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Research Article

Determinants of Factors Influencing the Choice of Livelihood Sustainability Strategies among Small-Scale Farmers in Flood Prone Area of Jigawa State

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ABSTRACT

This study was conducted to assess the factors influencing the choice of livelihood sustainability strategies among small-holder farmers in flood-prone areas of Jigawa State, Nigeria. Multistage sampling procedure was used to select 383 smallholder farmers and an online questionnaire (Kobotool box) was used to elicit information from the sampled population. The collected data was analyzed, using descriptive statistics, multinomial logit and multiple regression analysis. The study revealed that Sex (P<0.1), marital status (P<0.05), household size (P<0.1), monthly income (P<0.05), farming experience (P<0.05), and membership of cooperative society (P<0.1) were found to be factors influencing the choice of livelihood sustainability strategies employed by the smallholder farmers in the study area. Self-employment (P<0.01), pension (P<0.1), non-farm wage (P<0.01), and business of agricultural product income (P<0.05) were the factors affecting livelihood sustainability options for smallholder farmers' income in the study area. The study concluded that there are existed socio-economic variables that had significant influence on the choice of livelihood sustainability strategies engaged by the smallholder farmers in the study area. It is recommended that the government, non-governmental organization, as well as community stakeholders should improve rural infrastructures like good roads, rural electrification, potable water, telecommunication services, and an affordable healthcare system since they are important for enhancing economic activities and improving livelihoods.

Keywords: Livelihood; Flood Prone; Strategies; Sustainability; Off farm income; Multinomial logit

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INTRODUCTION

A flood is a natural disaster that occurs when there is an excessive amount of water or rain in a certain area. It can be brought on by a storm's continuous downpour, the melting of huge amounts of snow or ice quickly, or the failure of dams or levees. Floods typically occur when a large body of water overflows or erupts over territory that is not typically submerged (Daniel and Udo, 2019). Floods are notorious for their extensive devastation, which results in significant socioeconomic and environmental harm to human lives, structures, properties, and farmlands. Consequently, the communities that are impacted endure intense suffering (Ikani, 2016). Floods and other natural disasters impede growth, food security, and sustainable development. Natural disaster losses, like as floods, are on the rise and disproportionately affect less developed nations. They ruin opportunities for general development and the

quality of life (Ikani, 2016). Jigawa State has experienced floods, according to the Jigawa State Emergency and Management Agency (SEMA). Twenty people have died in the state as a result of the disastrous flood, which has damaged thousands of houses and farmlands. Floods ruin the lives of residents in seventeen local government out of the twenty seven local government districts each year. On September 5, 2020, a heavy rainstorm destroyed several crops, including maize, rice, millet, and guinea corn, across the majority of the State's local government areas (LGAs). Their livelihood may have been impacted by the 50,000 structures that have been destroyed by an annual flood (Vanguard News Nigeria, 2020).

Rural households in developing nations depend on agriculture for their livelihoods and way of life (Eshetu and Mekonnen, 2016). However, in growing economies like Jigawa State, Nigeria, yearly floods and a decrease in the proportion of agricultural area to population make people more vulnerable and less resilient to poverty and food insecurity. The rural regions of low-income nations are home to almost two-thirds of the worlds impoverished, who mostly rely on subsistence farming and other natural resources for their livelihood (Aguilar and Sumner 2020). Since unemployment is extremely high, especially in developing countries (International Labour Organization (ILO) 2018), household livelihood strategies and entrepreneurship can help raise the standard of living for the unemployed, poor, and marginalized (Alemu 2012; United Nations Food and Agriculture Organization [UN-FAO] 2013). The dispersion of production assets among a range of farm and non-farm revenue-generating endeavors is referred to as diversification. Wan, Li, Wang, Liu, and Chen (2016) define diversification as the process of creating many sources of revenue. Additionally, the authors contend that income diversity is determined by the number of income sources available to a farm household at a particular moment in time, while the degree of income diversification of the household over time is indicated by the difference in the number of income sources available to a farm household at a different time.

