Research Article

Assessment of Livelihood Sustainability Strategies among Small-Holder Farmers in Flood-Prone Areas of Jigawa State, Nigeria

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ABSTRACT

This study was carried out to assess the livelihood sustainability strategies among small-holder farmers in flood-prone areas of Jigawa State, Nigeria. Multi-stage sampling technique was used to select 383 smallholder farmers and a structured questionnaire (Kobotool box) was used to elicit information from the sampled population. The collected data were analyzed using descriptive statistics, and the priority index. The study revealed that the majority (89.30%) of the small-scale farmers were male (89.3%) and married (90.9%) within the mean age of 45 years, while the mean monthly income earned by the respondents was N46, 412.30. The study also reveals that the mean farming experience of the respondents was 18 years, with an average farm size of 2.42 ha, and 53.30% of them were members of cooperative societies. The study identified 23 diversified economic activities strategies adopted by the respondents in the study area as a source of livelihood. The study depicted that vulnerability (0.89), high investment costs (0.85), and inadequate capital to diversify (0.82) were the major factors militating against livelihood sustainability strategies among the small-scale farmers in the study area. The study concluded that most small-scale farmers in flood-prone areas of Jigawa State, Nigeria, maintained a well-diversified income portfolio with an average sustainable livelihood status. It was therefore 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: Income; Sustainability; Strategies; Flood; Livelihood**;** Climate

INTRODUCTION

Climate change is currently causing widespread worry due to its trans-boundary and complex harmful consequences. These have a greater impact on rural poverty and agricultural livelihoods (Food and Agricultural organization, United Nations International Children Emergency Funds, World Food Program and World Health Organization (FAO, UNICEF, WFP, and WHO), 2018). Shifts in cropping seasons and a decrease in agricultural output are also two of the negative effects of climate change on farm-based livelihoods (Inter-governmental Panel on Climate Change [IPCC], 2014; Qaisrani *et al.*, 2018). Agriculture is the primary occupation and source of income for more than 70% of the country's population (Federal Ministry of Environment (FME), 2014; Onah *et al.* 2016; Shiru *et al.* 2018; Onwutuebe, 2019). The majority of

Nigeria's agricultural produce is rain-fed. As a result, farmers find it difficult to organize their activities due to the unpredictable nature of rainfall (Building Nigeria's Response to Climate Change (BNRCC), 2011; Anabaraonye *et al.* 2019). Flood is a natural disaster caused by too much rain or water in a location, and could be caused by prolonged rainfall from a storm, rapid melting of large amounts of snow or ice, or the bursting of dams or levees. Generally, flooding is an overflowing or eruption of a great body of water over land not usually submerged (Daniel and Udo, 2019).

Disasters such as flooding, hamper sustainable development food security and growth. The losses from natural disasters like flood are increasing and have a disproportionate impact on less developed countries. They devastate the standard of living and overall development prospects (Ikani, 2016). According to the Jigawa State Emergency and Management Agency (SEMA), there has been flooding in Jigawa State. The devastating flood has destroyed thousands of homes and farmlands, and the state's death toll has increased to twenty. Every year, floods devastate the lives of people residing in seventeen out of the twenty seven local government districts in the state. A significant downpour on September 5, 2020, resulted in the destruction of a large number of crops, including rice, millet, guinea corn, and maize, in most of the State's local government areas (LGAs). An annual flood has also destroyed 50,000 structures (Vanguard News Nigeria, 2020).

The terms 'livelihoods' have been defined by many social scientists and economists worldwide. In the very onset, Chambers and Conway (1992) defines livelihood as comprising the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is said to be sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term'. However, 'Livelihood strategy is an activity undertaken by smallholder households to provide a means of living. A key goal of livelihood strategies is to ensure household economic and social security' (Prasad, *et al.*, 2014). The additional livelihood activities contribute to income and enable people to cope with different livelihood shocks, trends, and seasonal changes associated with agricultural production (Liu, *et al.*, 2020). Nigeria is no exception, as most of the households in its rural areas are involved in agricultural activities, making diversification of rural livelihood systems desirable. As such, rural households across

Nigeria, specifically Jigawa state where they suffered from annual flooding participated in one activity or the other in order to earn and sustained their livelihood.

