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Arable farmers' livelihood options as a means of climate variability adaptation strategies in Ondo State, Nigeria

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Abstract

The study was designed to assess arable farmers' livelihood options as a means of climate variability adaptation strategies in Ondo State, Nigeria. Specifically, the objective described the socioeconomic characteristics of arable farmers in Ondo State; examined other livelihood options engaged by the arable farmers in combating effects of climate variability on their farm income; determined the contribution of alternative livelihood options to total income and identified factors that influence the choice of alternative livelihood options. Multi-stage sampling technique was employed in the study area to collect data through in-depth interview from one hundred and sixty (160) arable farmers in four (4) designated agricultural zones in Ondo State. Moreover, the primary data collected were analyzed using descriptive statistics and multinomial logistic regression. Apart from the fact that the findings revealed that majority of the respondents (78.75%) were male, it was also observed that the predominant age of the respondents was between 41 and 50 years (34.38%), with an average age of 45 years. The study also revealed that 21.3% of respondents selected off-farming as their option for a livelihood, while 32.5% of respondents engaged in non-farming activities as source of income. The study also revealed that the respondents' participation in non-farming and off-farming activities contributed about 40% of the total income they took in, making this choice the one that had the greatest impact on overall income. Multinomial logistic regression result revealed that respondents who chose farming as a livelihood option shows that age and primary education significantly influence the choice of choosing farming at 5% level of significance. Marital status, secondary education and, farm experience significantly influence the choice of choosing farming at 10% level of significance, while distance from of home to market significantly influence the choice of choosing farming at 1% level of significance. Also, respondents who chose off-farming as a livelihood option shows that age and farming experience significantly influence the choice of choosing off-farming at 10% level of significance, while respondents who chose non & off-farming livelihood option shows that age significantly influence the choice of choosing non & off-farming at 5% level of significance and farming experience significantly influence the choice of choosing non and off-farming at 1% level of significance: using non-farming as a base category.

Keywords: Livelihood options; Adaptation strategies; Climate variability; Arable farmers

1. Introduction

The idea of climate change has evolved into a scientific fact. Climate change has had a significant impact on agricultural productivity (crop yield and quality) and everyday life [14]. One of the biggest risks to sustainable development is climate change, which is quickly becoming a key global development issue that affects many global industries [16]. Globally, enormous growth in greenhouse gas emissions has increased the effects of climate change. Since agricultural

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operations rank third in terms of increasing greenhouse emissions, behind the use of energy and the manufacturing of chlorofluorocarbons, it has been established that they significantly contribute to climate change [4]. In fact, it is estimated that land use changes, which are frequently done for agricultural purposes, account for another 8% to 15% of the total human greenhouse gas emissions that are now occurring [12]. The effects of human-caused greenhouse gas accumulation in the atmosphere, such as changes in mean temperature, seasonal shifts, and an intensification of extreme weather events, are currently visible and will continue to get worse in the future [4].

The sustainable growth and development of Africa, and particularly Nigeria, is seriously threatened by climate change [17]. A significant issue is the mounting evidence that climate change will harm Nigerian agriculture [10]. This issue includes potential effects on environmental services, agricultural output, and livelihood (way of life) options. An activity or group of activities that a household engages in to make a living [7] and which may be related to agriculture, non-agricultural, or both can be referred to as livelihood options. Household activity decisions are influenced by a variety of factors, both economic and non-economic. When determining which activities households engage in, assets, skills, incomes, and general endowments are just as significant as social class and taste, opportunities, family networks, ethnicity, institutional and political regimes governing access to opportunities, social capital, and household perceptions of risk [2, 3, 15, 18].