However, rural populations around the world nowadays are working in a variety of jobs to build a varied portfolio of livelihood activities rather than depending only on agriculture (Alemu, 2012). To accomplish their livelihood objectives, households engage in a variety of activities, including commerce, entrepreneurship, informal employment, agriculture, and migration (Ellis 1998). However, due to a number of constraints, particularly with regard to access to essential resources, rural households' goals are not always met. These include inadequate rainfall, a shortage of inputs, a lack of money, and a lack of education (Blein 2013; Mishi and Mudziwapasi 2014). Therefore, it is crucial for people or households in emerging nations to diversify their sources of income, assets, and occupations.

Evidence suggests that between 40 and 45 percent of average household income in rural Africa comes from off-farm activities. Off-farm work is also a means of escaping poverty because it has a positive correlation with wealth and income (Barrett *et al*., 2005). Agriculture is the backbone of developing economies, but because of rapid population increase, flood susceptibility, and a drop in the ratio of agricultural land to people, it cannot adequately support rural communities. The subsistence stage of agriculture in the study area is also marked by little acreage and recurring floods, which force rural people to diversify their sources of income into non-farm pursuits. Despite the fact that flooding has been a recurring concern in this area, there appears to be a scarcity of empirical data on factors influencing the choice of livelihood sustainability strategies among smallholders in the flood-prone areas of Jigawa State, Nigeria. This necessitated the study to be conducted to assess the factors influencing the choice of livelihood sustainability strategies among smallholder farmers in the flood-prone area of Jigawa State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in some selected local government areas of Jigawa State, Nigeria. The State shares boundary with Yobe State to the northeast, Kano and Katsina states to the west, and Bauchi State to the east. Also Jigawa State shares international boundary with Zinder in the Republic of Niger, this provides a chance for inter border trading activities (Mohammed, 2014). The area lies between latitude in the north-western part of the country between latitude 11^0.00'N to 13^0.00'N and longitudes 8^0.00'E to 10^0.15'E and covers a land area of about 24,742 km^2. The state has the population of 4.348,649 (NPC, 2006) with a projected population of about 7,499,100 in 2022 (City Population, 2022). According to Ahmed (2010), about 14% of the total landmass of Jigawa State constitutes its wetlands (Fadama) area with a combination of tropical wet and dry climates (with seasonal rainfall between May and October), the State is mainly Sudan Savannah vegetation with the remaining constituting the Sahel Savannah vegetation type (Ahmed, 2010). It has a maximum temperature of about 40°C in the months of March to September, and low temperature of 11°C

between October and February with considerable variations during these times (Bidoli, *et al*., 2012). The average rainfall is about 650mm with a minimum of about 600mm and a maximum of 1000mm.

