Income Diversification among Small-Holder Farmers in Bosso Local Government Area of Niger State, Nigeria

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Abstract
The study focused on income diversification among smallholder farmers in the Bosso Local Government Area, Niger State, Nigeria. Two-stage sampling procedure was used to select a total of 94 respondents for the study. Primary data were used and collected with the aid of a structured questionnaire and complemented with an interview schedule. Descriptive statistics, the diversity index, and the Tobit regression model were used to analyzed the data collected. From the analysis results, average age of the farmers was 44 years, the average household size was eight members and average farm size was 2.4 hectares. The majority (78.7%) of the respondents acquired one form of formal education or the other, while 21.3% did not have formal education. Reasons for income diversification were poor crop and animal yield (97.9%), availability of off-farm opportunities and limited income from animal production (78.7%), and limited income from crop production (75.5%) ranked 1st, 2nd and 4th, respectively. The result further revealed that 69.2% of the respondents had an income diversity index of 0.21 - 0.40 indicating that level of income diversification was moderately low. The determinants of income diversification in the study area were age (-2.12), household size (1.83), land ownership (2.36), non – farm opportunities (5.42) and farm size (-2.47). These variables were positively related to income diversification and statistically significant at 10%, 5% and 1% level of probability, respectively. In conclusion, diversification into various income sources have helped the respondents to sustain family demands, although, level of income diversification was low. It was therefore recommended that the Government should formulate and implement policies that encourage smallholders to diversify their income in the study area.

Keywords: *Diversification, Farmers, Households, Income, Smallholder.*

Introduction

Rural farming households in Nigeria and other developing nations have historically placed a high importance on diversifying their sources of income (Ajayi *et al.,* 2016). According to Assan and Beyene (2013), there are various types of income diversification based on the degree of freedom of choice (to diversify or not) and reversibility of the effect. To reduce their susceptibility to environmental risk, rural households or individuals may try to diversify their sources of income. Small-holder farmers can rely on income diversification programs as a source of income during hard times. In order to increase their income, which is typically insufficient compared to the expanding demands of their family, small-holder farmers in rural areas employ a number of income diversification

strategies (Tenaw, 2016). Therefore, by engaging in both on and off-farm activities that are utilized to generate income in addition to the household's basic agricultural operations, rural households can diversify their sources of income. However, the patterns of income diversification among rural households in Nigeria showed that majority of households have fairly diversified income sources (Tashikalma *et al.,* 2015).

According to Ajayi *et al.* (2016), there has been a long-term concern about the ability of smallholder farmers to provide sufficient income for their increasing households' daily needs. Meanwhile, it had been argued that, profitability of smallholder farmers can increase through diversification of agriculture into modified high yielding crops and off-farm activities which are perceived livelihood strategies (Omotayo, 2016). Therefore, rural farmers employ a range of strategies to increase their income and level of living. The diversity of rural areas is a significant topic for rural development in addition to the predicted benefits on income and poverty reduction since it is essential for understanding rural exodus and out-migration movements, two additional diversification approaches (Omotayo, 2016). The objectives of income diversification often time have not been fully achieved due to problems like political and economic instability, low crop yields, a decline in the amount of land available for agricultural use, and a lack of credit facilities at the local and national levels (Omotayo, 2016; Yisa *et al.,* 2019). More so, the political instability, climate change and its variability have continued to aggravate the living conditions of most households particularly living in rural areas.

The question of "whether or not diversification is a necessity or a choice" is up to individual rural household. If rural families are to diversify their sources of income out of necessity, policies that make it simpler for disadvantaged household members to move from high-risk jobs into non-farm wage and self-employment jobs are essential. Also, if income diversification is a matter of choice that is typically carried out by wealthier households who have the needed income and assets, a significant policy must be implemented along with the removal of barriers to engaging in high value agricultural activities like

the production of cash crops for export markets (Tashikalma *et al.,* 2015). The diversification of household income is the most common tendency in rural areas due to lack of resources and opportunities for specialization. Studies by Yisa *et al.* (2019) and Ogaji *et al.* (2019) reported that rather than promoting specialization within existing portfolios which may be out of the reach of the average rural farmer, upgrading them to augment income could be more realistic for the purpose of alleviating poverty and providing a sustainable way of life.

