Livelihood Diversification for Food Security by Farmers in Toro Local Government Area, Bauchi State, Nigeria

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DOI: http://dx.doi.org/10.15520/20233

Abstract: This study was carried out to analyze the institutional and environmental factors influencing livelihood diversification by rural farmers in Toro local government area of Bauchi State. Data for the study were collected using questionnaires administered to respondents who were selected randomly. Data collected were analyzed by means of descriptive statistics, Foster, Greer and Thorbecke (FGT), Herfindahl index and Ordered Probit regression model. The result showed that the main reason why farmers engage in livelihood diversification activities was to raise household’s income portfolio ostensibly to enhance food security. FGT analysis for poverty level of farmers reveal that the poverty line was constructed to be at per capita monthly expenditure equal or higher than (₦1,780). The poverty count index (P₀) for the entire household was 0.517, this means 52% of the farming household in the study area were poor. The Herfindahl index showed that most of the household heads had more than 2 sources of income. The Ordered Probit regression analysis indicates that credit received and season of the year were significant determinants of livelihood diversification at 1% level while accessibility to market and natural resources available to the farmers were significant at 5% level. As a deliberate strategy to encourage farmers to diversify, it is recommended that soft loans should be made available to the farmers and also they should be educated on how to use natural resources around them sustainably. These will enable them to be food secured and liberate them from the hold of poverty.

Keywords: Diversification, food, livelihood, security.

INTRODUCTION

The existing gaps in poverty, unemployment and inequality between the urban and the rural sectors of the world have attracted the attention of social scientists to the study of rural livelihood (Grown and Sen, 1987). Butler and Manzur (2004) observed that the rate of Africa’s development is lagging significantly behind much of global south despite decades of assorted development approaches. This is in spite of increased attention received from many multinational institutions. Studies over the past 15years have highlighted the increasing importance of non-agricultural sources of income to rural dwellers. The focus on livelihood diversification necessarily implies a process-a broadening of income and livelihood strategies away from purely crop and livestock production towards both farm and non-farm activities that are undertaken to generate additional income. This could be via production of other agricultural and non-agricultural goods and services; and the sale of waged labour or self-employment in small enterprises (Hussein and Nelson, 1999).

It is evident that rural household in Nigeria engage in multiple livelihood activities such as trading (Marketing or adding value to commodities) (small scale business enterprises, carpentry, radio and bicycle repairs) and processing of agricultural goods and arts and craft (weaving, mats and basket making) in order to supplement earning from agriculture (Edna et al; 2007). These activities (livelihood diversification) are influenced by certain factors which operate at both internal and external environment of rural household (Kinsella et al; 2000, Bateman and Ray, 1994, Butler and Mazur, 2004).

It is against the above background that this study attempts to analyse factors that influence farmers to engage in any other business apart from farming in Toro local government area of Bauchi State, Nigeria.

METHODOLOGY

Study Area:

The study was carried out in Toro Local Government Area of Bauchi State. It covers a total land area of 693km² and a total population of 350,404 (Department of Works, Land and Survey, 2011). It has its administrative capital in Toro. The amount of rainfall received in the area is 820mm per annum, which begins in April and end in October, it has two seasons: wet and dry. Toro local government generally has fair weather with temperature range between 35°C for low land and 31°C for high land (Department of Works Land and Survey, 2008). The vegetation zone of the area is Sudan savannah and Sahel savannah, and has a vast fertile soil which is an advantage to cattle rearing and agricultural production. Cash crops and food crops such as maize, guinea corn, millet, rice, beans etc, are grown. This has impacted on the standard of living, economic development and revenue generation in the local government area. The local government is divided into three (3) districts for administrative and development purpose. These districts include Toro district with headquarter at Toro, Jama’a district with headquarter at Nabardo and Lame district with headquarter at Gumau. It shares boundaries with local governments such as Dass to the south, Ningi to the north, Bauchito the east and Jos occupies the western flank of the Local Government Area.

