by number of income sources. Consequently, the Poisson regression model was applied to achieve their objectives. Vimfall (2015) Applied a generalized Poisson regression on the determinants of number of income sources among female headed households in Kenya. Toyin and Mushunje (2016) also employed poisson regression model on income diversification and its determinants among households in Eastern Cape Province, South Africa. The study employed poisson regression model to determine the factors influencing household income diversification among smallholder maize farmers in the drylands areas of Northern Nigeria. Poisson regression model was used to determine the factors influencing rural income diversification. The model were specified in the following relationship:

$$Y_{ij} = X\beta + U \text{ ----- (1)}$$

The explicit form of the logistic model can be expressed in the following model:

$$Y_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \dots + \beta_k X_k + U \text{ ---- (2)}$$

Where,

Y_{ij} = Number of income generating activities by the household (Count)

X_1 = Age of maize producers (years)

X_2 = Farming experience (years)

X_3 = Access to credit (1= access and 0= No access)

X_4 = Education (years)

X_5 = Farm size (ha)

X_6 = Access to market (Access 1, No access 0)

X_7 = Off-farm income (₦)

X_8 = Cooperative membership (Member 1, Non-member 0)

X_9 = Household size (Number)

X_{10} = Maize output (kg)

X_{11} = Extension contact (Contact 1, No contact 0)

β_0 = Slope or intercept

$\beta_1 - \beta_{10}$ = Coefficient of regressors

U = error term

RESULTS AND DISCUSSION

Table 2: Quantitative Socioeconomic Characteristics of Smallholder Maize Farmers

| Variables | Minimum | Maximum | Mean | S.D |
|----------------------------|---------|---------|------|--------|
| Age of the farmer (years) | 20 | 85 | 44 | 10.979 |
| Farming experience (years) | 04 | 60 | 25 | 11.510 |
| Formal education (years) | 00 | 22 | 07 | 6.321 |
| Household size (ha) | 01 | 40 | 12 | 7.158 |
| Farm size (ha) | 0.1 | 4.5 | 3.5 | 3.532 |

Source: Field Survey, 2017

Age of Smallholder Maize Farmers

Table 2 depicts information on qualitative socio economic characteristics of smallholder maize farmers in the study area. The variable presented includes age of the farmer, farming experience, years of formal education, household size, total household farm size and farm size devoted for maize production, maize production experience. Other variables considered are related to household income which specifically comprised maize income, other farm income and off farm income generating activities.

The statistics of farmers' age indicated that the population of the study area is characterized by a predominance of young people. This was testified by the statistical distribution of age especially the minimum, mean and standard error which was 20, 44 and 0.501 respectively. These finding goes in conformity with Ahmed, Eugene and Abah (2015). The nature of households in terms of population age might be attributed to marital status, polygamous nature and other cultural heritage associated with households in the study area. In addition, agricultural and non-agricultural investments require strong and energetic people to provide the required labour for various activities. The age of the population in the context of agricultural work force, might be considered as a great potential particularly in provision of labour both young and adult (male and female). This might have a primary influence in increasing productivity which may also resulted to secondary contribution in increasing food security and reducing poverty in the Savannahs of Northern Nigeria.

Farming Experience of the Farmer

Farming experience was also another important variable considered for the study. It comprises the number of period (Years) spent by the household for active involvement in Agricultural activities. Previous studies indicated that smallholder farmers in the study area gathered very high experience in agricultural production which has been attributed to their involvement in such activities right from childhood. The findings of the study revealed statistics of 4, 60 and 25 for minimum, maximum and

mean age respectively. In typical rural agricultural settings, age and farming experience are variables that correlate with each other. This is because as farmers' age increases, his involvement in agricultural production also increases as members of a particular household. This support the findings of Mamman, Wudil and Halliru (2016).

