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Assessing Smallholder Farmers' Responses to Climate Shocks and Adaptation Strategies: Implications for Agricultural Policy and Sustainable Development in FCT-Abuja

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Abstract

This paper explored how smallholder farmers respond to and cope with climate shocks in the Federal Capital Territory (FCT), Abuja, Nigeria. Quantitative research design was adopted and data were gathered from 80 farmers through semi-structured survey, and analysed with descriptive statistics and binary logistic regression. The results indicated that the common climate shocks experienced by farmers are irregular rainfall, heat stress, and pest/disease outbreaks, out of which 85% of the farmers recorded a moderate to severe effect on agricultural production. In spite of these, a large percentage of respondents 87.3% were found to have at least embraced one of these adaptation strategies such as non-farm income, crop diversification, use of better seeds, and crop diversification. Nevertheless, regression findings depict that age, education, farm type and size are examples of key socio-demographic predictors of adaptation behaviour but are not statistically significant. The findings indicate that adaptation is mostly necessity based driven and influenced by structural constraints such as low access to finance, high input prices, and poor institutional support. Interestingly, it was found that 95% of the respondents did not receive any extension services, and 79.8% of them indicated that current agricultural policies were insufficient. The papers concludes that while adaptation measures exists, it is incremental with certain limitations. Policy responses should thus go beyond the principles of encouraging adaptation to the reality of overcoming the existing structural impediments which constrain the ability of farmers to gain sustainable resilience.

Keywords: Climate Change Adaptation, Smallholder Farmers, Climate Shocks, Agricultural Policy, Sustainable Livelihoods Framework

1. Introduction

The issue of climate change has become one of the most significant structural risks to agricultural systems all over the world (Ahmed *et al*., 2022) [2], even though its consequences are not equally distributed or experienced. Such asymmetry is more common among smallholder farmers in developing countries where agriculture activities continue to be rain-fed and highly weather-sensitive. In sub-Saharan Africa, almost 80 percent of food is produced by smallholder farmers, yet these farmers are worst hit by climatic variability including unpredictable rainfall, prolonged droughts, and frequent flooding (IPCC, 2022; Bedeke, 2023) [17, 3]. Nigeria is a prime example of this paradox as the most populous country in Africa - having enormous potential to farm, and at the same time facing increased climate disorders that threatens to destroy rural livelihoods and food security. Of particular interest within this greater national context is the Federal Capital Territory (FCT) of Abuja. Although they are linked to fast urbanisation, but peri-urban and rural societies in FCT remain excessively dependent on the smallholder agriculture.

Nevertheless, the growing inability to predict rain patterns and heightened occurrence of extreme weather patterns have begun to disrupt the conventional farming seasons and production systems. There is empirical evidence to indicate that the Nigerian farmers have been experiencing large-scale yield losses attributed to climate variability, with some researchers estimating a reduction in production of staple crops due to extreme climatic conditions (Omokaro, 2025) [24]. However, with these worrying tendencies, the level to which the smallholder farmers in FCT-Abuja are aware, react to, and adapt to these shocks is under-

researched.

This paper is theoretically underpinned by the Sustainable Livelihoods Framework (SLF) and Adaptation Theory, which highlight the dynamic interaction between vulnerability, access to assets and adaptive capacity (Scoones, 1998; Adger, 2006) [27, 1]. Although the SLF maintains that the resilience of farmers depends on their accessibility to financial, human, social and natural capital, the adaptation theory establishes the role of agency and institutional structures in developing responses to environmental stressors. Nevertheless, there is a tense issue in the literature. On one hand, optimist views believe that the smallholder farmers are innately adaptive, as they rely on indigenous knowledge and adaptability in livelihood approaches (Deressa *et al*., 2009) [9]. Conversely, less optimistic explanations argue that structural factors, especially poor access to credit, information and extension services, have a drastic impact on constraining adaptive capacity, thus trapping vulnerability (Below *et al*., 2012) [4]. This leads to a very crucial empirical question: are the adaptation strategies of smallholder farmers truly transformative or simply short-term coping strategies that conceal systemic vulnerabilities?

Moreover, policy actions in response to climatic change in Nigeria have been frequently criticised to be piecemeal, top-down and less responsive to local realities. Although national policies and plans like the Agricultural Promotion Policy and climate adaptation strategies are in place (Da'an *et al*., 2024) [8], their actualization at the local level is lopsided and raises concerns about inclusivity. This suggests the need to research in a context-specific and empirically-grounded way - filling the gap between policy formulation and lived experience. It is within this background that this paper attempts to evaluate the responses of smallholder farmers to climate shocks and their adaptation efforts in FCT-Abuja. This also includes a critically examination of the implication on agricultural policy and sustainable development.

1.1 Research Objectives

Research Objective 1: To identify key climate shocks affecting smallholder farmers in FCT-Abuja.

Research Objective 2: To examine smallholder farmers' adaptation and coping strategies in response to climate shocks.

Research Objective 3: To analyse factors influencing the adoption of climate adaptation strategies.

Research Objective 4: To assess institutional and policy support available to smallholder farmers.

2. Literature Review

2.1 Climate Change and Smallholder Agriculture

Climate change and smallholder agriculture have undergone an extended period of theorisation, but there has been intense debate about this subject in the literature of both empirical and policy relevance. On the one hand, the hegemonic discourse, supported by the Intergovernmental Panel on Climate Change, is the idea that the rising temperatures, changes in precipitation patterns, and an increasing frequency of extreme weather events are already having quantifiable stressors on agricultural productivity, especially in sub-Saharan Africa (IPCC, 2022) [17]. As an example, it has been projected that crop production in some areas of Africa might face a reduction of as much as 20-30% by 2050 due to emission scenario at high level (Simane *et al*., 2026) [28]. These are usually result to viewing smallholder farmers as passive victims of environmental change.

This deterministic framing has, however, raise some concerns. According to scholars, it is a danger to the socio-political and economic aspects of vulnerability. Climate change, as argued by Morton (2007) [20] does not run alone but it works in synergy with already existing structural inequalities such as poverty, poor infrastructure and poor access to markets. Therefore, the effects of climate change are not uniform. Within the Nigerian setting, research has shown that certain segment of farmers have been witnessing drastic losses in yield, while others have been resilient, which implies that the results will be determined by the availability of resources and institutional encouragement (Nhemachena *et al*., 2020) [21]. This brings up one important question: does climate change cause agricultural vulnerability or is just a way of intensifying underlying structural frailties?