Sampling Procedure and Sample Size:

The three districts were selected for the study. In each of the district, 20 households were randomly selected. This
individuals with lives measures no aversion to poverty: $P_0$.

Suppose $\alpha = 0$: This equals the headcount ratio, the index

Three members of the FGT index are: FGT weighted poverty measure: Foster, Greer and Thorbecke (FGT), Herfindahl index and Logit regression model.

The Foster, Greer and Thorbecke (Foster, et al., 1984), weighted poverty index were used for the quantitative assessment of poverty. The $P$-alpha ($P^\alpha$) measures in analysing poverty relate to different dimensions of the indices of poverty, $P_0$, $P_1$ and $P_2$ and used for headcount, depth and severity of poverty respectively. The measure is able to accomplish this, through the choice of a poverty aversion parameter $\alpha$ (alpha). The larger the $\alpha$, the greater the weight given by the index to the severity of poverty. The three measures are all based on a single formula, but each index puts different weights on the degree to which a household or individual falls below the poverty line. To see how the measures are defined, the consumption or household expenditures were arranged in ascending order, from the poorer $Y_1$, next poorest $Y_2$... with the least poor $Y_q$. The poverty index is defined mathematically as follows:

$$P^\alpha = \frac{1}{n} \sum_{i=1}^{q} \left( \frac{Z - y_i}{Z} \right)^\alpha$$

Where

- $\alpha =$ the FGT index and takes values 0, 1 or 2
- $n =$ total number of households
- $q =$ number of households below the poverty line
- $Z =$ poverty line
- $Y_i =$ the MPAEHE of the household in which individual $i$ lives

Three members of the FGT index are:

Suppose $\alpha = 0$: This equals the headcount ratio, the index measures no aversion to poverty:

$$P_0 = \frac{1}{n} \sum_{i=1}^{q} \left( \frac{Z - y_i}{Z} \right)^0 = \frac{1}{n} \sum_{i=1}^{q} (Z - y_i)$$

Suppose $\alpha = 1$: the $P^\alpha$ is the headcount times the average expenditure shortfall:

$$P^1 = \frac{1}{n} \sum_{i=1}^{q} \left( \frac{Z - y_i}{Z} \right)^1 = HI$$

Here, $P^\alpha =$ Headcount $\times$ average income shortfall

The Herfindahl index measures the level of income diversification which is the degree of concentration (scatteredness) of household’s income into various sources. Households with most diversified income will have the largest values of D. Households with less diversified income will have the smallest values of D. Least diversified households (those depending on a single income source) takes on the minimum value of D i.e 1. The higher the number of income source(s) and or the more evenly distributed the income share, the higher the value of D.

Ordered Probit Model:

The ordered probit model was used to characterize the households’ activities into one two and more than two. The specification of the model is as follows: Let $Y_i$ denote the number of livelihood diversification activities – one activity($Y_i = 0$), two activities ($Y_i = 1$), or more than two activities ($Y_i = 2$). In this study, an ordered probit specification allows the study of the factors that determine number of livelihoods activities by heads of households.

The ordered probit specification is stated as follows:

$$Y^* = X_i \beta + \epsilon_i$$

The latent continuous variable, $Y^*$ is a linear combination of some predicted factors, $X_i$, plus a disturbance term $\epsilon_i$ that has a standard normal distribution. The latent variable exhibits itself in ordinal categories, which could be coded as 0, 1, 2, ..., k. The response of category k is thus observed when the underlying continuous response falls in the $k-th$ intervals as:

$$Y^* = 0 \text{ if } Y^* \leq \delta_0$$

$$Y^* = 1 \text{ if } \delta_0 < Y^* \leq \delta_1$$

$$Y^* = 2 \text{ if } \delta_1 < Y^* \leq \delta_2$$

$$P_2 = \frac{1}{n} \sum_{i=1}^{q} \left( \frac{Z - y_i}{Z} \right)^2$$

This measure, unlike the first two $P_\alpha$ measures is sensitive to the distribution of expenditure among the poor. Here, the $P_\alpha$ is the weighted sum of individual expenditure shortfalls where income gaps themselves are the weights. Thus, the expenditure gap ratios of poorer households weigh more importantly in the calculation of $P_\alpha$ than the expenditure gap ratios of less poor households.