Climate change is expected to have a higher impact on livelihoods in Africa than in other regions of the world [5, 9]. Some of the livelihood options available to farmers in Africa include seasonal migration of livestock keepers and distribution of livestock herds in different locations; rainwater harvesting; casual labor to meet food and other household needs; livestock sales; and participation in small businesses such as shops, local restaurants, and kiosks [1, 11]. An individual's vulnerability is determined by his or her asset base, as well as the pattern and usage of these assets. With inadequate livelihood assets, disadvantaged individuals and groups may respond in an unsustainable or even maladaptive manner. Inadequate institutional policies and processes have the potential to aggravate shocks and pressures at the local level. This limits livelihood methods and, as a result, livelihood outcomes. Farming and other non-farm revenue producing activities are essential for survival. To sell their labour, most farmers generally relocate to more dynamic and economically fruitful places. According to Nassef et al. 2009 [6], many pastoralists migrate to urban areas in quest of alternate livelihoods.

The study's primary goal is to evaluate the livelihood possibilities for arable farmers in Ondo State, Nigeria, as a form of climate adaptation and the specific goals are to examine the socioeconomic traits of Ondo State's agricultural producers and analyze additional means of subsistence used by arable farmers to counteract the impact of climate variability on their farm income. Moreover, the slow rate of poverty reduction among rural food arable farmers indicates the urgent need for Ondo State's climate adaptation strategy to effectively target the rural areas where the poor dwells and the activities on which their survival depends. As a result, this study evaluates the potential of a few alternative livelihoods as a way to improve rural livelihood options in Ondo State, giving policy makers enough information or a foundation on which to design more pro-poor policies that will have greater effects on these livelihood activities as complementary options aimed at helping the rural poor escape poverty and as a means of climate adaptation strategy in Ondo State, Nigeria.

2. Material and methods

The study was carried out in Ondo State, Nigeria. The state is bounded on the west by Osun and Ogun States, on the north by Ekiti and Kogi States, on the east by Edo and Delta States, and on the south by the Atlantic Ocean. It is located between latitude 5°45 and 8°15N and longitude 4°30 and 6°5E. According to the 2006 population census [8], the State has 18 Local Government Areas (LGAs) which are located within the mangrove rainforest; has a land area of 14,788.723 square kilometers and a population of 3,460,877 people. The climate is tropical, with two distinct seasons: the rainy season (April to October) and the dry season (November to March).

Throughout the year, the temperature ranges from 21 °C to 29 °C, and humidity is relatively high. The yearly rainfall ranges from 2000mm in the south and 1150mm in the north of the State. Rainfall amounts and distribution decrease from the coast to the inland. The LGAs grow a variety of cash crops, such as cocoa, coffee, oil palm, raffia palm, rubber, and cashews, in addition to yam, maize, cassava, rice, tomatoes, fruits, and vegetables.

To accomplish the study's goals, responses to a pre-tested and validated structured questionnaire were utilized to collect primary data, which was then used to create a qualitative data set. The instrument used to collect the data concentrated on socioeconomic factors, alternative means of subsistence used to offset the impact of climate variability on their farm income, the contribution of alternative means of subsistence to total income, and factors that affect the choice of alternative means of subsistence.