As a result, households with many sources of income are thought to have more income variety. As a result, increasing the number of income sources accessible to households over time leads to greater diversification. Due to the recurring floods that occur every year, Jigawa State smallholder farmers face problems accessing and implementing sustainable livelihood strategies that can mitigate the impact of floods on their agricultural activities and overall livelihood. Floods in the study area expose small-scale household farmers to various risks, such as crop damage, livestock destruction, and property destruction. These risks make it difficult for farmers to sustain their livelihoods and improve their socio-economic conditions. Smallholder farmers often lack knowledge about effective strategies and techniques to adapt to flood-prone environments. This lack of awareness hinders their ability to adopt sustainable livelihood strategies that can enhance their resilience and minimize the negative effects of flooding. Despite the fact that flooding has been a recurring concern in this area, there appears to be paucity of empirical data on livelihood sustainability strategies among small-holder farmers in the impacted communities. This necessitated the study to be conducted to assess the livelihood sustainability strategies among small-holder farmers in 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 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

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(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.
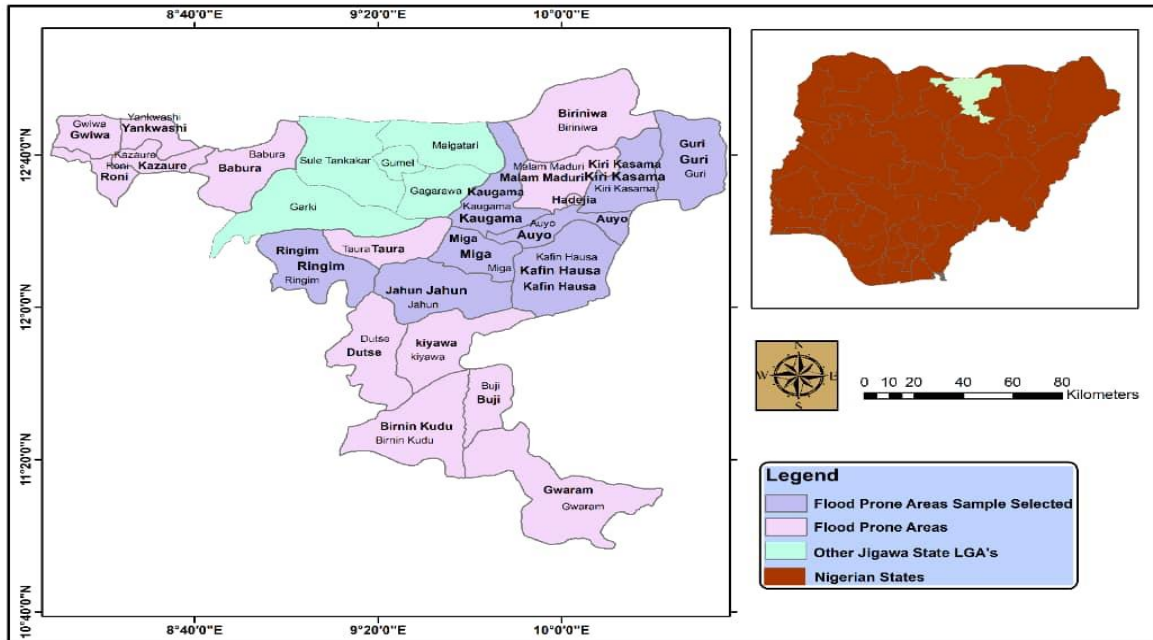

Figure 1. Sampling Procedure and Sample Size

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;

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

Where

h = number of years for which development program is implemented

i = stratum number,

i = 1, 2, 3, ……………………h

N_i = numbers of beneficiaries in the iᵗʰ 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).