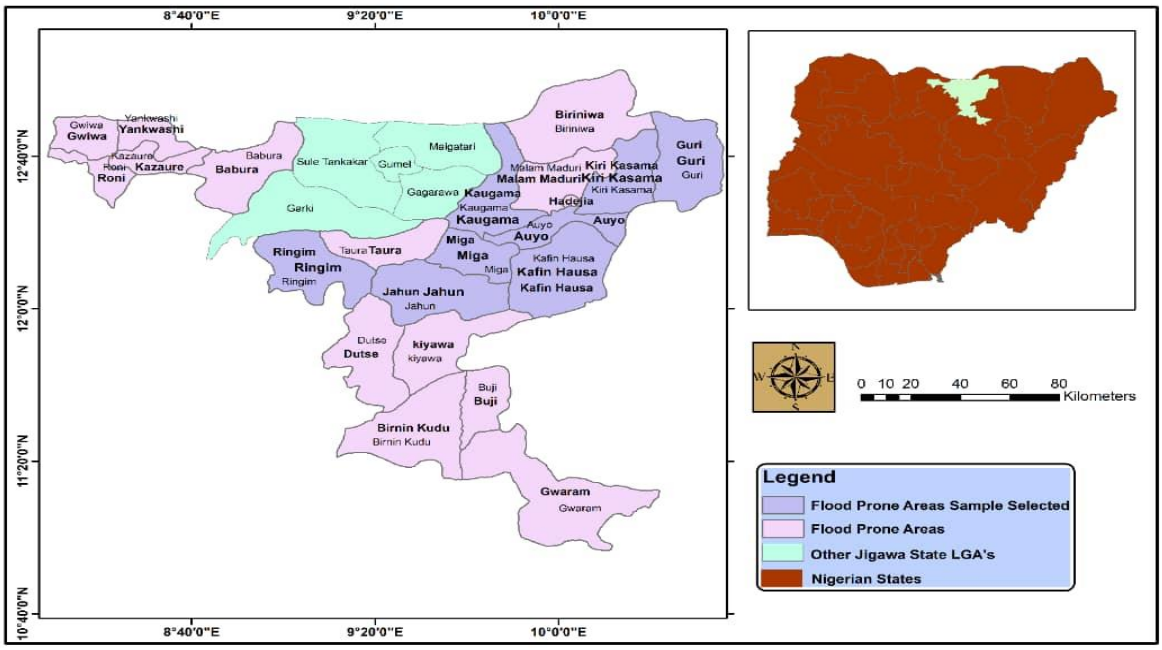

Figure 1. Sampling Procedure and Sample Size

Multi-stage sampling procedure was employed for this study. In the 1st stage, a purposive sampling was used to select 8 local governments areas out of the 22 local governments that have been affected by flooding based on the frequent occurrence of flooding in the State. In the 2nd stage, a purposive sampling was also used to select five (5) villages from each local government, the selection was made based on the high number of farm household heads affected and the proneness of the villages to flood in the local government, which make a total number of 40 villages. In third (3rd) stage, the raosoft sample size online calculator was used to determine the sample size of the study where by the calculator was set at a margin error of 5%, a confidence level of 95%, population of 126, 776 and a response distribution of 50%, which gave a total sample size of 383 (Mason, *et al*. 2018; Orifah, *et al*. 2020, Orifah, *et al*., 2021). In the 4th stage, the Bowley's proportion allocation formula (Bowley, 1926) as it was used by Orifah *et al*. (2021) in their studies to establish the sample proportion from each of the villages selected for the study. Bowley's proportion allocation formula is shown below;

$$W_i = \frac{(h-i+1)N_i}{N_{hy}} \quad \ldots\ldots(1)$$

Where

h = number of years for which development program is implemented

i =stratum number,

i=1, 2, 3, ……h

Ni = numbers of beneficiaries in the i^{th} stratum

N_{Hy} = Sum of total numbers of beneficiaries adjusted by the impact or phase factor with product of stratum population (Pandey and Verma, 2008).

Data collection

Primary data was used for the study. The primary data was obtained from the respondents using structured questionnaire and focus group discussion. The questionnaire was administered by the researcher and trained enumerators. The data collected includes socioeconomic characteristics of small-scale farmer's, various types of livelihood diversification strategies activities engaged by the small-scale farmers, and the factors militating against efficient livelihood diversification among the small scale household farmers in the study area.

Model Specification

Multinomial Logit Regression Model

According to Wassie *et al*. (2008) multinomial logit model is a widely used technique in the analysis of polytomous response categories in different areas of socio-economic science. Wassie *et al*. (2008) stated that multinomial logit model is an important model to examine the determinants of household livelihood strategy choices among the alternative

livelihood strategies. The assumption is that in a given period at the disposal of household asset endowment, a rational household head chooses among the four mutually exclusive livelihood strategies that could offer the maximum utility. Following the work of Greene (2003), multinomial logistic regression model was used to examine the determinants the choice of livelihood strategies engaged by small scale farmers in Jigawa State. The multinomial Logit model is specified as;

1) $P\ (Y_{i=j}) = \frac{e^{(\beta_i X_j)}}{\sum_{j=0}^{J} e^{(\beta_i X_j)}}$ j = 0……2 …… (3)

Therefore, following the work of Adepoju, (2013); Samatar, (2015); Yizengo, Okoyo and Beyene, (2015) dependent variable for this study will be the small-scale farmer's choice of livelihood diversification strategies which are specified as follows:

On-farm strategy: refers to an activity that involves crop production, livestock production, poultry production and fish rearing etc.