Herfindahl Index:

The level of livelihood diversification was determined by computation of Herfindahl index. The income diversification index used in the study was defined as the inverse of the Herfindahl index as adopted by Idowu, et al. (2011) thus:

$$D = \frac{1}{\sum^2_{i=1} s_i}$$

$D =$ level of income diversification

$S_i =$ share of income source $i$ in households total income

$Y_i =$ total income from source $i$

$Y =$ total household income from all sources

Ordered Probit Model:

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Where:

\[ Y^* (i = 0, 1, 2) \text{ are the unobservable threshold parameters that will be estimated together with other parameters in the model, is normalized to a zero value and hence only } k = 1 \text{ additional parameters are estimated with } Xs (Green, 2000). \]

Like the model for binary data, the probabilities for each of the observed ordinal response which in this study has 3 responses \((0, 1, 2)\) will be given as:

\[
\text{Prob}(Y = 0) = P(Y^* = 0) = P(\beta'X + \varepsilon_i \leq 0) = \Phi(\beta'X)
\]

\[
\text{Prob}(Y = 1) = \Phi(\delta_i - \beta'X) - \Phi(\beta'X)
\]

\[
\text{Prob}(Y = 2) = 1 - \Phi(\delta_i - \beta'X)
\]

(7)

Where:

\[ 0 < \ldots < \ldots n \text{ is the cumulative normal distributive function such that the sum total of the above probabilities is equal to one.} \]

The ordered probit model allows for the possibility of sequential household choice of livelihoods activities. The specification of the ordered probit model is as follows:

\[
\text{Ordered probit}^i_{i} (1 \text{ activity, } 2 \text{ activities, } 3 \text{ activities}) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + u_i \]

(8)

Where:

\[ i = \{\text{Diversify or not} \} = 1 \text{ activity} = 0, 2 \text{ activities} = 1, 3 \text{ activities} = 2; \]

\[ X_1 = \text{Market Accessibility (1=relatively easy access, } 0= \text{ otherwise)} \]

\[ X_2 = \text{Credit Received (Amount in Naira)} \]

\[ X_3 = \text{Membership of Farmers Organization (Number)} \]

\[ X_4 = \text{Natural Resource material (Number of Materials)} \]

\[ X_5 = \text{Natural Disaster (Number of Disasters)} \]

\[ X_6 = \text{Proximity to Cities (Km)} \]

\[ X_7 = \text{Season of the Year (Number of Months)} \]

\[ X_i - X_7 \text{ = vectors of explanatory variables influencing household’s decision to diversify livelihoods} \]

\[ b_0 = \text{Constant or intercept} \]

\[ b_1 - b_7 = \text{Estimated coefficients} \]

\[ u_i = \text{Error term} \]

RESULT AND DISCUSSION

Reasons for Engagement in Livelihood Diversification Activities:

The finding shows that the main reason why the respondents engaged in livelihood diversification activities was to raise household income portfolio (Table 1). This had the highest score of 24%, closely followed by food security with 23% to ranked 2nd. This finding corroborates those of Ellis (1998) Gordon (2000) and Dercon and Krishnan (1996) whose studies shows that rural farmers diversify sources of livelihood to increase household income portfolios. Other reasons include the avoidance of risk associated with farming and for leisure.