Despite the growing importance of livelihood diversification in both on and off-farm activities, little is known about how it affects smallholder farmers' ability to make a living in developing nations like Nigeria (Ajayi *et al.*, 2016). It is commonly known that rural households tend to have many vocations, but there haven't been many systematic attempts to connect this behaviour to rural income diversification. This informational void or knowledge gap needed to be filled. Therefore, it's critical to understand the factors that lead to household income diversification, the scope of the issue and the incentives that drive it. The goal of the study is to determine how smallholder farmers in the Bosso Local Government Area of Niger State, Nigeria diversify their sources of income; hence the following objectives were formulated to describe the socio–economic characteristics of the small-holder farmers; identify reasons for income diversification among smallholder farmers; assess the level of income diversification and evaluate the determinants of income diversification in the study area.

Materials and Methods
The study was carried out in Bosso Local Government Area of Niger State, Nigeria. The Niger State is located between Latitudes 8° 20' and 11° 30' North of the equator and Longitudes 3° 30' and 7° 20' East of the Greenwich Meridian. Bosso is one of the 25 Local Government Areas (LGAs) of Niger State which is home to many towns and villages including Bosso town, Maikunkele, Chanchaga, Pyatta, Gidan-kwano, Garatu, Beji, and Maitumbi. According to statistics from the National Population Commission (NPC) (2006), Bosso LGA has a

population of 147,359 people. However, based on a population growth rate of 3.4%, the projected population was 251,597 as at 2022 (National Bureau of Statistics (NBS), 2023). The three main ethnic groups in the LGA are Nupe, Gwari, and Hausa, while it covers a total land area of 1,592 km^2 with the inhabitants mostly into agriculture. Crop produce includes yam, beans, rice, millet, groundnuts, maize and sugarcane, while livestock reared includes cattle, goats, sheep and chickens.

Two-stage sampling procedure was used to select respondents for the study. The first stage involved a random sampling of 4 villages from the LGA. The second stage was proportionate sampling by 30% of the small-holder farmers from each of the villages selected. Thus, a total of 94 respondents was selected for the study out of the 314 small-holders' farmers in Bosso LGA that registered with Niger State Agricultural Mechanization and Development Authority (NAMDA). A structured questionnaire and an interview schedule were used to collect the primary data from the respondents. Data collected were analyzed using descriptive statistics (frequency distribution, percentages and mean) and inferential statistics (Tobit regression model) as well as Simpsons Index of Diversity (SID).

Model Specification

Tobit regression model

Tobit regression model is referred to as a censored regression because of restriction imposed by the values taken by the dependent variable. The Tobit regression model as used by Ajayi *et al.* (2020) is given as in equation (1):

$$Y^* = x'\beta + \varepsilon \qquad (1)$$

Where;

Y^* is the unobserved censored latent variable as shown below,

x is the predictor variables to be estimated

β is the coefficient of the unknown threshold parameters

ε is the error term

The explicit form of the model is specified as in equation (2):

$$Y^* = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e \qquad (2)$$

Where;

Y = Income diversification of the small-holder farmers measured using Simpson index

X_1 = Age (years)

X_2 = Education (years)

X_3 = Household size (Number)

X_4 = Occupation (1 if farming and 0 if otherwise)

X_5 = Land ownership (Number of plots)

X_6 = Non – farm opportunities (1 if available and 0 if otherwise)

X_7 = Farm size (hectares)

X_8 = Access to credit (Naira)

α = Model intercept

$\beta_1 - \beta_8$ = Coefficients of the independent variables

$X_1 - X_8$ = Independent variables

e = error term

The Simpsons Index of Diversity (SID)

The Simpson Index of Diversity as used by Joshi *et al.* (2006) was an adapted procedure to measure the level of income diversity among the smallholder farmers in the study area. The SID was similarly adapted by Mclaughlin (2016) on diversification studies. Thus, Simpson Index of Diversity can be mathematically denoted as in equation (3):

$$SID = 1 - \sum P_i^2 \qquad (3)$$

Where;

SID = Simpson Index of Diversity

P_i = Proportion of income from *ith* sources

$\sum$ = Summation sign

1 = Constant

Simpson index of diversity ratio falls between zero and one depending on the event that there are steady well-springs of income realized by the respondents.

Results and Discussion

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents described are age, gender, marital status, household size, education and farm size. Table 1 revealed that the majority (59.6%) of respondents were between the ages of 41 and 60 with a mean age of 44 years. This implies that the respondents were at their most active and productive age at the time given their capacity to engage in a variety of income generating activities. This result is in agreement with the work of Ajayi *et al.* (2016) who reported mean age of 44 years for the respondents in their study area indicating an active farming age. Majority

(96.8%) of the respondents were males implying that males are more involved in diversification than the female because they carry larger responsibilities in their various households. This finding agrees with that of Durba *et al.* (2019) who reported greater proportion of respondents in his study area were male that engaged in various income activities. More so, majority (86.2%) of the respondents were married implying that they are responsible thus the need to diversify their income base in order to adequately cater for the family needs.