2.2 Climate Shocks and Farmer Vulnerability

Climate shocks is considered to be one of the main manifestations of climate change on the local scale - it is a sudden and extreme climatic events (droughts, floods, heatwaves) (Ferreira, 2024) [10]. The exposure, sensitivity and adaptive capacity are usually conceptualized within the context of the vulnerability theory as the three pillars that define how individuals or communities feel such shocks (Adger, 2006) [1]. High exposure and sensitivity that characterise smallholder farmers are due to their reliance on rain-fed agriculture. However, the literature shows a lot of controversy on the scope and character of this vulnerability. Although research like Below *et al*. (2012) [4] notes that the institutional marginalisation of smallholders is further aggravated by the fact that they have less assets, there have been other scholars who warn against homogenisation of smallholder experiences. Indicatively, Deressa *et al*. (2009) [9] show that vulnerability among different regions and households differs in enormous ways influenced by the land ownership, education and access to information.

In Nigeria, there is empirical evidence of rising levels of flooding and rainfall variability especially in central Nigeria, the FCT being one of them. Such shocks do not only impact agricultural cycles, but their enduring effects on food security and incomes of the rural population (Umar & Gray, 2023) [31]. However, there remains an unsolved conflict: are the shocks essentially exogenous environmental events, or are their effects magnified by governance failures, including insufficient drainage systems or poor land-use planning? This vagueness makes it hard to analyze and create a policy.

2.3 Adaptation Strategies in Smallholder Farming

The concept of adaptation, with respect to climate change, can be referred to as any changes in practices, processes, or structures with the purpose to reduce the possible harm or to use new opportunities (Adger *et al*., 2006; Biswas & Rahman, 2023) [1, 6]. Some of the adaptation strategies that are likely to be adopted by smallholder farmers include diversifying their crops, planting high quality seedlings, modification of the planting time and being involved in non-farm earnings. Using the prism of the Adaptation Theory, such responses are often seen as the indicators of agency and the resilience of farmers. As a matter of fact, some of

these studies emphasize the resourcefulness of the smallholder farmers in implementing the systems of indigenous knowledge to survive the environmental unpredictabilities (Deressa *et al*., 2009; Grey & Manyani, 2020) [9, 13]. However, critics note that a lot of these so-called adaptation strategies are actually reactive coping strategies, which only provide short-term relief without fixing underlying susceptibilities (Bene *et al*., 2014) [5].

This difference between coping and adaptation has far-reaching policy implications. Even though there is short term stability, coping mechanisms have the potential to cause mal-adaptation in the live-lihoods such as over-dependence on chemical inputs which adversely affects soil quality in the long-run. In such a way, the way farmers are changing is not the key question, but whether these changes are sustainable, scalable, and can lead to increased resilience in the long-term.

2.4 Determinants of Adaptation

The aspects of determinants of adaptation have been greatly studied using the Sustainable Livelihoods Framework (SLF) framework which focuses on the impact of different types of capital, that is human, financial, social, natural, and physical capital, in influencing livelihood strategies (Scoones, 1998; Kumar *et al*., 2023) [27, 18]. According to the empirical studies, education, size of the farm, income, credit and extension services are always found to be the drivers of adaptation (Thottadi & Singh, 2024) [30].

Nevertheless, the causal mechanisms are controversial. However, in as much as there are studies indicating the ease of adaptation with an increase in the level of education and income, due to a rise in access to information and resources (Nor Diana *et al*., 2022) [22], there are more intricate phenomena. As an example, the more affluent farmers will be less motivated to implement some of the low-cost adaptation methods, as they will think that they are inferior or even unnecessary. These inconsistencies point out the drawbacks of strictly economistic approaches to adaptation, which are more likely to give preference to quantifiable variables and overlook less objective aspects such as cultural norms, risk perception, and institutional trust. This has led to a rising demand to have more refined, context-specific analyses which reflect the multi-dimensional character of the adaptation decision-making.

2.5 Policy and Institutional Support

Policy and institutional frameworks are critical aspects of determining the results of adaptation, but their efficiency is extremely diverse. Theoretically, government interventions which include, subsidies, extension services, climate information systems and insurance schemes are aimed at increasing the adaptive capacity of farmers (Prasad *et al*., 2024; Thottadi & Singh, 2024) [25, 30]. In reality, their influence is frequently limited by the problems of access, execution, and control. Historically, the agricultural policies in Nigeria have been typified by the top-down policies without much involvement of the small scale farmers. Although more recent policy is aimed at supporting climate-smart agriculture (Olabanji, & Chitakira, 2025) [23], it is doubtful whether this is effective and reaches out to the grassroots. The Food and Agricultural Organization reported that an overall less than 30% of the smallholder farmers in sub-Saharan Africa have access to formal extension services (FAO, 2021) [12], a figure that shows the magnitude of the institutional inefficiency.

2.6 Synthesis and Research Gap

The literature reveals a contradictory narrative. While it is widely accepted that climate change presents a serious problem to smallholder agriculture, there is very little consensus regarding what the actual problem is, how well adaptation is implemented and whether policy interventions are available. More importantly, most of the literature is based on an aggregate/national data, thus missing local dynamics and context-specific differences. This paper fills this gap by presenting empirical data from FCT-Abuja by offering a more detailed insight into how the smallholder farmers experience and react to climate shocks in a given socio-economic and institutional framework. By so doing, it will add to the current academic discourses and yield insights that will be of immediate policy and practice uses.

3. Methodology

3.1 Research Design

The research design adopts a quantitative research approach directed towards a cross-sectional survey method. The quantitative paradigm was considered because the study focused on the measurement, comparison, and the establishment of statistically significant relationships among variables (Liu, 2022) [19]. The study is consistent with a positivist epistemology, which also supposes the objectivity of social phenomenon measurement and their analysis by observable indicators (Bryman, 2016) [7].