In addition, experienced farmers are expected to gathered more awareness and understand in terms of procurement and use of agricultural production inputs (API), proper application of labour and output marketing as well as other household income generating activities. Most experienced farmers interacted with extension agents and participated in one development activities or the other. The implication of this is that, those farmers might use the experience to improve the style and strategy of investment which might lead to production efficiency in maize and other agricultural enterprises. However, age of the household head or experience of the farmer might be an important variable particularly in respect of technical decision making and other resource allocation for the important of household living standard (Food Security Improvement and Poverty Reduction).

Production experience was generally lower compared to general household farming experience. The result revealed minimum, maximum and mean maize farming experience of 4, 6 and 20 years respectively. The higher experience fo farming and specifically maize production can be attributed to the fact that farming is a major occupation of rural household while maize is an important staple crop for the farming families in the Savannahs of Northern Nigeria.

The study further obtained information on total household farm size and farm size devoted for maize production as shown in table 2. Despite evidence of land fragmentation in African communities as a result of inheritance and other external issues such as industrialization and infrastructural development, smallholder farmers are still in possession of land for maize production and other enterprise. Findings of the study indicated that the mean total household farm size was 3.5 ha. These findings goes in line with

Agricultural Performance Survey (APS, 2014) which has been an annual wet season exercise conducted by NAERLS and Federal Ministry of Agriculture. Based on the findings of the study, smallholder with relatively larger farm size devoted for maize might obtain higher output which may result to improvement of food security. Such households might also obtain market surplus to provide future income for the households. Availability of farm land for household is an important assets which may determine to some extent the level of crop production diversification, average annual income and farm output. This might also play a significant role in determining household consumption and assets acquisition among smallholder maize farmers in the study area.

Years of Formal Education

Smallholder maize farmers' education was also quantitatively measured in years as depicted in table 2. In the context of this study, education comprises the number of years spent in the process of acquiring formal education. The unit of measurement considered was 6 years for completion of primary education, 12 years for completion of secondary school education, 16 years for completion tertiary education and lastly 0 year for farmers with no formal education. Educational attainment is an important variable and a key for mastery of agricultural management skills, such as acquisition of production inputs, allocation of farm resources, risk management in production and marketing of farm output as well as knowledge of farm budgetary techniques. The statistics for years of formal education revealed that minimum, maximum and mean age of 0, 22 and 7 years respectively. The findings indicated that substantial number of farmers acquired one form of formal education or another while others never obtained formal education. Smallholder maize farmers who obtained formal

education might use their formal literary towards proper resources utilization. Maikasuwa and Ala (2013) reported that education is an important instrument that influences agricultural production decision of smallholder farmers.

Household Size Maize Farmers

Socio economic researches especially rural and urban household surveys takes into consideration household size as an important variable. In this study, household size is considered as number of people both male and female (children, youth and adults) with different activities, needs as well as sharing the same resources to accomplish household needs. Typical agricultural households particularly in rural settings are expected to use family members for the provision of unpaid labour in farming activities provided that the members attain the minimum requirement to participate in one farm activity or another.

From the findings of the study, it was reported that the households has a minimum, maximum and mean number of 01, 40 and 12 with standard deviation of 6.321 and standard error of 0.288 respectively. This implies that majority of the households in the study area possess reasonable number of individuals who shares household resources. Mamman, Wudil and Halliru (2016) also reported similar findings with respect to household size of smallholder maize farmers. Household size and composition can be interpreted in two different ways. First, households with large number of people are expected to experience increase in household expenditure on food and non-food requirement which directly exerts pressure on household income. On the other hand, large number and composition of household might be used as an opportunity to provide labour for farm activities and related occupation engagement by the household. This will help in reducing household expenditure on labour and accelerate the acquisition of income for satisfying the needs of the household.