As shown in Table 1, majority (71.3%) of the respondents had household size ranging between 1 and 10 with mean household size of 8 members which is fairly large and could influence the choice for income diversification in the study area. In terms of education, majority (78.7%) of the respondents acquired formal education (primary, secondary and tertiary) implying that literacy level was high as most of the respondents acquired one form of formal education or the other which could enhance income diversification. This finding is in agreement with the work of Ajayi *et al.* (2016) who reported that most of the respondents in their study area acquired formal education that could easily influences income diversification. It also corroborates the work of Tashikalma *et al.* (2015) who reported that education is crucial for enhancing knowledge of contemporary farming techniques and income diversification among farming households. More than half (55.3%) of respondents had farm size of less than 2.1 hectares with a mean farm size of 2.4 hectares implying that the respondents in the study area were smallholder farmers which is an important reason to diversify their income sources. This finding is in line with the work of Omotayo (2016) who reported that small farm size influences farmers to diversify into non-farm occupations.
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Reasons for Engaging in Income Diversification
Distribution of the respondents based on the reasons for engaging in income diversification is presented in Table 2. It revealed that Majority (97.7%) of the respondents were engaged in income diversification due to poor yield from crop and animal production, followed by availability of

off-farm opportunities and limited income from animal production (78.7%), and limited income from crop production (75.5%) ranked 1st, 2nd and 4th, respectively. Other reasons include large family size (73.4%) and limited financial power (72.3%) ranked 5th and 6th and 7th, respectively. This implies that poor yield from agricultural production ranked top most among the reasons for diversification of income sources by the respondents. Poor yield from agricultural production in most cases lead to decline in farm incomes, hence the need to diversify against agricultural production and market risks by engaging in off-farm employment opportunities. This finding is in corroboration with study of Ajayi *et al.* (2016) who reported that rural households are forced into off-farm and non-farm activities due to increasing uncertainties associated with farming such as climate change variability and poor yield. Meanwhile, the least reason for the respondents' diversification of income sources is fun of diversification (34.0%) ranked 7th. This implies that only few proportions of the respondents diversify their income sources just for fun of it. It is note-worthy that most rural households are into income diversification in order to meet up with household consumption needs.

Level of Income Diversification by the Respondents
The level of income diversification among smallholder farmers in the study area was determined using Simpson's Index of Diversity and the result is presented in Table 3. The result of the Simpson index ranges between 0.1 and 0.6. The majority (69.2%) of the respondents had Simpson index ranging between 0.21 – 0.40. This is followed by 28.7% of respondents with Simpson index of less than 0.21 and 2.1% of the respondents that had Simpson index ranging between 0.41 – 0.60. However, the mean Simpson index of the respondents was 0.314 implying that the level of income diversification among smallholders in the study area was moderately low. This finding is in contrast to the work of Babatunde and Qaim (2010) who reported mean Simpson index of 0.479 in their study area indicating that income diversification was on the average as respondents tried to adopt multiple income sources.
The low level of income diversity indicated that

the households in the study area had less sources of income aside from their main sources. They consequently concentrated their income on a small number of jobs, mostly in agriculture. Rural farming households must, however, diversify their sources of income in order to meet the obligation of providing for the family. The households might receive training to improve their chances of landing well-paying jobs outside of farming. Thus, rural farming households may be able to balance their sources of income using this method.

Determinants of Income Diversification

The results of the Tobit regression analysis on the factors affecting respondents' income diversification in the study area are shown in Table 4. The explanatory factors in the model explain around 52% of the variation in the respondents' income diversification, according to the Pseudo R-square value of 0.5181. The remaining 48% of the variation unaccounted for could be due to other predictor variables not included in the model or externalities beyond the control of researcher. The Chi-squared value of 49.87 which is significant at 1% level of probability implies goodness of fit for the overall model. Out of the eight variables that were included in the model, the z-value of the regression revealed that five independent variables—age (-2.12), household (1.83), land ownership (2.36), off-farm opportunities (5.42) and farm size (2.47) were statistically significant at different levels of probability.

The coefficient of age (-0.0028) was negative and statistically significant at the 5% level of probability, hence inversely correlated to income diversification and indicating a negative association. Respondents' age-related income diversification grew as a result of older farmers being less risk-averse in their source of income. This outcome is consistent with finding of Tashikalma *et al.* (2015) who reported that farmers' involvement in income diversification declines as they age.