Off-farm strategy: here refer to agricultural activities which take place outside the farmers' own farm (*i.e*. within agriculture). The activities involved daily wage labour on others farms, agricultural marketing and agricultural processing.

Non-farm strategy: It refers to all rural economic activities outside agriculture.

Y_i represents four (4) unordered categories of livelihood strategy;

Y_0= On-farm strategy alone

Y_1 = Combination of On-farm and Off-farm strategy

Y_2 = Combination of On-farm and Non-farm strategy

Y_3 = Combination of On-farm, Off-farm strategy and Non-farm strategy

Where Y_0 is the reference case of the livelihood strategies.

P = is the probability of an economic activity,

j = is the livelihood category,

e = is the natural log,

β = is coefficients associated with X_i independent variables.

Independent variables are:

X_1 = Age of small-scale farmers (Years)

X_2 = Gender of small-scale farmers (male=1, 0 if otherwise)

X_3 = Educational qualification of small-scale farmers (formal education=1, 0 if otherwise)

X_4 = Primary occupation of small-scale farmers (farming=1, 0 if otherwise)

X_5 = Household size (number)

X_6 = Total farm size of small-scale farmers (ha)

X_7 = Monthly income in naira (Naira)

X_8 = Number livelihood activities engaged by small-scale farmers (number)

X_9 = Access to extension service (yes=1, 0 if otherwise)

X_{10} = Membership with farmers group (yes=1, 0 if otherwise)

X_{11} = Access to credit (yes=1, 0 if otherwise)

Multiple Regression Analysis

Multiple regressions were used to achieve objective two (2) to determine the effects of livelihood sustainability options on smallholder farmer's income in the study area. To determine the effects of livelihood sustainability options on smallholder farmer's income in the study area, the Cobb-Douglas function was selected to estimate the contribution of key variables for the effects of livelihood sustainability options on smallholder farmer's income in the study area. The specific of the Cobb-Douglass function for the effects of livelihood sustainability options on smallholder farmer's income is as follows;

$Ei = \alpha_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9$…… (4)

Four functional forms were employed to select the best fit equation. The linear form of the equation was selected as shown below.

Linear function:

E_i=b0+b1X1+b2X2+……..b6X6+Ui…… (5)

Where

E_i is the farmer's income (N).

α_0 is the intercept

X_1 = FCI =food crops income,

X_2 = CCI =cash crops income,

X_3 = LIVSTI=Livestock income,

X_4= LIVSTI=Livestock income,

X_5 = FWI =farm wage income,

X_5 = FWI =farm wage income,

X_6= NFWI=Non-farm wage income,

X_7 = SEI =self-employment income,

X_8 = REI =remittance income,

and β_1, β_2, β_3, β_4, β_5, β_6, β_7, and β_8 are the regression parameters to be estimated

RESULT AND DISCUSSION

Factors influencing the Choice of Livelihood Sustainability Strategies Engaged by the Smallholder Farmers in the study area

A multinomial logistic regression (or multinomial regression for short) is used when the outcome variable being predicted is nominal and has more than two categories that do not have a given rank order. This model can be used with any number of independent variables that are categorical or continuous. Table 1 of the study depicts the result of a multinomial logit regression of factors influencing the choice of livelihood sustainability strategies engaged by the farmers in the flood-prone areas of Jigawa State. The Table shows that the likelihood ratio statistics (883.790) is significant

at 1% level and this implies that the variables in the model have a significant influence on the farmers' choice of livelihood strategy in the study area. The Cox & Snell R Square was 0.131 which implies that about 13.10% of the variation in the choice of livelihood strategies of smallholder farmers was explained by the explanatory variables included in the model, while the chi square statistics value of 53.800 was significant at 1% level, which implies that the model is the best fit for the expression and an indication of the overall significance of the regression.