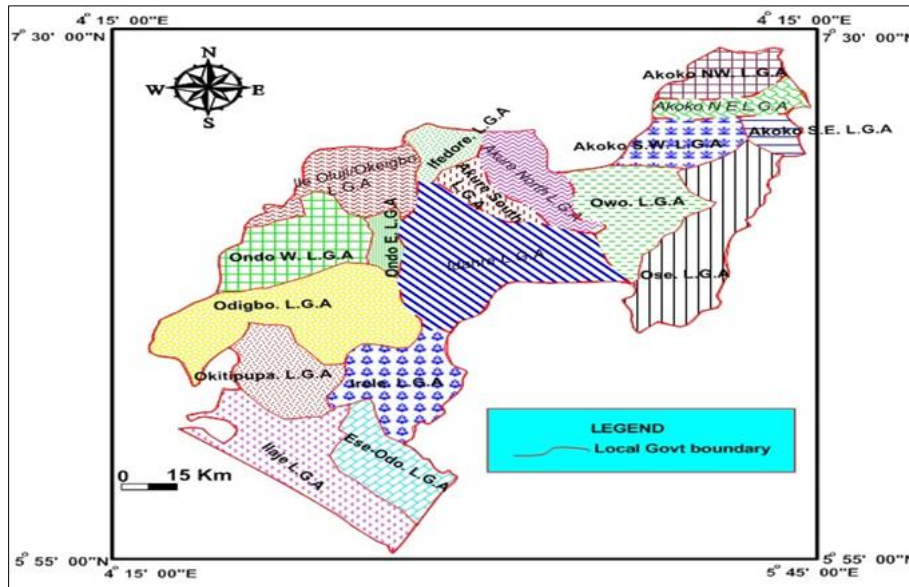


Figure 1 Map of Ondo State Showing Local Government Areas

The technique of multi-stage sampling was used to choose the respondents (food crop farmers). The Agricultural Development Program (ADP) separated Ondo State into four (4) agricultural zones for administrative purposes. Second, the state's four (4) agricultural zones were chosen. Third, a total of four (4) extension blocks were chosen at random, one (1) from each agricultural zone. It means that four local governments (LGAs) in Ondo State, Nigeria, were randomly chosen, together with four farming villages or communities from each LGA's extension blocks, for a total of sixteen (16) villages or communities.

To make a sample size of one hundred and sixty (160) arable farmers, 40 from each local government area were selected for the in-depth interview. Ten (10) respondents per community/farming village were then randomly chosen from the sixteen (16) villages/communities that had been chosen.

The data were analyzed using descriptive statistics to certify the socioeconomic characteristics of the respondents and a multinomial logistic regression model to analyze the factors that affect the choice of alternative means of subsistence.

2.1. Model Specification

The Multinomial Logistic Regression Model was used to examine the factors that influence the choice of livelihood options in the area of study. When the dependent variable has more than two outcomes, this model is applied. If 'Yi' is a polychotomous variable (random), it means 'Yi' has values of 0, 1, and 2, where 0 symbolizes farmers who only employ off-farming; 1 indicates non-farming livelihood options, and 2 depicts both non-farming and off-farming livelihood options.

Where;

$$Pr(Y_i = j) = \frac{\exp(\beta_j X_i)}{1 + \sum_{j=1}^k \exp(\beta_j X_i)}$$

We deploy this model to indicate the likelihood of arable farmers' livelihood options as a means of climate variability adaptation techniques in a certain category based on the livelihood alternatives they engage in countering the effects of climate change. We assume in the multinomial logit model that the log-odds of each response follow a linear model.

Where:

$$\text{Logit } P(Y_{ij}) = \log \frac{\exp(\beta_j X_i)}{1 + \sum_{j=1}^k \exp(\beta_j X_i)} = \alpha_j + \sum \beta_j X_i$$

Where Y_i = if success (i.e. respondent uses any of the livelihood options which falls under Off-farming, Non-farming and, Non & Off-farming)

X_i = Independent variable / Response variable

β = Logistics coefficient of independent Variable

α = Constant Term

The independent variables specified as determinants of choice of livelihood options to climate changes are:

X_1 = Age (in years)

X_2 = Gender of Household Size (male = 1, female = 2)

X_3 = Martial Status (married = 1, otherwise = 0)

X_4 = Educational status (in years)

X_5 = Size of Household (in number)

X_6 = Farmers experience (in years)

X_7 = Distance of Farm to Market (in km/h)

X_8 = Distance of Home to Farm (in km/h)

X_9 = Distance of Home to Market (in km/h)

X_{10} = Access to Credit (yes = 1, no = 0)

X_{11} = Access to Extension Services (yes = 1, no = 0)

X_{12} = Dependency Ratio

3. Results and discussion

3.1. Socioeconomic Characteristics of the Respondents

Table 1 Socioeconomic Characteristics of the Respondents

Characteristics	Frequency	Percentage (%)
Age		
≤ 40	31	19.37
41 – 50	55	34.38
51 – 60	30	18.75
61 – 70	38	23.75
> 70	6	3.75
Gender		
Male	126	78.75
Female	34	21.25
Marital Status		
Married	125	78.12
Single	10	6.25
Separated	3	1.88
Widowed	22	13.75
Educational Status		
No Formal Education	17	10.63
Primary Education	19	11.87
Secondary Education	70	43.75
Tertiary	54	33.75
Farm Size (Hectares)		
< 2.0	41	25.63
2.0 – 4.0	91	56.87
> 4.0	28	17.50

Source: Field Survey, 2021.