Table 3: Socioeconomic Characteristics of Smallholder Maize Farmers

| Variables | Frequency | Percentage |
|---------------------------|-----------|------------|
| Gender | | |
| Male | 455 | 94.8 |
| Female | 25 | 5.2 |
| Marital Status | | |
| Single | 18 | 3.75 |
| Married | 448 | 93.33 |
| Widow | 12 | 2.50 |
| Divorced | 02 | 0.42 |
| Educational Status | | |
| No formal education | 159 | 33.1 |
| Primary education | 111 | 22.7 |
| Secondary education | 122 | 23.1 |
| Tertiary education | 68 | 25.4 |
| Vocational | 20 | 4.20 |

Gender, Marital Status and Education

The study further makes inquiry on other qualitative socio-economic characteristics of smallholder maize farming household which includes gender, marital and educational status. From the result, majority (94.8%) of the farmers (Household head) in the study area were male among which 93.33% were married. This finding implies high level of responsibility for men in terms of household and farm's decision making process. On the other hand, the low level of female as maize farmers might be attributed to the cultural, religion and other traditional organization which limit female access to land, leadership and other resources. Studies have shown that marriage is an important constitution typically in the study area, thus very minimal single (3.75%), Divorced (0.42%) and widow (2.50%) maize farmers in the study area. This corroborates with findings of Ahmed, Eugene and Abah (2015).

However, we mentioned earlier that education (Table 2) is a key for easy mastery of managerial tools such as agricultural calendar, procurement and use of inputs as well as other investment decision making.

From these results, substantial numbers of farmers (33.1%) do not possess formal education while majority (71.4%) attains one form of formal education or another. Specifically, 22.7%, 23.1% and 25.4% of the smallholder maize farmers attained primarily, secondary and tertiary education respectively. The presence of formal education among farmers might help them in understanding new agricultural innovations for improved production and better living standard among farming families.

Income Sources among Smallholder Maize farmers in the Study Area

The study basically identifies available sources of income as depicted in figure 2. Major sources identified include aquaculture/fishing, civil service, trading/business, rural artisan and livestock rearing. Beside crop production, livestock rearing and trading were reported as the most prominent source of income among households in the study area. This implies that households in the study area alternative income sources that can be used to support agricultural production and overall livelihood.