The model result is presented using on-farm agriculture alone strategy as a base/reference case scenario and the interpretations of only statistically significant variables are presented as follows. The Table depicts that the coefficient of (1.062, 1.033, and 1.109) sex across the three categories (on-farm + off-farm, on-farm + non-farm, and on-farm +off-farm + non-farm) of livelihood diversification strategies was found to be significant and positively related to the household farmers decision to diversify their livelihood activities at 10% level of probability. The result of the odds ratio depicts that, keeping other factors constant, the odds ratio in favor of the likelihood of the households to choose on-farm + off-farm, on-farm + non-farm, and on-farm +off-farm + non-farm livelihood diversification strategies will increase by a factor of 1.062, 1.033, and 1.109, respectively, as the number of genders in the household increases by 1 member. This implies that male respondents are more likely to diversify their livelihood activities than their female counterparts. Conversely, male-headed households have a greater tendency to engage in various livelihood options than their female counterparts; the probable reason is that female households have difficulty participating in non-farm activities due to cultural barriers and have more responsibilities in home management activities. In other words, men and women have differentiated social roles in the community.

The key informants also stated that culture-based gender role discrepancy forces female households to engage in fewer diverse livelihood activities, and females were busy in domestic roles such as childcare, cooking, washing clothes, and fetching water in the study area (Abera *et al.,* 2021). This finding is in line with the findings of Mishi *et al.* (2020), who reveal that male household heads were more likely to diversify their livelihood than their female counterparts in both categories of livelihood strategies.

The Table depicts that the coefficient of (1.873, 1.644, and 1.547) marital status in the three categories of livelihood sustainability strategies was found to be significant and positively related to the household farmers decision to diversify their livelihood activities at 5% level, respectively. The result of the odds ratio depicts that, keeping other factors constant, the odds ratio in favor of the likelihood of the households to choose on-farm + off-farm, on-farm + non-farm, and on-farm +off-farm + non-farm livelihood diversification strategies will increase by a factor of 1.873, 1.644, and 1.547, respectively, as the number of marital statuses in the smallholder household increases by 1 married. This implies that married household farmers are more likely to diversify their livelihood activities than the unmarried household farmers in the study area.

The possible explanation for this finding is that smallholder household farmers who have spouses form part of a productive labor force, as they can join or combine the surplus income acquired from various income-generating activities. This is in line with the finding of Mudzielwana *et al.* (2022) in their study, who found that the marital status of the respondents was significant and positively influenced the participation of farmworkers in on-farm activities only and in a combination of on-farm + off-farm + non-farm income-generating activities, respectively. The possible explanation of this finding is that respondents who are married may put more into the different livelihood strategies so as to sustain their domestic household demand, save little in anticipation of an increase in the total number of households, and improve their livelihood income. The implication of this finding for the study is that the state of being married may have serious implications for being a responsible and rational decision-making unit.

The Table depicted that the coefficient of (0.303, 0.266, 0.292) household size of smallholder farmers in the three categories of livelihood sustainability strategies was found to be significant and positively related to the household farmers decision to diversify their livelihood activities at 10% level, respectively, which is in line with a prior expectation. The result of the odds ratio depicts that, keeping other factors constant, the odds ratio in favor of the likelihood of the households to choose on-farm + off-farm, on-farm + non-farm, and on-farm +off-farm + non-farm livelihood diversification strategies will increase by a factor of 0.303, 0.266, and 0.292, respectively, as the number of household members in the smallholder household increases by 1 member. This implies that there are more people to feed, which necessitates a greater effort to obtain food from other sources of livelihood strategies.

Eshetu and Mekonnen (2016) reported in their study that, as economic theory predicts, family size is found to have a positive and significant relation

to the diversification of livelihood strategies into local off-farm activities and migration at a 10% probability level. The positive correlation between family size and diversification might be due to the relation between larger family size and household labor or correspondingly higher demand for food in the household, which implies that while an additional member to the household increases the probability of participating in local off-farm activities and outmigration in order to meet the basic needs of the family (Eshetu and Mekonnen, 2016).