But this methodological option is not devoid of criticism. The critics of positivist methods believe that subsequent transformation of complex socio-environmental phenomena, e.g. climate adaptation, into quantifiable variables may be simplified to such an extent as to be disastrous (Sapkota, 2024) [26]. Indicatively, a statistical model can be used to establish the correlation between education and adaptation, but rarely to explore the underlying driving factors, perceptions, and cultural processes that define decision-making. However, these limitations are frequently overridden by the ability of quantitative methods to generate generalisable and comparable results.

3.2 Study Area

The research took place in Abuja, the Federal Territory of Nigeria. The FCT has a large population of rural and peri-urban communities that practice smallholder agriculture despite the fact that it is reputed to be the administrative centre of the country. Such agricultural systems are rain-based, and hence highly susceptible to climate uncertainty. This duality of the FCT both as urbanised and agrarian is a significant point of analysis. Although the position of Abuja as location of national institution may indicate that they are more likely to access the agricultural support services, however, it was found that a large number of smallholders farmers are marginalized thus contravening the assumptions of spatial advantage and institutional accessibility.

3.3 Sampling and Data Collection

A total of 80 smallholder farmers were selected for the study. The structured questionnaire that was utilized in the collection of data was based on Google Forms and field-assisted distribution. Owing to the limitation on time, accessibility, and availability of resources, the study used non-probability sampling method (convenience and

purposive) method. Methodologically speaking, the non-probability sampling method has valid issues of representativeness and external validity. Although the probability sampling methods would have increased the generalisability, it is not always workable in the situations where the sampling frames are unavailable or challenging to create. Findings of this study, therefore, can only be said to be representative and not conclusive of the larger population of the smallholder farmers in the FCT.

3.4 Instrument Design and Measurement

Structured questionnaire (12 close ended questions) was used to collect data, as it contained important variables that were to be measured to suit the objective of the study. The questionnaire was designed based on the Sustainable Livelihoods Framework (SLF) that conceptualises livelihood outcomes in terms of availability of different types of capital (Scoones, 1998) [27]. Based on this, the operationalisation of variables like education, farm size and access to extension services were used as proxies of human, natural and institutional capital. The dependent variable - adoption of adaptation strategies was a binary outcome (Yes/No) which is in line with the logistic regression analysis requirements (Hilbe, 2009) [15].

Definition of variables

1. Dependent Variable: Adoption of adaptation strategies

Coded as:
1 = Yes (farmer adopted at least one adaptation strategy)
0 = No (farmer did not adopt any strategy)

2. Independent Variables

a. Age Group

Coded as ordinal categories:
1 = Below 25
2 = 25–34
3 = 35–44
4 = 45–54
5 = 55+

b. Education Level

Coded as:
0 = No formal education
1 = Primary
2 = Secondary
3 = Tertiary

c. Type of Farming

Dummy coded as:
1 = Crop farming
2 = Livestock
3 = Mixed farming

d. Farm Size (Q4)

Coded as ordinal categories:
1 = Less than 1 hectare
2 = 1–2 hectares
3 = 3–5 hectares
4 = Above 5 hectares

However, operationalisation of the complex constructs into discrete variables depict some possible measurement constraints. Using the example of categorisation of the adaptability variable as a binary variable, variations in the intensity or effectiveness of various strategies can be obscured. Although it is essential to simplify statistical analysis, such simplifications reveal the nature of trade-offs in quantitative research design.

3.5 Data Analysis Methods

The socio-demographic characteristics, types of climate shocks and adaptation strategies used by the respondents were summarised using descriptive statistics (frequencies, percentages and charts) (Hilbe, 2009) [15]. A binary logistic regression model was used to test the determinants of adaptation, where adoption of adaptation strategies was the dependent variable, and age, education, type of farm, and size of the farm were independent variables. The method is common in the agricultural field and climate research to simulate dichotomous results and approximate the likelihood of adoption given predictor variables (Hosmer *et al*., 2013) [16].

Although the logistic regression is a powerful regression model, it is based on a number of assumptions that include independence of observations and the lack of multicollinearity. Since the sample size (n = 80) is relatively small, there is a risk that it could decrease the statistical power, and that it can impact the reliability of the estimates of coefficients. Moreover, the cross-sectional data prevents reaching any causal conclusions, and observed relationships could be based on correlation, but not on a direct effect.

Model Specification

The logistic regression model is expressed as:

$$\text{Logit}(P) = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Education}) + \beta_3(\text{Farm Type}) + \beta_4(\text{Farm Size}) + \varepsilon$$

Where:

- P = Probability of adopting adaptation strategies
- $\beta 0$ = Constant term
- $\beta 1$–$\beta 4$ = Coefficients of independent variables
- ε = Error term

3.6 Ethical Considerations

The code of ethics were observed during the research. The respondents participated voluntarily, and an informed consent was given to all participants. Anonymisation of the data was done to maintain confidentiality and no personal identifiable information was gathered. Nevertheless, the area of ethics is not limited to procedural compliance. Structured questionnaires might imply an unwitting limitation of respondents on their capacity to give full descriptions of their experiences, thus giving greater precedence to pre-selected categories over lived realities.

4. Results and Analysis

4.1 Socio-Demographic Characteristics of Respondents

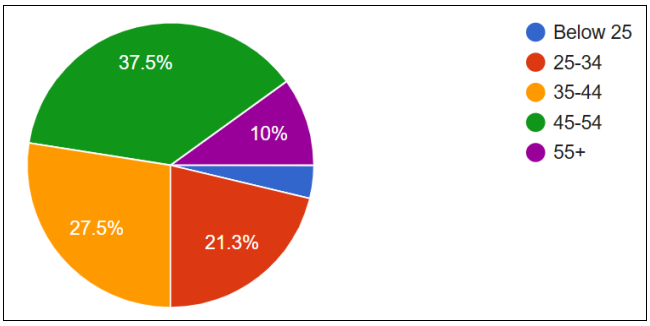

Fig 1: Age of respondents

The socio-demographic background of the respondents gives a necessary basis in explaining the vulnerability and adaptation patterns (see Fig 1). The statistics reveal that respondents spread across various age groups with most (30 respondents) at age bracket 45-54 years representing 37.5%. This is in line with the larger trends of agricultural labour in sub Saharan Africa where working adults are the dominating force in farming.