The coefficient of household size (0.0885) was positive and statistically significant at 10% level of probability, hence directly correlated to income diversification and indicating positive relation. Larger household size of the respondents implies more mouth to feed, thus greater the needs to diversify income sources in order to meet up with the family responsibilities. This finding agrees with the work of Tenaw (2016) who posited that large household size is positively related income diversification in order to meet up with the household consumption and expenditure needs.

The coefficient of land ownership (0.2331) was positive and statistically significant at 5% level of probability, hence directly correlated to income diversification and indicating positive relation. Respondents' title land for farming activities could influence greater needs for income diversification as it is one of the important factors of production. This finding is in corroboration with the work of Yisa *et al.* (2019) who reported that title to farm land is positively related to income diversification as the farmers could diversify into different farming activities.

The coefficient of off-farm opportunities (0.2049) was positive and statistically significant at 1% level of probability, hence directly correlated to income diversification and indicating positive association. This implies that availability of off-farm opportunities enhances income diversification as individuals could participate in other activities to further generate additional income in support of their primary income source. This is in line with Ajayi *et al.* (2016) who reported that employment opportunities significantly influence livelihood diversification.

The coefficient of farm size (-0.0387) was negative and statistically significant at 5% level of probability, hence inversely correlated to income diversification and indicating negative association. This implies that increase in farm size decreases income diversification, while farmers with small farm size have a greater need for income diversification. This finding agrees with Omotayo (2016) who reported that farm size play significant role in influencing income diversification of rural households as a smaller farm size may enable farmers to diversify their sources of income.

Conclusion

Based on the empirical evidence from the findings of the study, it could be concluded that most of

the respondents were male, married and in their most active and productive age; thus acquired formal education that could easily enhance income diversification. However, the main reason for income diversification was poor yield from crop and animal production, although the level of diversification was low in the study area. The low level of income diversification indicates that households were less diversified from their primary income generating activities, thereby concentrating their income sources on few activities especially those related to farming. Factors influencing income diversification are age, household size, land ownership, off-farm opportunities and farm size which were found to be statistically significant. It was therefore recommended that Government should formulate and implement policies that encourage smallholders to diversify their income, while smallholder farmers should be encouraged through extension education to develop their skills that will facilitate income diversification and not to be over dependent on agriculture alone in the study area.

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Table 1: Distribution of the respondents based on socio-economic characteristics (n = 94)

Variables	Frequency	Percentages	Mean
Age (years)			
21 – 40	33	35.1	
41 – 60	56	59.6	
> 60	5	5.3	44
Sex			
Male	91	96.8	
Female	3	3.2	
Marital status			
Single	11	11.7	
Married	81	86.2	
Widowed	2	2.1	
Household Size (Number)			
1 – 10	67	71.3	
11 – 20	21	22.3	
21 – 30	6	6.4	8
Educational Status			
Non Formal	20	21.3	
Primary	16	17.0	
Secondary	33	35.1	
Tertiary	25	26.6	
Farm Size (Hectares)			
< 2.1	52	55.3	
2.1 – 4.0	23	24.5	
4.0 – 6.0	10	10.6	
> 6.0	9	9.6	2.4

Source: Field Survey, 2018

Table 2: Distribution of respondents based on reasons for income diversification

Reasons	Frequency*	Percentages	Rank
Poor crop and animal yield	92	97.9	1st
Availability of off-farm opportunities	74	78.7	2nd
Limited income from animal production	74	78.7	2nd
Limited income from crop production	71	75.5	4th
Large family size	69	73.4	5th
Limited financial power	68	72.3	6th
Fun of diversification	32	34.0	7th

Source: Field Survey, 2018
*Multiple responses

Table 3: Simpson index of the respondents' level of income diversification (n = 94)

Index	Frequency	Percentages
< 0.21	27	28.7
0.21 – 0.40	65	69.2
0.41 – 0.60	2	2.1
Mean	0.314	

Source: Field Survey, 2018

Table 4: Tobit regression estimates of determinants of income diversification

Variables	Coefficients	z – value
Constant	0.1029	2.20**
Age	-0.0028	-2.12**
Education	-0.0199	-0.82
Household size	0.0885	1.83*
Occupation	0.2251	1.37
Land ownership	0.2331	2.36**
Off –farm opportunities	0.2049	5.42***
Farm size	-0.0387	-2.47**
Access to credit	0.1029	1.17
Pseudo R – squared	0.5181	
Chi – squared	49.87***	
Log likelihood	76.175438	

Source: Field Survey, 2018

Note: * implies significant at 10%, ** implies significant at 5% and * implies significant at 1%**