The result in Table 1 of the study depicted that the coefficient of (-0.199, -0.227, and -0.228) of monthly income of smallholder farmers in the three categories of livelihood sustainability strategies was found to be significant but negatively related to the household farmers decision to diversify their livelihood activities at 5% level, respectively, which is not in line with a prior expectation. The result of the odds ratio depicts that, keeping other factors constant, the odds ratio is not in favor of the likelihood of the households choosing on-farm + off-farm, on-farm + non-farm, and on-farm +off-farm + non-farm livelihood diversification strategies will decrease by a factor of 0.303, 0.266, and 0.292, respectively, as the amount of monthly income of the smallholder farmers household increases by 1 naira. This implies that those smallholder farmers who have low monthly income in their various businesses have a lower probability of diversifying to other sources of livelihood income than those with high monthly income. The possible explanation for this finding is that having a low monthly income may not be enough for smallholder farmers to engage in other lucrative livelihood activities that may yield a high return on income. This finding is not in consonance with the finding of Abera, *et al*. (2021) in their study, who found household income has a positive and significant influence on the choice of agriculture + non-farm activities at a probability level of less than 5%, and they also disagree with the findings of Gecho, *et al.* (2014).

The Table of the study depicted that the coefficient of (-0.102) of farming experience of smallholder farmers in the on-farm + off-farm + non-farm category of livelihood strategies option in the study area was found to be significant but negatively related to the household farmers decision to diversify their livelihood activities at 5% level only, which is not in line with a prior expectation. The result of the odds ratio depicts that, keeping other factors constant, the odds ratio is not in favor of the likelihood of the households choosing on-farm + off-farm + non-farm livelihood diversification strategies, which will decrease by a factor of -0.102 as the number of farming experiences of the smallholder farmers household increases by 1 year. The implication is that the number of years of farming experience influenced the participation of the smallholder farmers in a combination of on-farm + off-farm + non-farm diversified livelihood strategies.

The more experience in farming, the lower the diversification of livelihoods, as the household head would have greater experience and be more invested in agriculture. This finding disagrees with the finding of Mudzielwana *et al.* (2022) in their study, who discovered that the years of farming experience by farmworkers were statistically significant and positively influenced the participation of the respondents in a combination of on-farm + off-farm and in a combination of on-farm + off-farm+ non-farm income-diversified livelihood strategies. This finding disagreed with that of Wondim, (2019). The result of the study depicted the coefficient of cooperative membership of smallholder farmers in the flood-prone area of Jigawa State.

The coefficient (0.723) of cooperative membership was found to be significant at 10% and positively related to smallholder farmer's livelihood sustainability strategies into on-farm + off-farm + non-farm activities only. This is in line with a prior expectation of the study: farmers who have a high number of years in cooperative society were found to be the ones who were most likely to diversify their livelihood strategies into on-farm + off-farm + non-farm. The result of the odds ratio depicts that, keeping other factors constant; the odds ratio is in favor of the likelihood of households choosing on-farm + off-farm + non-farm livelihood diversification strategies, which will increase by a factor of 0.723 as the number of years in cooperative society of the smallholder farmer's household increases by 1 year. The possible explanation for this could be that being a member of a cooperative society means not only providing agricultural extension services to farmers with inputs and credit but also entrepreneurial skills as the entry point for participating in on-farm, off-farm, and non-farm.

Table 1: Factors influencing the Choice of Livelihood Sustainability Strategies engaged by the Smallholder Farmers in the study area