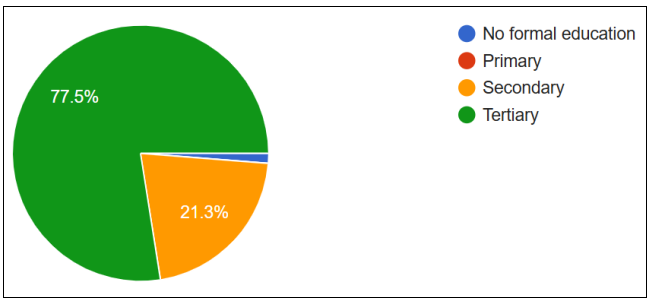

Fig 2: Education level of respondents

With respect to education, the respondents showed difference in levels of formal schooling, the lowest (1) being farmers having no formal education representing 1.3% of the total respondents (see Fig 2). There was a high percentage (77.5%) of farmers who have tertiary education. By implication, human capital is usually hypothesised to increase adaptive capacity in the Sustainable Livelihoods Framework (SLF). Nonetheless, education and adaptation are not always associated in a linear manner. Though education might enhance access to information, it does not necessarily result into behaviour change especially where financial or institutional constraints limit access to information.

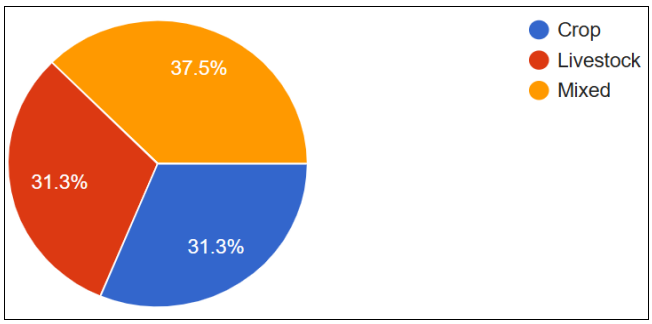

Fig 3: Farming Methods of Respondents

The result revealed that respondents are nearly equally spread across the three farming methods (see Fig 3). However, most of the farmers (30) operate mixed method representing 37.5%. The mixed method is usually adopted to remove risk. But mixed method can also be an indicator of weakness since farmers are diversified over a variety of activities instead of focusing on increasing productivity within a given area.

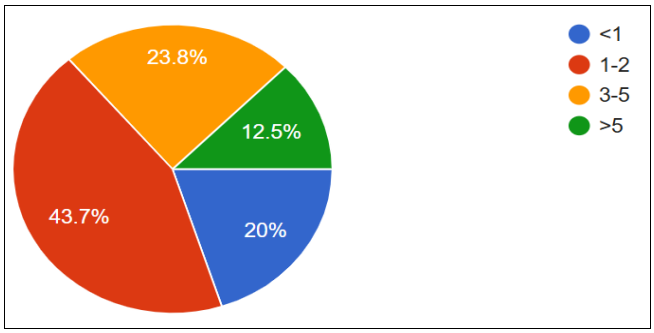

Fig 4: Farm Size (Hectare) of respondents

The size of the farms further reveal that the respondents in fact are smallholder farmers with majority of them constituting 63.7% having land size of less than 2 hectares (see Fig 4). Farmers with farmland of over 3 hectares are only 32.5% in number.

4.2 Climate Shocks Experienced (Objective 1)

The results indicated that smallholder farmers in FCT-Abuja are vulnerable to several climate-related shocks (see Fig 5). The most commonly recorded shocks are irregular rainfall (56.3%), heat stress (53.8%) and outbreak of pests/diseases (52.5%) as experienced by the respondents. Meanwhile drought and flooding constitute the least climate-related shocks experienced by the farmers.

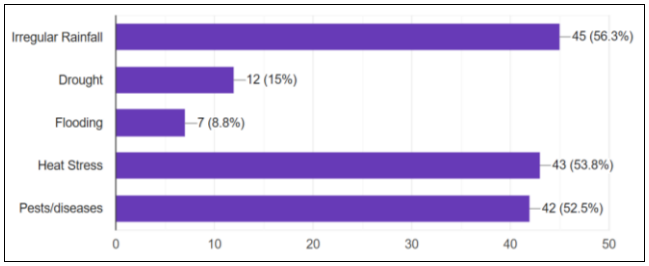

Fig 5: Climate-related shocks experienced by respondents

The presence of shocks is an important observation, as it makes it harder to adapt to critically co-occurring shocks. Instead of having individual phenomena, farmers tend to be faced with a combination of risks; e.g., erratic rainfall, heat stress and pest attacks. This confirms the claim made by the Intergovernmental Panel on Climate Change that climate risks are becoming systemic and not episodic (IPCC, 2022) [17].

On severity, a significant percentage of the respondents (85%) indicated moderate to severe effects on farm production (see Fig 6). This indicates that climate shocks are not just seen as threats but have physical effects on the level of agricultural production and lives. Nevertheless, recall bias or subjective understanding of loss may make the self-reported severity questionable.

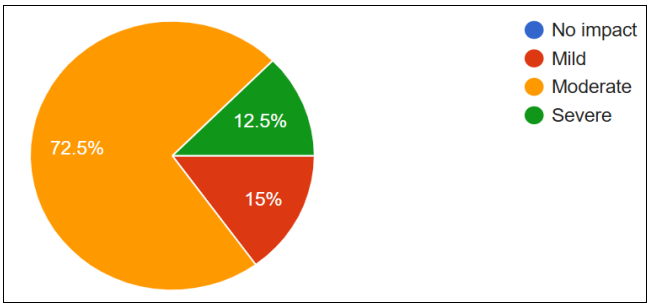

Fig 6: Severity of the impact of climate shocks

Moreover, the issue of climate shocks is often presented as external event; nevertheless, the impacts of these events may be mitigated by local factors, such as the quality of the soil, infrastructures, and irrigation. Thus, it is rather inaccurate to view climate variability as the one-sided solution to the problem of losses in production as the issue is more complex than it seemed.