Model Specification

Descriptive Statistics

These are concerned with scientific methods for summarizing presenting and analyzing data as well as drawing valid conclusions and making reasonable decisions on the basis of such analysis. This is done with the aid of mean, percentage, frequency distribution etc. Mean; this is the sum values in the data group divided by the number of values it is the most useful and fundamental measure of location:

$$\bar{X} = \frac{Efx}{Ef} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.2$$

Percentage; this is proportion obtained by dividing the number of observations in each class by the total number of observations multiplied by a hundred:

$$percentage \frac{actual\ change}{original\ amount} X100 \dots\dots\dots\dots\dots\dots\dots\dots$$
..3

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Frequency Distribution; this is an organized display of data set which falls into each mutually exclusive class. Therefore for easy comprehension of findings of this research and its contribution to knowledge it was grouped field data in the form of frequency distribution tables, bar charts, pie charts and percentage tables.

Priority index (P.I)

Priority index (P.I) was used to rank the constraints to adopting diversified activities in the study area. The number of diversified activities adopted profoundly by household will be highly influenced by the socio-economic and environmental factors. A set of constraints will be identified and ranked using the P.I given the following Equation (Karmokar *et al.,* 2015; Roy and Basu, 2020):

$$P.I = \sum S_i F_i / n (0 \leq P.I. \leq 1 ....(4)$$

Here, S_i is the scale value of ith priority, f_i is the frequency of ith priority and n is the total number of observations. A five-point scale was constructed the index very insignificant, insignificant, indifferent, significant, very significant, where the scale values range from 1 to 0 with the priority of 1–5, respectively.

RESULT AND DISCUSSION

The result of socioeconomic distribution of the respondents presented in Table 1 shows that the mean age of the smallholder farmers was 45 years, with a minimum age of 20 and a maximum age of 70 years, with a standard deviation of 10.62212. This finding indicates that the small-holder farmers in the study area were of active and productive age and hence could participate in many income-yielding ventures in order to maintain their families as well as improve their livelihood. The finding of this study is similar to the finding of Mamman *et al.* (2014).

The result of dependency ratio shows that 99.48% of the household smallholder farmers have above 60 years of family dependents, and those that have less than 18 years of dependents were 98.43%, while those aged 18–60 have a percentage of 51.44% of dependents. This inferred that the majority of the smallholder farmers in the study area have large family dependents, and this will make it difficult for them to cater to all the needs of their dependents without the necessary support from other source; hence, family burden will motivate them to establish livelihood strategies, which will improve their livelihoods. The mean farming experience of the Respondents was 18 years; the minimum was 1 year and the maximum

was 50 years, with a standard deviation of 10.90397. The implication of these findings for agricultural production is that small-holder farmers have the opportunity to use their experience to solve practical problems in farming activities as well as improve efficiency in resource use. This suggests that the smallholder farmers had a considerable amount of farming expertise. This implies that the farmers might decide firmly whether to engage in any form of income generation activity or not in order to better their standard of living.

The results of farm size of the respondents in Table 2 indicated that the minimum farm size owned by the farmers in the study area was 0.3 hectares, while the maximum was 5 hectares, and the mean farm size was 2.42 hectares with a standard deviation of 1.41793. This implies that most of the farmers were small-scale farmers with small land that could be used for agricultural activities. This finding is similar to the findings of Offar and Adewuyi (2022), in their study who reported that the less than half of the respondents cultivated 2 to 3 hectares of farm land. Farm size influence households' decisions to participate or not in different livelihood expansion activities. The result of monthly income earned by the respondents in the study area indicates that the mean monthly income was N46, 412.53, with a minimum of N3000 and a maximum of N300, 000, with a standard deviation of 43464.33875. This implies that majority of the small-holder farmers earned a relatively low monthly income, and this might be due to the fact that most of the small-holder farmers were located in flood-prone areas, where the major economic activities of farming and trading are not as prevalent as in the non-flood-prone areas.

The result of gender of the respondents in Table 3 discloses that the majority (89.30%) of the small-holder farmers in the study area were male, while the remaining 10.70% of the small-holder farmers were female. The finding of this study is in line to the findings of Offar and Adewuyi (2022), who reported in their study that majority of the respondents were males. This indicates that more men engage in agricultural production than women, possibly due to its economic and commercial value as well as the labor-intensive nature of the enterprise, and this finding might not be unconnected to the socio-cultural set-up of the people in the area where men were the bread-winners of households while women took care of children's upbringing and other household activities.