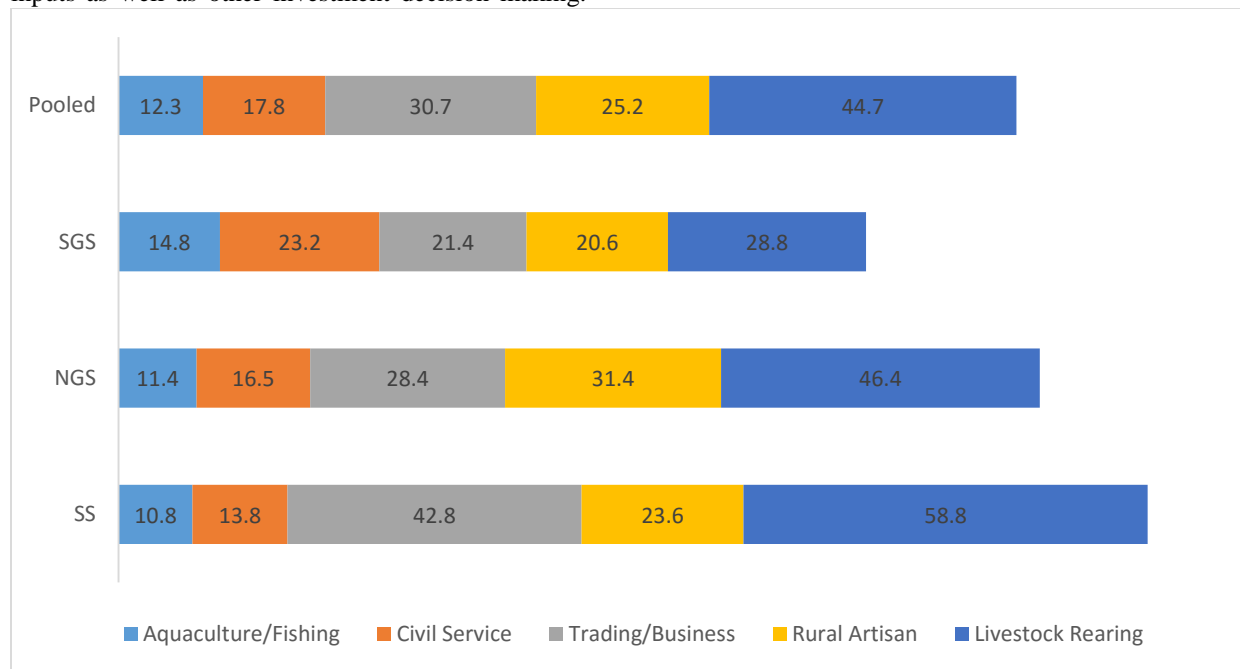


Figure 2: Alternative Sources of Income among Smallholder Maize Farmers

Factors Influencing Household Income Diversification of Smallholder Farmers

This component revealed poisson regression estimates for factors influencing smallholder household income diversification in the study area (Table 4). The dependent variable were count of

household income diversification while the regressors include age of the farmer, farming experience, access to credit, educational status, farm size, access to market, off-farm income, cooperative membership, household size, maize output, participation in development projects and extension contact.

Table 4: Factors Influencing Household Income Diversification

| Variables | β | S.E | t-value | Sign. | Tolerance | V.I.F |
|------------------------|-----------|-------|---------|----------|-----------|-------|
| Constant | 5.559 | 0.057 | 97.622 | 0.000*** | ---- | ---- |
| Age of the farmer | -0.031 | 0.001 | -0.629 | 0.530 | 0.440 | 2.273 |
| Farming experience | 0.053 | 0.001 | 1.126 | 0.261 | 0.475 | 2.107 |
| Access to credit | 0.079 | 0.014 | 2.244 | 0.025** | 0.884 | 1.185 |
| Educational status | 0.060 | 0.002 | 1.687 | 0.092* | 0.840 | 1.190 |
| Household farm size | -0.018 | 0.007 | -0.541 | 0.589 | 0.963 | 1.038 |
| Access to market | 0.015 | 0.030 | 0.469 | 0.639 | 0.976 | 1.024 |
| Off-farm income | 0.445 | 0.000 | 13.696 | 0.000*** | 0.988 | 1.044 |
| Cooperative membership | -0.003 | 0.019 | -0.076 | 0.940 | 0.883 | 1.133 |
| Household size | 0.068 | 0.001 | 1.771 | 0.077* | 0.716 | 1.396 |
| Maize output | 0.539 | 0.000 | 16.441 | 0.000*** | 0.980 | 1.020 |
| Extension contact | 0.043 | 0.021 | 1.250 | 0.212 | 0.910 | 1.099 |
| Model Statistics | | | | | | |
| R | 0.714 | | | | | |
| R-square | 50.9 | | | | | |
| R-square adjusted | 49.8 | | | | | |
| F-value | 40.238*** | | | | | |
| DW-statistics | 1.905 | | | | | |

Source: Field Survey, 2017

***p<0.01, **p<0.05 and *p<0.1

Income diversification with respect to agrarian livelihood is the process of switching from low-value crop (staple crop) to higher value crop (typically commercial crops), livestock and other non-farm activities. It is probably more useful to define them as crops that generate high economic return per unit of labour and land (Mogbowon and Mushunje, 2016). By this definition, diversification is seen as a source of income growth and thus a potential means of poverty reduction. The rural household motives for diversification as well as the opportunities available to them differ significantly across settings and income group (Abdulaziz&Nura, 2015). Additionally, rural households in many different countries have been found to diversify their income sources allowing them to spread risk and achieve better consumption and sustainable livelihoods.