4.3 Adaptation Strategies (Objective 2)

The result revealed that most of the respondents (87.3%) have embraced one or more strategies of adapting to climate shocks (see Fig 7). The result also revealed that their most prevalent strategies include leveraging non-farm income (54.4%), use of improved seeds (40.5%), diversification of crops and irrigation (36.6%) (see Fig 8).

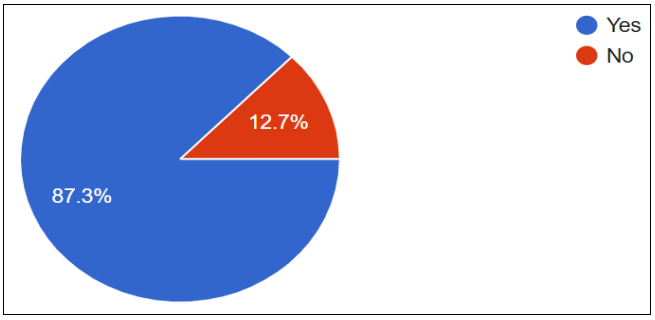

Fig 7: Farmers adoption of adaptation strategies against climate shock

According to the Adaptation Theory, such findings might be taken as the presence of farmer agency and resilience. Smallholder farmers are not inactive participants, as they are decision-makers who respond to the changes in the environment by modifying their practices. Yet, this narrative is made more difficult by a more critical analysis. To begin with, all the low-cost, and low-technology strategies are primarily based on adding value through changing planting dates, indicating that they are highly limited in the adaptation because of limited resource accessibility.

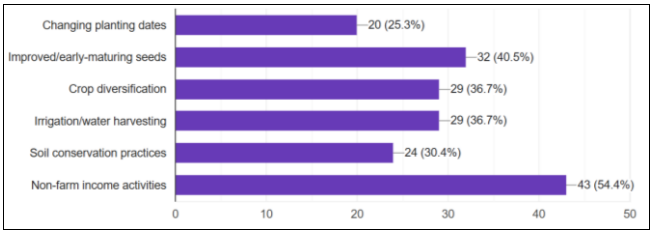

Fig 8: Common adaptation strategies being used

Second, the difference between coping and adaptation emerges. Though crop diversification has potential of lowering risk, it can also spread reduce productivity without proper supplies or inaccessibility to the market. On the same note, the dependence on non-farm income can be seen as a sign of distress-driven diversification, but not proactive adaptation.

Critically, the data testify to the universal compliance with adaptive practices, but question the depth and the durability of the strategies as well. Are farmers actually becoming resilient or are they merely managing vulnerability in the short run?

4.4 Determinants of Adaptation (Objective 3)

The binary logistic regression model was used to investigate the determinants of adaptation with the dependent variable being the adaptation strategies. Age, education, type and size of farm were categorized as independent variables.

	Coefficient	Std. Error	z	P>|z|	[0.025	0.975]	Odds Ratio
const	2.561671259	2.631341792	0.9735228117	0.3302935283	-2.595663883	7.719006402	12.9574545
Age_Group	0.08413176569	0.3373428603	0.249395424	0.8030549245	-0.577048091	0.7453116223	1.087772215
Education	-0.1138485283	0.8309318134	-0.1370130815	0.8910204551	-1.742444956	1.5147479	0.892393118
Farming_Type	-0.8891188269	0.5321461218	-1.670817075	0.09475781473	-1.93210606	0.1538684063	0.411017771
Farm_Size	0.6442121438	0.4385136346	1.469081217	0.1418107618	-0.2152587867	1.503683074	1.904485977

Fig 9: Binary logistics regression results

Table 1: Result summary table

Variable	Coefficient (β)	Std. Error	z-value	P>|z|	Odds Ratio (eβ)
Constant (Intercept)	2.5617	2.6313	0.9735	0.3303	12.9575
Age Group	0.0841	0.3373	0.2494	0.8031	1.0878
Education Level	-0.1138	0.8309	-0.1370	0.8910	0.8924
Type of Farming	-0.8891	0.5321	-1.6708	**0.0948**	0.4110
Farm Size	0.6442	0.4385	1.4691	**0.1418**	1.9045

As shown in Table 1, the result indicated that there is no significant predictors which questions the common beliefs about the determinants of adaptation. First, age, which was frequently theorised to represent farming experience and risk-taking ability positively impact adaptation (b = 0.0841), but not statistically significantly (p = 0.8031). The odds ratio (Exp(b) = 1.0878) indicates a weak positive chances of increased age influencing adaptation behaviour. The non-significance implies that age is a much less variable than one might initially think would influence adoption of adaptation strategy.

Education level, one of the key predictors of adaptation was also found to be negatively and statistically non significantly (b = 0.1138, p = 0.8910; Exp(b) = 0.8924). Such an outcome is especially impressive, since it contradicts a significant amount of empirical research that finds education as one of the enablers of climate adaptation. This can be explained by one of the potential interpretations that formal education does not always lead to locally specific agricultural knowledge, particularly in settings in which there is a weak or absence of extension services. Alternatively, it is possible that this result is due to the fact that broad educational categories are not suitable as proxies of adaptive capacity and functional knowledge.

Meanwhile, type of farming appears as a more important variable though with less significant statistical significance (b = - 0.8891, p = 0.0948). The odds ratio (Exp(b) = 0.4110) and negative coefficient indicate that some of the farming

systems and specifically those that are less diversified) can be linked to having a lower propensity to pursue adaptation strategies. Despite the result having a marginally significant value (at the 10% level), it indicates the relevance of production systems and diversification of livelihood in adaptive behaviour. This observation supports the notion that, diversified systems of farming because of the dispersion of risks among various activities, could potentially increase resilience.

The proxy of resource endowment is the farm size, which has a positive non-significant effect on adaptation (b = 0.6442, p = 0.1418; Exp(b) = 1.9045). The odds ratio indicates that a rise in the area of the farm can influence a rise in the likelihood of adaptation strategies up to about 90%. This interpretation is however dampened by the fact that it is not statistically significant. It is a reasonable possibility that access to land is not sufficient in itself without other inputs like credit, labour and information.