Livelihood strategies	On-farm + off-farm			On-farm + non-farm			On-farm +off-farm + non-farm		
Variable	Coeff.	Std.error	Sig	Coeff.	Std.error	Sig	Coeff.	Std.error	Sig
Intercept	-0.765	1.086	0.481	-0.234	1.108	0.832	-1.581	1.080	0.143
Sex	1.062	0.588	0.071*	1.033	0.608	0.089*	1.109	0.583	0.057*
Age	-0.047	0.036	0.192	-0.056	0.037	0.131	-0.005	0.036	0.896
Marital status	1.873	0.574	0.001***	1.644	0.580	0.005**	1.547	0.572	0.007**
Education	-0.053	0.204	0.797	-0.042	0.209	0.841	0.196	0.209	0.349
HH_size	0.303	0.140	0.031*	.266	0.149	0.074*	0.292	0.140	0.037**
Farm_size	-0.116	0.133	0.383	-0.128	0.142	0.368	-0.037	0.130	0.778
Income_month	-0.199	0.075	0.008**	-.227	0.080	0.005***	-0.228	0.076	0.003***
Experience	-0.022	0.036	0.548	0.011	0.037	0.756	-0.102	0.039	0.008**
Membership	0.631	0.397	0.112	0.355	0.407	0.383	0.723	0.393	0.066*
Model fitting									
-2 Log Likelihood	883.790***								
Chi-Square	53.800								
Cox and Snell	0.131								
Nagelkerke	0.141								
McFadden	0.053								

Source: Field survey, (2024). **Note. *** = significant at 1% (P<0.01), ** = significant at 5% (P<0.05), * = significant at 10% (P<0.1)**

Cooperative societies provide information and acts that enable households to take advantage of diversification opportunities. Also, households with a higher number of years of cooperative membership will have better productive innovations that will assist in diversifying their economic activities and hence increase their per capita income as well as their livelihood. This finding agrees with the finding of Gebru *et al*. (2018), who discovered that coefficients of cooperative membership were found to have a positive relationship between on-farm and non-farm livelihood strategies and were statistically significant at p<0.01 and p<0.05 probability levels, respectively. If other factors remain constant, the odds ratio in favor of the smallholder farmers to choose on-farm + non-farm or combination of the three (on-farm + off-farm + non-farm) livelihood diversification strategies increases by a factor of 7.506 and 5.898, respectively, as membership in cooperatives increases by one year.

Households who are members of formal cooperatives gain benefits like sharing income and labor, access to credit, reduced individual transaction costs, and updated market information on farm produce, such as inputs and farm equipment. The result is in agreement with previous findings obtained by Khatun and Roy (2012).

Effects of Livelihood Sustainability Options on Smallholder Farmers Income in the Study Area

The result on Table 2 of the study depicts that the R^2 was estimated at 0.355, which implies that about 35.50% of the variation in the smallholder farmers' incomes was jointly explained by the explanatory variables included in the model, while the remaining 64.50% were unaccounted and this could be probably due to random errors or the independent variables were superfluous. The F value statistic was 16.981 and significant at the 1% level, which implies that the model is the best fit for the expression and indication of the overall significance of the regression.

The coefficient (0.280) of self-employed income was found to have a positive and significant effect on the total income of smallholder farmers in the flood-prone areas of Jigawa State at the 1% level (P<0.01), and this is in line with a prior expectation of the study. The possible explanation for this finding is that as the smallholder farmers engaged and diversified into personal self-employed income, it is likely that the total income of the smallholder farmers will increase as a result of the increase in livelihood sustainability options adopted by the smallholder farmers. The coefficient (0.147) of pension income was found to have a positive and significant effect on the total income of smallholder farmers in the study area at 10% (P<0.1). This implies that as smallholder farmers diversify their source of income to pension income; their total income is likely to increase.

The coefficient of non-farm wage income (0.476) was found to have a positive and significant effect on the total income of household farmers in the flood-prone areas of Jigawa State at the 1% level (P<0.01) of significance. This implies that an increase in smallholder farmer's livelihood sustainability options for non-farm wage income will raise their income. This result is in line with the findings of Gebreyesus, (2016), who reported in his study that the number of non-farm activities has a positive and significant influence on livelihood diversification at a level of less than 1% significance. The positive coefficient indicates that the level of livelihood diversification of households that have been engaged in a large number of non-farm activities increased by 0.32 percent. This means households involved in various non-farm activities have livelihood diversification opportunities. This finding concurs with that of Apata, (2010) in that households with an increased number of non/off-farm activities can make more money from non/off-farm sources.