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Table 1: Quantitative Socio-economic Characteristic of Small-holder Farmers (n = 383)

Variables	Frequency	Percent	Min.	Max.	$\overline{X} \mp SD$
Age					
20-30	42	10.97	20	70	45±10.6
31-40	112	29.24			
41-50	124	32.38			
51-60	87	22.72			
61-70	18	4.69			
Mean	44.6527				
Household size					
1-10	149	38.90			
11-20	172	44.91			
21-30	47	12.27			
31-40	13	3.39			
41-50	2	0.52			
Mean	13.7389		1	46	14±7.47
Dependency ratio					
<18 years	377	98.43			
18-60	197	51.44			
>60 years	381	99.48			
Farming exp.					
1-10	140	36.55	1	50	18.14±10.90
11-20	121	31.59			
21-30	83	21.67			
31-40	35	9.14			
41-50	4	1.04			
Total	383	100.00			

Source: Field Survey Data (2024)

Table 2: Quantitative Socioeconomic Characteristics of Small-holder farmers (n = 383)

Variables	Freq.	Perc.	Min.	Max.	$\overline{X} \mp SD$
Farm size					
0.1-1	101	26.37	0.30	5.0	2.42±1.41
1.1-2	119	30.07			
2.1-3	68	17.75			
3.1-4	43	11.23			
4.1-5	52	13.58			
Monthly income					
1000-60000	309	80.68	3000	300000	46,412.3±43464.33875
61000-120000	57	14.88			
121000-180000	8	2.09			
181000-240000	5	1.31			
241000-300000	4	1.04			
Total	383	100.00			

Source: Field Survey Data (2024)

The result on the Table 3 also depicts that the majority (90.90%) of the small-holder farmers in the study area were married, and 5.00% of the smallholder farmers were single, while 2.30% were divorced, and only 1.80% were widowed. The possible explanation for this finding is that having the majority of married small-holder farmers in the study area will not be a surprise in the typical Hausa-Fulani community; this is because marriage is considered a symbol of maturity, and respect and responsibility are evident in the study area. It is believed that respondents who are married may put more into the farm business so as to sustain their domestic household demand and save little in anticipation of an increase in the total number of households (Muhammad, 2003).

The result of household status shows that majority (90.90%) of the small-holder farmers in the study area were household heads, while 9.10% of the small-holder farmers were not household heads. This implies that the majority of the smallholder farmers in the study area were household heads.

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The finding of this study is similar to the finding of Ahmed *et al*. (2018) in their study who discovered that majority of the respondents were male household head.