According to Table 1, respondents who were between the ages of 41 and 50 made up the largest percentage of the sample (34.38%), with a mean age of almost 45 years. The implication is that the arable farmers in Ondo State were relatively young, active, and involved in the economic activities; and this supports the findings of Arifalo and Ilesanmi (2022) [13], who discovered that the typical farmers of the same age range were leading in the adoption of sustainable soil management practices in Oyo State. Also, the majority of the respondents (about 80%) were male and 78.12% of the respondents were married. The implication is that the respondents had to support their households through a variety of economic endeavours because they were married. For them, it was essential to engage in sustainable livelihood activities and this corroborate the findings of Abiodun et al. (2019) [1]. According to the distribution of respondents based on their level of education, 10.63% of respondents had no formal education, while 43.75% had completed secondary school education. The evidence suggested that the research area's respondents were literate. However, farmers often had low levels of education, which may limit their capacity to diversify their sources of income into the service and retail sectors. The distribution of respondents by the size of their farms shows that 56.87% of respondents have farms that range in size from 2.0 to 4.0 hectares and according to the analysis, 17.5% of the respondents cultivated land of more than 4.0 hectares.

Table 2 Distribution of Respondents Based on Livelihood options Engaged in to Combat Effect of Climate Variability on Their Farm Income

Livelihood options	Frequency	Percentage (%)
Farming	25	15.6
Non-farming	52	32.5
Off-farming	34	21.3
Non & Off-farming	49	30.6
Total	160	100.0

Source: field data, 2021

Table 3 Distribution of Respondents by the Contribution of Alternative Livelihood Options to Total Income

Livelihood options	Frequency	Percentage	Total income	Livelihood options			Percentage (%)
				Non-farm income	Off-farm income	Non & Off-farm income	
Farming	25	15.6	9,530,000	0	0	0	
Non-farming	52	32.5	9,262,000	1,357,000	0	0	14.7
Off-farming	34	21.3	19,680,500	0	5,742,500	0	29.2
Non & Off-farming	49	30.6	14,512,000	0	0	5,773,000	39.8
Total	160	100.0	52,984,500				

Source: field data, 2021

Table 2 revealed that 32.5% of the respondents engaged in non-farming activities (such as trading, hairdressing, motorcycle operator, taxi driving etc.) as their livelihood options and; 21.3% of the respondent choose off-farming (such as livestock rearing, beekeeping, fishing, palm wine tapping etc.) as their livelihood options, while 30.6% of the respondents choose both non & off-farming as their livelihood options as a means of generating additional income. However, 15.6% of the respondents have no livelihood options but depended solely on their farming as well as remittances from rent, relatives and pension as their major source of income. In table 3, it was revealed that non-farming activities that the respondents engaged in contributed 14.7% of additional income to their total income while off-farming activities bring about 29.2% to the total income earned by the respondent. Also, the combination of non-farming and off-farming activities engaged in by the respondents attributed 39.8% of additional income to what the farmers earned. However, for the respondents who had no other livelihood options were solely dependent on the income from their farm.