The coefficient of business agricultural product income (0.110) was found to have a positive and significant effect on the total income of smallholder household farmers in the study area at the 5% level (P<0.05) of significance. This implies that as the smallholder farmers decide to increase their source of livelihood through the business of agricultural products, this will likely increase the total smallholder farmer's income in the study area. Other factors such as private employment, gifts, food crop income, livestock revenue, farm wage income, and farm machinery service rendering income were found to be negative but not significant at any level, whereas remittance and cash crop income were found to be positive but not significant at any level.

The results of these studies indicate that smallholder farmers' income will rise if they engage in more sustainable livelihood options. Justifying this result, Davis, Giuseppe, and Zezza (2017) inferred that incomes from non-agricultural enterprises and non-agricultural wage labor have accounted for 53% of the total household income of rural households in Africa. Similarly, Ogbanje, *et al*. (2015) corroborated that the majority of rural households receive income from off-farm sources and self-employment activities. Batool, (2017) stated that most diversified farm families diversify their income and livelihood mainly into off-farm, self-employment, etc. This suggests that the study area's increased livelihood diversification is crucial

to the income of rural farmers and has a big impact on the financial standing of their households.

Table 2: Effects of livelihood sustainability options on smallholder farmer's income in the study area

Variables	Std. error	Coefficient	t-value	p-value
(Constant)	2467.508	34987.588	14.179	0.000***
Self-employed income	0.026	0.280	6.263	0.000***
Private employed	0.709	-0.059	-1.411	0.159
Remittance	0.301	0.009	0.147	0.883
Gift	4.207	-0.007	-0.170	0.865
Pension	0.091	0.147	20.524	0.012*
Food crops income	0.002	-0.010	-0.225	0.822
Cash crop income	0.007	0.023	0.549	0.583
Livestock income	0.004	-0.007	-0.150	0.881
Non-farm wage income	0.083	0.476	11.226	0.000***
Farm wage income	0.401	-0.008	-0.191	0.849
Farm machinery service rendering income	1.225	-0.010	-0.230	0.818
Business of agricultural product income	0.077	0.110	2.608	0.009**
R^2	0.355			
R^2-adjusted	0.334			
F-value	16.981***			

Source: (Field Survey 2024) Note.* = significant at 1% (P<0.01), ** = significant at 5% (P<0.05), * = significant at 10% (P<0.1)**

CONCLUSION

In conclusion, this study has empirically assessed the factors influencing the choice of livelihood sustainability strategies among small-holder farmers in flood-prone areas of Jigawa State, Nigeria. The analysis of the influence of socio-economic variables on the choice of livelihood sustainability strategies engaged by the smallholder farmers in the study area showed that there existed socio-economic variables that had significant influence on the choice of livelihood sustainability strategies engaged by the smallholder farmers in the study area, which were sex, marital status, household size, income, experience, and membership in a cooperative society. Self-employed income, pension, non-farm wage income, and business of agricultural product income were the factors affecting livelihood sustainability options for smallholder farmer's income in the study area.

Based on the findings of this research, the following recommendations were made;-

(1) Government should recognize and support non-farm livelihood diversification strategies as part of the national job creation objectives instead of solely sticking to the inadequate and flood-prone farm income alone;

(2) Investing in quality education and increasing access to higher education will help the rural households' probability of participation in off-farm and non-farm livelihood diversification activities

(3) Expansion of rural–urban road has vital role to link and strengthen the socio-economic liaison and foster development between the rural and urban people.

(4) Government disaster management officials should view it as their duty to visit and consult with communities as part of a community participatory strategy in order to identify community resources that may be utilized for flood relief efforts. Along with training flood risk management measures to community members, this should begin early and, whenever possible, directly target susceptible homes by using "community dialect." This will increase the ability of the community to cope, thereby sustaining their livelihood.

(5) The government, non-governmental organization, as well as community stakeholders should improve rural infrastructures like good roads, rural electrification, potable water, telecommunication services, and an affordable healthcare system since they are important for enhancing economic activities and improving livelihoods.

Conflict of Interest

On the behalf of all authors, I the corresponding author do hereby state that there is no conflict of interest.

Authors' contributions

All authors contributed equally to this work.

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