The constant term (b = 2.5617, p = 0.3303) implies that the baseline probability of adaptation (Exp(b) = 12.9575) is relatively high, and that adaptation behaviour is widespread irrespective of characteristics which are observed. This supports previous descriptive research that most farmers have implemented more than one of the strategies of coping or adaptation.

Summarily, regression outcomes, this implies that standard quantitative models predicting adaptation behaviour are facing a limitation on its predictive power. There is no significant statistical significance in the main variables, and this fact indicates that the adaptation cannot be simply reduced to the set of observable socio-economic features. Rather, it can be motivated by additional factors, which are context-specific, and which are not sufficiently represented in the model, these may include social networks, cultural norms, risk perceptions, and informal knowledge systems.

4.5 Institutional Support and Policy Perception (Objective 4)

The result indicates that institutional support to respondents is seriously lacking with 95% of the respondents indicating that they have no access to extension services or government/NGO intervention (see Fig 10). This supports the argument on the coverage and efficiency of agricultural policies. The lack of access to timely information and technical support limits the possibility of farmers to get to the effective strategies of adaptation.

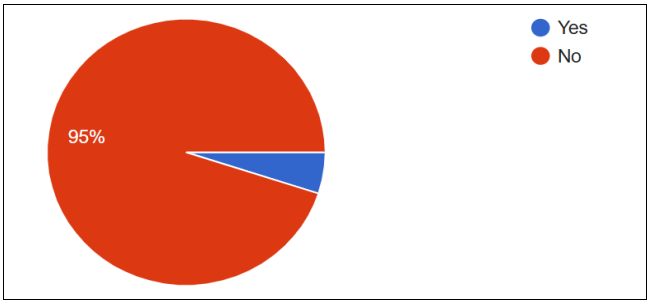

Fig 10: Access to extension services or government/NGO support

Critical attitudes to the policies can also be seen through the perceptions of the adequacy (see Fig 11). According to majority of the farmers (79.8%), the current agricultural policies and support systems are not sufficient to deal with the problems associated with climate change. This indicates the lack of relationship between policy design and implementation - a common theme in development literature.

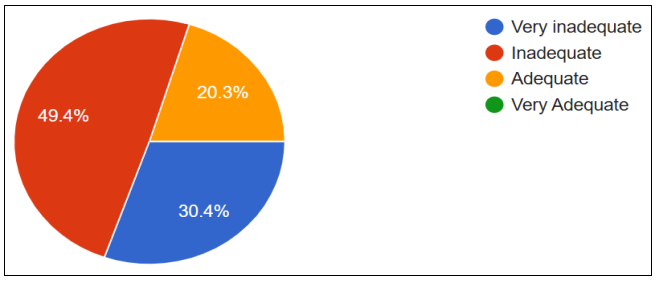

Fig 11: Adequacy of current agricultural policies and support systems

Nevertheless, negative attitudes towards policy can be characterized not only by the actual shortcomings of the policy but also by the gaps in expectations. The farmers can compare policies to the idealised standards instead of realistic standards thus increasing the perceived inadequacies. Moreover, the general trend indicates that the institutional support systems are not well aligned to meet the needs of smallholder farmers, raising the issues of policy impacts and inclusiveness.

The analysis of constraints demonstrates that there are a variety of obstacles to successful adaptation among farmers (see Fig 12). According to the respondents, the 3 major challenges are limited information (36.2%), shortage of finance (32.5%) and high cost of inputs (27.5%). These limitations align with the focus of the SLF on the restricted access to financial and institutional capital as the major sources of vulnerability.

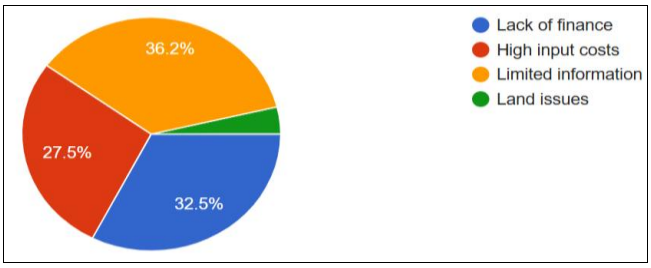

Fig 12: Challenge limiting adaptation

In terms of policy, the respondents suggest various priority interventions, however they prioritize access to credit (26.3%), access to climate and weather information (22.5%) and investment in irrigation infrastructure (17.5%) (see Fig 13). These suggestions are based on a practical idea of structural alteration to become more resilient.

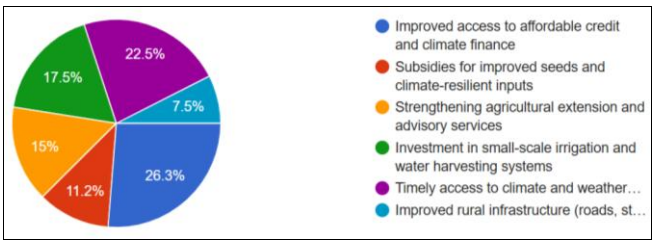

Fig 13: Recommended policy intervention

Nevertheless, there arises a crucial tension of whether these policy demands can be feasible. Increased subsidies and

state investment can increase adaptation in the short term, but at the cost of raising fiscal sustainability and reliance. In contrast, a market-based solution (e.g. privately provided credit or insurance) can be more sustainable but could exclude poorest farmers.

5. Discussion

The results of this research paper constitute a long-standing and frequently polarised debate in the climate-adaptation literature: does a smallholder farmer as an agent within a structural context act as a resilient agent who can structurally adapt themselves, or as a structurally constrained actor whose behaviour is largely reactive and limited? The FCT-Abuja evidence does not necessarily fit one side or the other side but in fact, it displays a more complex reality that is highly adaptive but poorly supported by structure and exhibits only a few explanatory determinants.

On the one hand, the findings are a very positive indicator of the statement that climate risks are systemic as promoted by the Intergovernmental Panel on Climate Change (IPCC, 2022) [17]. The irregular rainfall, heat stress, and pest outbreak are prevalent, and 85% of the respondents indicated a moderate to severe effect, which indicates that climate shocks are not a single event but a rooted interference with agricultural processes (Yang *et al*., 2024) [32]. But a more critical examination would be that such influences cannot be blamed entirely on climatic factors. The exposure is not decisive, but it is the combination of environmental stressors and socio-economic conditions that construct vulnerability, as it is argued in the vulnerability theory (Adger, 2006; Gumel, 2022) [1, 14]. Poor infrastructure and irrigation in the given case and poor institutional support seem to increase the impacts of climate shocks.