The result of educational status of the respondents depicts that 41.80% of the small-holder farmers in the study area have acquired non-formal education, while 20.10% of the smallholder farmers have attended secondary school, and also 19.80% of the smallholder farmers have attended a tertiary institutions, and 18.30% have attended only primary school. This implies that majority of small-holder farmers have had one form education, or the other. This implies that the educational level of the small-holder farmers in the study area is very low since the majority could not attain tertiary education. This finding is similar to the finding of Mamman *et al*. (2014) in their study where they reported that 51% of the respondents had no formal education. The result of primary occupation depicts that majority (98.20%) of small-holder farmers in the study area were crop farmers, while only 1.80% of the small-holder farmers in the study area raised livestock. This indicated that the majority of the small-holder farmers in the study area were crop producers. The high proportions of respondents in the study area who engaged in crop farming were not unexpected because the study area is well known as an agricultural center not only in Nigeria but also among many African countries. This shows that crop production is carried out by different categories of people, irrespective of sex, level of educational attainment, or vocation. This finding is similar to the finding of Abdulazeez *et al*. (2023) in their study who reported that majority of the respondents were full farmers in the study area. The distribution of respondents based on cooperative membership in Table 4 depicts that most (53.30%) of the small-holder farmers in the study area were not-members of any cooperative society, while 46.70% of the smallholder farmers were members of a cooperative society in the study area. This implies that more than half of the small-holder farmers in the study area were not members of any cooperative society in the study area. This result is inconsistent with the finding of Adebola *et al*. (2018), in their studies who reported that most of the smallholder farmers in the study area were members of a cooperative society in the study area. The implication of this finding is that only a few farmers would have access to credit facilities, information on modern technology, and other assistance since leading agencies such as NGO, governmental organizations, and agencies prefer to give assistance to farmers in groups, either cooperative societies or associations, rather than individually. The result of access to credit disclose that most (51.70%) of the small-holder farmers in Jigawa State have access to credit facilities, while 48.30% have no access to credit facilities. This implies that most of the small-holder farmers have access to credit facilities in the study area. This is similar to the finding of Adebola *et al*. (2018), in their studies in which they reported that most of the smallholder household have access to credit facilities, while few have no access to credit facilities in the study area. Sources of credits of the respondents indicates that most (65.15%) of the small-holder farmers in the study area sources their credit through informal sources, while some (34.85%) of the small-holder farmers' source their credit through formal sources. This implies that most of the small-holder farmers in the study area have informal sources of credit. This agrees with the findings of Ajah *et al.* (2017), who observed that most (57.67%) of the total rice farmers who have accessed credit facilities patronized money lenders (informal sources). The possible reason could be due to the fact that it was easily found and accessed in rural areas, as well as the non-availability and cumbersome nature of formal loan procedures.

The result on Table 4 shows that most (52.00%) of the small-holder farmers in the study area have extension contact, while some (48.00%) of the small-holder farmers do not have contact with extension service. The implication of this finding for small-holder farmers in the study area is that information related to new farming techniques, access to credit, marketing systems, etc. can be easily accessed by the small-holder farmers in the study area. The frequency of extension contact of agents in the study depicted that 46.23% of the small-holder farmers had contact with an extension agent on a quarterly basis, and also 26.63% had contact with extension agents on a monthly basis, while 20.60% had annual contact with extension agents, and 3.52% had contact with extension agents once a week, and only 3.01% had daily contact with extension agents. This implies that extension service deliveries were quite low in the study area, and this will not improve access to new farming innovations for small-holder farmers, thereby decreasing their farm productivity and, hence, decrease their livelihood. Aphunu and Agwu (2013) affirmed that farmers, whether small, medium, or large-scale, need information on production-recommended technologies for farm management, acquisition, allocation, and utilization of farm resources.

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Table 3: Qualitative Socio-economics Characteristics of Small-holder Farmers (n = 383)

Variables	Frequency	Percent
Gender		
Female	41	10.7
Male	342	89.3
Marital Status		
Divorce	9	2.3
Married	348	90.9
Single	19	5.0
Widowed	7	1.8
Household Head		
Non-Household Head	35	9.1
Household Head	348	90.9
Educational status		
Non-formal	160	41.8
Primary	70	18.3
Secondary	77	20.1
Tertiary	76	19.8
Primary occupation		
Crop production	376	98.2
Livestock production	7	1.8
Total	**383**	**100.0**

Source: Field Survey Data (2024)

Table 4: Distribution of Respondents According to Qualitative Socioeconomic Characteristics (n = 383)

Variables	Frequency	Percent
Cooperative membership		
Non cooperative member	204	53.3
Cooperative member	179	46.7
Access to credit facilities		
Have access	198	51.7
No access	185	48.3
Source of credits		
Formal	69	34.85
Informal	129	65.15
Extension contact		
Have contact	199	52.0
No contact	184	48.0
Frequency of the extension contact		
Daily	6	3.01
Weekly	7	3.52
Monthly	53	26.63
Quarterly	92	46.23
Yearly	41	20.60
Total	199	100.00

Source: Field Survey Data (2024)

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Types of Livelihood Sustainability Strategies Activities Practiced by the Smallholder Farmers in the Study Area

The choice to engage in an alternative livelihood activity for most of the smallholder farmers in Jigawa State is influenced by current flood trends, as more than half (69.20%) of respondents have resorted to alternative livelihood activities due to the loss of farm crops, building structures, agricultural land, animals, and household properties, as well as crop failure and low yield. Table 5 of the study presents the diversified economic activities adopted by households to secure their income flow. A total of 23 diversified economic activities have been identified in the study area. Since agriculture is associated with risk and uncertainty, farming households rely on both agricultural and non-agricultural activities to secure their livelihoods (Asmah, 2011; Martin and Lorenzen, 2016).