In line with the above relevance of household income diversification in rural communities particularly towards poverty reduction, this study employed poisson regression model to estimate factors influencing household income diversification in the Savannah of Northern Nigeria. Poisson regression is often applied when the dependent variable is a count variable, which in this case number of income sources as a count variable. Poisson regression was used in identifying factors that does influence income diversification. In addition to the estimated model, multi-collinearity test was carried out to check the consistency and validity of the estimated model as depicted in table 4.

The mean VIF (variance inflation factor) multi-collinearity test was found to be 1.31 and none of the

individual variables have a VIF value above 5.00, and the tolerance level of 82.4 percent indicates the absence of any serious multi-collinearity. Variables that were found to be significant in influencing income diversification include access to credit, educational status, off farm income, household size, maize output and participation in development project.

At 5% level of significant, access to credit statistically influence income diversification of household positively. The coefficient of access to credit was 0.079 implying that a unit increase access to credit ends to correspondent increase in the number of income diversification sources. This result is in conflict with findings of Ahmed (2012) who reported access to credit as variable that doesn't significantly influence household income diversification. This disagreement can be argued that since most of the alternative investment requires finance for diversification, agricultural credit/loan has a greater role to play for the improvement of rural income diversification to venture into off-farm and non-farm income generating activities.

The importance of education of a household generally and specifically the farmers is ascertained in table 3.. Education promotes job mobility and skills acquisition that could be needed to engage in other economic activities. Educational attainment of the farmer indicates a significant positive relationship with number of income sources or diversification alternatives at 10% probability level. This shows that the higher the level of farmers' education, the higher will be the probability of creative thinking to venture into alternative income source. Similar findings were

reported by Adepoju and Obayelu (2013) on relevance of educational attainment to income diversification. Megbowan and Mushunje (2016) also reported education as significantly positive variable that influence diversification of income sources among rural farming household the coefficient of educational status was 0.060, implying that a unit increase in educational attainment result in 6.0 percent increase in the income sources of smallholder farming households. Bishop (2014) also reported similar findings concerning educational attainment. The importance of off-farm income generalizing activities plays integral role towards improvement of rural livelihood. It comprises income generating activities form non-agricultural sources such as carpentry blacksmithing, tailoring in rural areas. The influence of off-farm investment in increasing income sources of the household is shown in table 3 with statistics of positive and significant coefficient of the variable at 1% level of probability (table 4). This implies that a unit increase in off farm income might result to corresponding increase of household income diversification. This is in conformity with findings of Amanze, Ezeh and Okoronkwo (2015) who reported off-farm income as an important parameter that contribute substantially to rural livelihood.

The study further revealed household size as a significant important variable that positively influenced household income diversification at 10% level of probability. The estimated coefficient implies that income diversification of household will increase by 6.8% for a unit increase in household size. This result conforms to the findings of Bishop (2014) who reported significant positive influence of household size on income diversification in rural areas. The nature of household composition with more adult and energetic members can be used to support farming and other alternative investment in rural communities.

Maize production output were also discovered as a significant variable that positively influence household income diversification at 1% level of probability. The estimated coefficient of 0.539 for maize output implies that a unit increase in maize output will increase the number of income diversification sources by 53.9%. Production surplus of maize in this context can be used to initiate alternative income source among smallholder farmers in the study area. Megabowon and Mushenge (2016) reported positive probability of agricultural activities in increasing the number of income diversification sources in rural areas.

CONCLUSION AND RECOMMENDATIONS

Maize is a staple and economic crop which formed an important portion of household food items and income generation. It was also concluded that, diversification of income sources among smallholder farmers is an effective strategy to improve household income thereby reducing food insecurity and poverty level.

Farmers should be encouraged to diversify their economic activities to earn more income to be able to maintain their food and non-food expenditure of their households. This can be achieved through creation of enabling socio-economic environment that will generate employment opportunity for farming household. These may include encouraging the formation of effective farmers' cooperatives and other farmers' social group. This will help to facilitate of knowledge transfer, input and output marketing and distribution, savings mobilization, and farm credit sourcing and supply.

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