The fact that the rate of adoption of adaptation is high (87.3%) at first seems to support the positive side of the Adaptation Theory, which focuses on the agency of farmers (Deressa *et al*. 2009; Below *et al*., 2012) [9, 4]. However, it is the basic regression findings that make this narrative more complex. The fact that there were no statistically significant predictors, especially in the case of such variables as education and age is a direct challenge to the overall hypothesis that human capital and demographic components are the main determinants of adaptation. Farm size, which is usually related to resource capacity was not statistically significant even though it was positively correlated.

This brings a critical theoretical conflict: in the event that adaptation is both common, yet not powerfully outlined by noticeable socio-economic factors, then what drives adaptation? We may therefore assume that adaptation not an issue of strategic optimisation but rather an indication of necessity. The large probability of adaptation (Exp(b) = 12.9575) indicates that farmers do not adapt due to favourable conditions, but have no other alternative that is viable. To this end, adaptation is not that much a sign of resilience but rather a symptom of vulnerability.

In addition, this interpretation is supported by the nature of adaptation strategies. The prevalence of low-cost-based approaches like non-farm income, as well as incremental adjustments (e.g., better seeds, crop diversification) indicates that farmers have to work in limited resource settings. Such strategies, as pointed out in the literature, can be a coping strategy and not a transformative adaptation strategy, which is troublesome as to the long-term sustainability (Béné *et al*., 2014; Filho *et al*., 2022) [5, 11].

The most notable discovery perhaps is connected with the institutional vacuum in which these adaptations take place. Having found that 95% of the respondents did not access any extension services, and 79.8% felt that the policies were not effective, the study reveals a massive disconnect between the policy frameworks and the local realities. This confirms criticism of top-down policy strategies, which in most cases do not result in any significant support at the grassroots. Nevertheless, this would be simplistic to blame this solely on policy failure. Farmer demands e.g. credit demand, subsidies and infrastructure could be greater than the one which is financially or institutionally feasible and hence there is an expectation-reality gap.

In conclusion, the findings show that adaptation process is not a linear and predictable process that takes place under the influence of certain identifiable variables, but a complicated context-specific process that takes place as a result of necessity, constraint and insufficient institutional support. This weakens the adequacy of the conventional econometric models and requires more realistic and interdisciplinary ways of understanding climate adaptation.

6. Policy Implications

The implications of the findings in this study are far reaching in the sense that they shed more light on the lack of fit between the widespread adaptation behaviour and the weak institutional support systems. Although a large percentage of farmers (87.3%) practicing adaptation is already in place, the application of adaptation is more often self-initiated, small-scale, and limited, which also casts doubts on its sustainability and ability to scale.

One of the policy priorities would be the necessity to fill the institutional gap in terms of the extension services and information dissemination. It is clear that the current agricultural extension systems are not just performing poorly since 95% of the respondents do not have access to formal support but are virtually nonexistent among most of the smallholder farmers. But extension services should not be enlarged only. The success of such systems, as it is indicated, relies on their relevancy and accessibility. The policies should then focus more on the context specific and decentralised model of extension incorporating both local knowledge and scientific innovation (Sulekha *et al*., 2025) [29].

Another intervention area is access to finance and affordable inputs. The fact that finance and input costs were identified as key limitation indicates the constraints in anticipating that farmers will finance the adaptation on their own. However, this raises a more basic policy dilemma. Although public funding and subsidies can lead to an improvement in adaptive capacity in the short run, it can also cause dependency and long-term financial liabilities. On the other hand, market-supported mechanisms, including individual credit and insurance, have the potential to enhance efficiency, but can exclude poorer farmers. This implies that there is the necessity of hybrid policy strategies, taking the form of targeted subsidies and inclusive financial instruments.

The fact that climate information and irrigation infrastructure are the most prioritised also demonstrates the relevance of discussing both informational and physical limitations. This can be made possible through reliable weather information which is a source of proactive decision-

making and irrigation which can lead to reduced reliance on rainfall. Nevertheless, massive infrastructure projects need a lot of money and its management to prevent unjustified access.

Notably, the findings of the regression refute the efficiency of the one-size-fits-alls policies of socio-demographic targeting. The policies that presuppose that different demographics will respond uniformly to any given behaviour might be misinformed because variables like education and age were not a significant predictor of adaptation. Rather, structural constraints, including finance, information and infrastructure should be used to intervene as opposed to individual characteristics.

Lastly, the paper observes that the policy should be coherent and coordinated. Climate adaptation is overlapping with a variety of sectors but the current responses are still divided. Policies in agriculture, environmental and economic policies must be aligned with frameworks promoted by Intergovernmental Panel on Climate Change (IPCC, 2022) [17], so that interventions can be supportive of one another. Overall, it is not only necessary to encourage adaptation, but to change the premises according to which this adaptation takes place.

7. Conclusion

The paper explored how smallholder farmers in FCT-Abuja respond to climate shocks. The results suggest a paradoxical situation: while the level of adaptation is high indicating that 87.3% of farmers implement at least one strategy, it is also incremental, need-based, and with structural constraints. However, contrary to the prevailing theoretical expectations, the regression analysis did not establish any statistically significant predictors of adaptation, defying the idea that socio-demographic factors like education, age, or farm size are key determinants. This implies that adaptation here is not so much a matter of personal capability but rather it is a collective reaction to systemic forces. The fact that there is a high probability that farmers adapt also supports the idea that farmers adapt not because it is favourable but because they need to.

Simultaneously, the gap in the institutional support is also significant, as most farmers do not have access to extension services, and they do not feel that the current policies are effective. Such disconnection between policy models and local reality contributes to the failure of adaptation processes and emerges as a major challenge to governance and practice. Finally, the paper questions simplistic accounts of resilience and vulnerability, instead of promoting a more complex view of adaptation as a constrained and situational process. To achieve sustainable agricultural development, policy interventions should not focus on promoting adaptation as a principle, but geared towards meeting the structural conditions under which this is put into practice. The dynamics therein should be examined in more details in future studies, specifically on what role informal institutions, social networks, and behavioural aspects play that are not thoroughly studied in quantitative models.