It is seen from the Table that many smallholder farmers in the study area are into petty trading, representing 36.60% of the respondents. Its predominance was because it requires relatively less capital to commence and is easy to manage. 19.62% of the respondents were into fishing; this is similar to Roy and Basu (2020), who reported that in coastal communities, fish cultivation is very common as a source of income. They mostly depend on fishing for their livelihood. The estimated result shows that 68 percent of households in the study area are engaged in commercial fish production. The adoption of fishing is one of the important occupations in coastal areas reported in many research works (Martin *et al.*, 2013; Olale and Henson, 2013). About 13.97% were civil servants, 10.19% were tailors, 7.92% were into the food retail business, 7.55% were into the manual business, 6.79% were agro-processors, and 5.28% were into technical services (mechanics, electricians, etc.) and pensioners, respectively. This finding clearly depicts the growing contribution of non-farm sectors to the income basket of rural households in the study area. This finding is an indication that the majority of households in flood-prone areas of Jigawa State, Nigeria, maintain a well-diversified income portfolio. Like previous studies, this study reveals that diversification of livelihoods has become a common strategy for coping with economic and environmental shocks (flood) and instrumental in poverty reduction and rural sustainability (Rahut and Scharf, 2012; Gautam and Andersen, 2017; Radicic *et al.,* 2017).

Table 5: Types of Livelihood Sustainability Strategies Activities Practiced by the smallholder Farmers in the Study Area

Strategies	Frequency	Percentage
Petty trading	97	36.60
Food retail business	21	7.92
Technical Services (mechanics, electricians etc.)	14	5.28
Hair saloon/barbing	7	2.64
Tailoring	27	10.19
Manual work	20	7.55
Civil servant	37	13.97
Pensioners	14	5.28
Artisans	7	2.64
Agro-processing	18	6.79
Laundry	2	0.75
Operation of grinding machine	1	0.38
POS/phone selling	6	2.26
Fishing	52	19.62
Commission agent	2	0.75
Butcher	2	0.75
Computer centre	1	0.38
Driving	6	2.26
Okada	12	4.53
Black market petroleum seller	1	0.38
Property and estate agent	2	0.75
Iron Scrape seller	4	1.51
Traditional healers and medicine	6	2.26

Source: Field survey data (2024)

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Constraints Militating against Livelihood Sustainability Strategies among the Small Scale Farmers in the Study Area

Priority index (P.I.) Estimated data analysis shows that the occurrence of frequent disasters (vulnerability) ranks first as the barrier to household diversification level (P.I. = 0.89). This is in line with the finding of Roy and Basu (2020) in their study, where they found that the occurrence of frequent disasters ranks first as the barrier to household diversification level (P.I. = 0.85) in the study area. Since the study area is highly prone to natural calamities (flooding), the frequency and intensity of natural disasters have a strong influence on livelihood diversification activities (Cinner and Bodin, 2010). High costs of investment were ranked 2nd (P.I. = 0.85). Inadequate capital to diversify was ranked 3rd (P.I. = 0.82); this is in line with the findings of Roy and Basu, (2020) in their

study, where they found that money for new ventures ranks seventh as the barrier to household diversification level (P.I. = 0.46) in the study area. Inadequate support from the government was ranked 4th (P.I. = 0.77). Inadequate infrastructural facilities were ranked 5th (P.I. = 0.72). Lack of access to formal loans was ranked 6th (P.I. = 0.71). Unstable electricity was ranked 7th (P.I. = 0.69). Poor access to markets was ranked 8th (P.I. = 0.65). Lack of vocational skills was ranked 9th (P.I. = 0.64). Lack of awareness of different businesses was ranked 10th (P.I. = 0.63) as analyzed by P.I. The respondents have emphasized the risk of a new job as the second most important constraint. The findings are consistent with the findings of other research as well. Dinku, (2018) argued that the adoption of diversified economic activities is constrained by a lack of basic infrastructural facilities and natural disasters such as cyclones, droughts, floods, etc.