Table 1: Distribution based on reasons for livelihood diversification

<table>
<thead>
<tr>
<th>Reasons for diversification</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase income</td>
<td>38</td>
<td>23.9</td>
<td>1st</td>
</tr>
<tr>
<td>Food security</td>
<td>36</td>
<td>22.66</td>
<td>2nd</td>
</tr>
<tr>
<td>Avoid farming risk</td>
<td>33</td>
<td>20.75</td>
<td>3rd</td>
</tr>
<tr>
<td>Family necessities</td>
<td>32</td>
<td>20.13</td>
<td>4th</td>
</tr>
<tr>
<td>Leisure</td>
<td>20</td>
<td>12.58</td>
<td>5th</td>
</tr>
</tbody>
</table>

Poverty Level of Household Heads in Study Area:

The poverty line used for this study was calculated from the monthly MPAEHE of the sampled households shown in Table 1. Two third (0.67) of the monthly MPAEHE of the sampled households was used as the poverty line. This was used by similar studies in nigeria (Omonoma; 2010; FOS, 2004; and Bandabla 2005).

The poverty profile of the farming households which include poverty head count or incidence (\(P_0\)), poverty gap or depth (\(P_1\)) and squared poverty gap or severity (\(P_2\)) were calculated. The \(P_0\) for the entire households was 0.517. This means that 52% of the household heads in the study area were poor. The poverty gap index \((P_1)\) usually referred to as the depth of an average poor person from the poverty line was 0.56% this implies that 56% of the poverty line \((1,001.84)\) was required to bring an average poor person in the study area to the poverty line. The poverty index \((P_2)\) which measures the distance of each poor person to one another was found to be 3.53 this means that among the poor households 35% were severely poor. This shows that the poor household were not equally poor but they vary in their degree of poverty.

Table 2: Poverty Profile of Respondents

<table>
<thead>
<tr>
<th>Index</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPAEHE</td>
<td>2.671</td>
</tr>
<tr>
<td>2/3 MPAEHE</td>
<td>1.780</td>
</tr>
<tr>
<td>1/3 MPAEHE</td>
<td>0.890</td>
</tr>
<tr>
<td>Headcount index ((P_0))</td>
<td>0.517</td>
</tr>
<tr>
<td>Poverty Gap index ((P_1))</td>
<td>0.56</td>
</tr>
<tr>
<td>Poverty severity index ((P_2))</td>
<td>3.53</td>
</tr>
</tbody>
</table>

Level of Livelihood Diversification:

The measure of income diversification which takes into account the variation in the income shares is the inverse of Herfindahl index concentration. The upper limit for D depends on the number of income sources available and their relative shares. The higher the number of income sources \((S)\) and or the more evenly distributed the income shares, the higher the value of D.

Result in Table 3 revealed that 20% of farm households were not diversified i.e they depended solely on farming, 58% were moderately diversified meaning they depended on two income sources and 22% were highly diversified (had more than two income sources). This implies that majority of farm households in the study area had at least two income sources.
Livelihood diversification. The results indicate that natural resources (X4), has significant influence on households engagement in livelihood diversification by 0.26%. The implication of this finding suggest that belonging to farmers organisation (X3) a unit change in number of membership of farmers organisation will raise the probability of household heads engagement in livelihood diversification by 0.16%. This finding is in tandem to the result in Table 1 which shows that household heads engage in livelihood diversification to raise their income portfolios. For farmers organisation (X3) a unit change in number of membership of farmers organisation will raise the probability of household heads engagement in diversification by 0.26%. The implication of this finding suggest that belonging to farmers organisation would significantly influence household heads engagement in livelihood diversification activities beside farming, because the experience of working and sharing ideas and common problems in groups would educate them, and also enable them to learn more about other opportunities which may exist outside their immediate engagement and environments.

The result in the Table further examines the environmental factors influencing livelihood diversification of farmers such as natural resources, natural disaster, proximity to cities and season of the year which were equally hypothesized to have no significant relationship with livelihood diversification. The result indicate that natural resources (X4), has significant influence on households livelihood diversification. This is an indication that a unit change in natural resources would increases the likelihood of households engagement in livelihood diversification by 0.012%. As reported by Ellis (1998), certain activities depend on natural resource base, therefore, their availability would encourage household heads participation in livelihood diversification. Proximity to cities and season of the year were equally found to be significant determinants of diversification among the household heads (Table 4).