3.2. Multinomial Logistic Regression showing factors Influencing the Choice of Alternative Livelihood Options

The multinomial logistic regression results in table 4 revealed factors influencing the choice of alternative livelihood options. The table expound the analysis for the three livelihood options (non-farming; off-farming and non and off-farming). In respect to responders who focused on farming as the only livelihood option, it was noted that age and primary education significantly influence the choice of choosing farming at 5% level of significance which indicated that as the respondents begin to increase in age there is a positive likelihood that they will be willing to adopt farming as a livelihood option while the significance of primary and secondary education access the fact that respondents will likely adopt farming based on the level of education. Also, marital status; secondary education and farm experience significantly influence the choice of choosing farming at 10% level of significance. However, the significance of marital status and farm experience emphasized less likelihood of choosing farming as a livelihood option as the farmers begin to marry and retrogress in farming experience respectively. In addition, at 1% level of significance, the respondents' willingness to select farming as a livelihood option is considerably influenced by the respondents' distance from house to market, however this influence is less pronounced the farther away from home to market the respondents are, the less likely they are to choose farming as a livelihood option. Also, respondents who chose off-farming as a livelihood option revealed that age and farming experience significantly influence the choice of choosing off-farming at 10% level of significance. It means as the respondents begin to increase in age there is a positive likelihood that they will be willing to shift to off-farming as a livelihood option, also farming experience shows that there is a decreased likelihood that the respondents will be willing to choose off-farming has an options because an increase in farming experience will have less likelihood of choosing off-farming as an option. This denotes that age and farm experience do not correspond, as seen by the fact that as responders get older, they tend to take on more responsibility and earn more money. However, as their expertise and farm experience grow, so do the number of farming tasks they are involved in. The similar pattern holds true for respondents that selected non and off-farming livelihood option at 5% level of significance.

Table 4 Distribution of Respondents Based on Multinomial Logistic Regression Result Showing Factors Influencing the Choice of Alternative Livelihood Options

Variable	Farming			Off-Farming			Non & Off-Farming		
	Coef	Std	p-value	Coef	Std	p-value	Coef	Std	p-value
Age	(0.088)**	0.445	0.050	(0.071)*	0.039	0.071	(0.839)**	0.369	0.023
Sex	0.268	0.877	0.760	0.075	0.671	0.910	0.406	0.589	0.491
Marital Status	(-2.283)*	1.192	0.055	13.045	644.63	0.984	-0.699	1.054	0.507
Primary Education	(2.020)**	0.939	0.031	0.898	0.702	0.201	0.923	0.517	0.147
Secondary Education	(1.309)*	0.741	0.077	0.373	0.580	0.519	0.034	0.052	0.948
Farm Experience	(-0.086)*	0.501	0.087	(-0.089)*	0.047	0.055	(-0.128)***	0.048	0.007
Household Size	0.171	0.212	0.421	0.133	0.176	0.448	0.045	0.169	0.788
Distance F-M	0.684	0.050	0.173	-0.013	0.045	0.775	0.004	0.043	0.918
Distance H-F	0.589	0.043	0.171	-0.003	0.044	0.949	0.018	0.038	0.623
Distance H-M	(-0.158)***	0.062	0.010	0.002	0.040	0.969	-0.038	0.040	0.347
Credit Access	-0.054	0.648	0.934	-0.538	0.563	0.339	-0.189	0.499	0.705
Extension Access	-0.961	1.679	0.567	-0.241	1.553	0.877	-1.272	1.311	0.332
Dependency ratio	-0.172	1.155	0.881	1.306	1.000	0.192	1.262	0.895	0.158

Source: Field Survey, 2021; Notes: *, ** and *** indicate that coefficient is significant at 10%, 5% and 1% significant level respectively.

4. Conclusion

In order to develop solutions for coping with climate unpredictability in the Ondo State of Nigeria, the study looked at the possibilities available to arable farmers for a living. The study also discovered that farmers typically engaged in a variety of livelihood options, such as off-farm activities; non-farm activities; and non-farm & off-farm activities, while only about 16.0% of respondents in the study area depended solely on farming as a source of income (income from their farm and other remittances). These were created as a kind of specialized microeconomic livelihood system based on

the many opportunities and resources that were accessible to them. Low yield and crop failure, as well as rising production costs due to increased input use and decreased income from agriculture, are further reasons for pursuing alternate livelihood options. In view of these, there is no proper monitoring of farmers' progress, and the degree to which government policies and interventions actually reach the grassroots varies and it is possible that the respondents may be willing to switch to alternative livelihood options. This is suggestive of the fact that everything that has an impact on one livelihood will also have an impact on another and it deciphers that initiatives aimed at improving important livelihoods would have a significant positive impact on other aspects of the villages and communities.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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