Table 6: Constraints Militating against Livelihood Sustainability Strategies among the Small Scale Farmers in the Study Area

Indicators	1=1	2=0.75	3=0.50	4=0.25	5=0	Σf_i	PI	Rank
Lack of proper guidance on diversification	15	175	102	70	21	383	0.56	11th
Unavailable skilled labour supply	15	163	105	50	50	383	0.53	12th
Inadequate of capital to diversify	166	167	38	9	3	383	0.82	**3rd**
Lack of awareness of different business	29	194	112	37	11	383	0.63	10th
Lack of access to formal loan	43	260	60	15	5	383	0.71	6th
High cost of business premises	11	49	143	121	59	383	0.39	15th
Unstable electricity	72	188	99	19	5	383	0.69	7th
Poor access to market	36	227	77	24	19	383	0.65	8th
Low market of agricultural related and non-related activities	19	142	113	47	62	383	0.51	13th
Illiteracy level of household farmers	15	120	158	72	18	383	0.53	12th
Inadequate of time to diversify	29	76	143	120	15	383	0.49	14th
Inadequate of support from government	75	276	20	4	8	383	0.77	**4th**
Lack of vocational skills	47	218	51	33	34	383	0.64	9th
High investment cost	193	162	19	2	7	383	0.85	**2nd**
Inadequate of infrastructural facilities	71	227	68	9	8	383	0.72	**5th**
Insecurity	3	57	89	104	130	383	0.30	16th
Vulnerability (flood, drought, erosion)	242	122	16	0	3	383	0.89	**1st**

Source: field survey data (2024) 1= very significant, 2=significant, 3=indifferent, 4=insignificant, very insignificant

CONCLUSION

In conclusion, this study has empirically assessed the livelihood sustainability strategies among small-holder farmers in flood-prone areas of Jigawa State, Nigeria. On the basis of the findings of this study, it was generally observed that a total of 23 diversified economic activities have been identified in the study area. The study concluded that the major

constraints militating against livelihood sustainability strategies among the small scale farmers in the study area were vulnerability (flood, drought, and erosion), high investment costs, and insufficient capital to diversify.

Based on the findings of this research, the following recommendations were made;- It is imperative to provide education to small-scale farmers in flood-prone areas regarding the importance of investing

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in alternative livelihoods. In order for the locals to invest in various businesses and so have sustainable livelihoods, stakeholders must also provide grants and soft loans to them; Enhancing access to current climate change information and acknowledging farmers' lifelong experience with adaptation measures would be crucial to the ongoing government efforts on climate change adaptation and flood management. The study recommends that concerned development stakeholders provide capacity-building training in climate change to raise smallholder farmers' awareness of adaptation choices to climate change and its measures. Farmers' access to worth schooling will enhance rural households' perceptions of climate change and enable them to use environmentally friendly best adaptation practices to climate change and to further scale up in other parts of the nation.

Therefore, it is advised that the Jigawa state legislature increase the scope of its partnerships with non-governmental organizations and other commercial organizations in order to give capital, training, and skill development to support local alternative livelihood initiatives and open doors to increase the range of livelihood possibilities.

It recommends that farmers be encouraged to join existing cooperative societies and that new cooperative societies be formed in order to boost the number of small and medium-sized businesses. This will guarantee that farmers combine their resources to realize economies of scale for enterprises operating on a large scale. It should be a goal to provide rural households with access to profitable non-farm opportunities. This involves the construction of roads, marketplaces, electricity, telephone, storage facilities, and other rural infrastructure, as well as institutional improvements aimed at lowering obstacles to entry and improving the lot of underprivileged livelihood groups. Good roads could facilitate farmers' access to markets and, as a result, encourage their diversification into non-farm pursuits.

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

Authors' contributions
All authors contributed equally to this work.

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