<table>
<thead>
<tr>
<th>Level of Diversification</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not diversified (HI=1)</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Moderately diversified (1.0&lt;HI&lt;2.0)</td>
<td>35</td>
<td>58.3</td>
</tr>
<tr>
<td>Highly diversified (HI&gt;=2.0)</td>
<td>13</td>
<td>21.7</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Distribution of Farm Household Heads by level of Livelihood Diversification

### The Institutional and Environmental Factors Influencing Livelihood Diversification:

In the study, it was hypothesized that there is no significant relationship between institutional factors (Market, Credit, Farmers Organisation) and livelihood diversification of farmers. Table 4 show the analysis carried out using logit regression model. The result revealed that amount of credit received by household heads has a positive influence on their livelihood diversification because a unit change in the amount of credit (X2) obtained resulted in an increased engagement in livelihood diversification by 0.16%. This finding is in tandem to the result in Table 1 which shows that household heads engage in livelihood diversification to raise their income portfolios. For farmers organisation (X3) a unit change in number of membership of farmers organisation will raise the probability of household heads engagement in diversification by 0.26%. The implication of this finding suggest that belonging to farmers organisation would significantly influence household heads engagement in livelihood diversification activities beside farming, because the experience of working and sharing ideas and common problems in groups would educate them, and also enable them to learn more about other opportunities which may exist outside their immediate engagement and environments.

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<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>T-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market (X1)</td>
<td>0.2895</td>
<td>0.13365</td>
<td>2.817**</td>
</tr>
<tr>
<td>Credit (X2)</td>
<td>0.1585</td>
<td>0.5689</td>
<td>2.379*</td>
</tr>
<tr>
<td>Farmers org (X3)</td>
<td>0.2552</td>
<td>0.6057</td>
<td>0.421***</td>
</tr>
<tr>
<td>Natural reso (X4)</td>
<td>0.1179</td>
<td>0.537</td>
<td>0.292**</td>
</tr>
<tr>
<td>Natural dis(X5)</td>
<td>0.487</td>
<td>0.9706</td>
<td>0.502**</td>
</tr>
<tr>
<td>Proximity to (X6)</td>
<td>0.2002</td>
<td>0.1581</td>
<td>2.727**</td>
</tr>
<tr>
<td>Season of year (X7)</td>
<td>-0.3168</td>
<td>0.6196</td>
<td>-0.503*</td>
</tr>
<tr>
<td>C1</td>
<td>0.2673</td>
<td>1.6253</td>
<td>-1.6253</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-45.8702</td>
<td>-44.85</td>
<td></td>
</tr>
<tr>
<td>LR chi-square X2</td>
<td>26.34***</td>
<td>28.20***</td>
<td></td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>0.6124</td>
<td>0.626</td>
<td></td>
</tr>
</tbody>
</table>

** at 5% level of significant, * at 1% level of significant, ns = no significant.

### CONCLUSION AND RECOMMENDATIONS

The result of this study revealed that farmer’s involvement in livelihood diversification activities is as a result of overwhelming need to increase household income portfolio. Given that most of the households are poor and that majority of them had at least two income sources. Also, institutional and environmental factors are significant determinants of the likelihood of household heads’ engagement in livelihood diversification activities. The finding of this study suggest that livelihoods diversification is an antidote to rural household’ quest for poverty reduction, as it secure them from the vulnerability of food insecurity. This supports the facts that poor rural household heads’ over dependence on agricultural production would mean depleting the only food and income source, thereby exposing them to risk of income failure and food insufficiency.

Based on this finding, the following recommendations are made:

- Market institutional frameworks should be flexible enough to allow rural farmers access with a view to encouraging them to diversify.
- Credit facilities should be made available to the farmers to enable them venture into agro-entrepreneurial ventures.
- The rural farmers need to be educated on how to use the natural resources around them sustainably. This will help them to maximize the economic, tangible and intangible benefits from the adjoining natural resource bases.
- The farmers need entrepreneurship education and or awareness on the possible economic activities available to them during the off rainy months.
REFERENCES