8. References

1. Adger WN. Vulnerability. Glob Environ Change. 2006; 16:268-281. Doi: 10.1016/j.gloenvcha.2006.02.006
2. Ahmed M, Hayat R, Ahmad M, Ul-Hassan M, Kheir AM, Ul-Hassan F, *et al*. Impact of climate change on dryland agricultural systems: a review of current status, potentials, and further work need. Int J Plant Prod. 2022; 16(3):341-363. Doi: 10.1007/s42106-022-00197-1
3. Bedeke SB. Climate change vulnerability and adaptation of crop producers in sub-Saharan Africa: A review on concepts, approaches and methods. Environ Dev Sustain. 2023; 25(2):1017-1051. Doi: 10.1007/s10668-022-02118-8
4. Below TB, Mutabazi KD, Kirschke D, Franke C, Sieber S, Siebert R, *et al*. Can farmers' adaptation to climate change be explained by socio-economic household-level variables? Glob Environ Change. 2012; 22(1):223-235. Doi: 10.1016/j.gloenvcha.2011.11.012
5. Béné C, Newsham A, Davies M, Ulrichs M, Godfrey-Wood R. Resilience, poverty and development. J Int Dev. 2014; 26(5):598-623. Doi: 10.1002/jid.2992
6. Biswas RR, Rahman A. Adaptation to climate change: A study on regional climate change adaptation policy and practice framework. J Environ Manage. 2023; 336:117666. Doi: 10.1016/j.jenvman.2023.117666
7. Bryman A. Social Research Methods. 5th ed. London: Oxford University Press, 2016.
8. Da'an SA, Haggai HP, Sabo K, Chuwang G, Chaska AA, Mwansat GS. National policies on climate change in Nigeria: A review. Policy Strategy. 2024; 21(1):117. Available from: https://www.researchgate.net/profile/Muritala-Oke/publication/383646736_Nigerian_Journal_of_Policy_Strategy_SPECIAL_EDITION_Contents/links/66d4fe92b1606e24c2ae4964/Nigerian-Journal-of-Policy-Strategy-SPECIAL-EDITION-Contents.pdf#page=129
9. Deressa TT, Hassan RM, Ringler C, Alemu T, Yesuf M. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. Glob Environ Change. 2009; 19(2):248-255. Doi: 10.1016/j.gloenvcha.2009.01.002
10. Ferreira S. Extreme weather events and climate change: Economic impacts and adaptation policies. Annu Rev Resour Econ. 2024; 16(1):207-231. Doi: 10.1146/annurev-resource-101623-095314
11. Filho WL, Wolf F, Moncada S, Salvia AL, Balogun ALB, Skanavis C, *et al*. Transformative adaptation as a sustainable response to climate change: Insights from large-scale case studies. Mitig Adapt Strateg Glob Change. 2022; 27(3):20. Doi: 10.1007/s11027-022-09997-2
12. Food and Agriculture Organization. Empowering smallholder farmers to access digital agricultural extension and advisory services [Internet]. Rome: FAO, 2021 [Cited 2026 May 10]. Available from: https://openknowledge.fao.org/handle/20.500.14283/cb5944en
13. Grey MS, Manyani A. Integrating local indigenous knowledge to enhance risk reduction and adaptation strategies to drought and climate variability: The plight of smallholder farmers in Chirumhanzu district, Zimbabwe. Jàmbá J Disaster Risk Stud. 2020; 12(1):1-10. Available from: https://hdl.handle.net/10520/ejc-jemba-v12-n1-a21
14. Gumel DY. Assessing climate change vulnerability: A conceptual and theoretical review. J Sustain Environ Manage. 2022; 1(1):22-31. Doi:

10.5281/zenodo.6206933
15. Hilbe JM. Logistic Regression Models. Boca Raton: Chapman and Hall/CRC, 2009.
16. Hosmer DW Jr, Lemeshow S, Sturdivant RX. Applied Logistic Regression. 3rd ed. Hoboken: John Wiley & Sons, 2013.
17. Intergovernmental Panel on Climate Change. Climate Change 2022: Impacts, Adaptation and Vulnerability [Internet]. Geneva: IPCC, 2022 [Cited 2026 May 10]. Available from: https://www.ipcc.ch/report/ar6/wg2/
18. Kumar S, Sengupta K, Gogoi BJ. Interventions for sustainable livelihoods: A review of evidence and knowledge gaps. Int J Soc Econ. 2023; 50(4):556-574. Doi: 10.1108/IJSE-06-2022-0402
19. Liu Y. Paradigmatic compatibility matters: A critical review of qualitative-quantitative debate in mixed methods research. Sage Open. 2022; 12(1):21582440221079922. Doi: 10.1177/21582440221079922
20. Morton JF. The impact of climate change on smallholder and subsistence agriculture. Proc Natl Acad Sci USA. 2007; 104:19680-19685. Doi: 10.1073/pnas.0701855104
21. Nhemachena C, Nhamo L, Matchaya G, Nhemachena CR, Muchara B, Karuaihe ST, *et al*. Climate change impacts on water and agriculture sectors in Southern Africa: Threats and opportunities for sustainable development. Water. 2020; 12(10):2673. Doi: 10.3390/w12102673
22. Nor Diana MI, Zulkepli NA, Siwar C, Zainol MR. Farmers' adaptation strategies to climate change in Southeast Asia: A systematic literature review. Sustainability. 2022; 14(6):3639. Doi: 10.3390/su14063639
23. Olabanji MF, Chitakira M. The adoption and scaling of climate-smart agriculture innovation by smallholder farmers in South Africa: A review of institutional mechanisms, policy frameworks and market dynamics. World. 2025; 6(2):51. Doi: 10.3390/world6020051
24. Omokaro GO. Multi-impacts of climate change and mitigation strategies in Nigeria: Agricultural production and food security. Sci One Health. 2025; 4:100113. Doi:10.1016/j.soh.2025.100113
25. Prasad R, Anil K, Prahlad P, Manohar KN, Rajesh CM, Jadhav A, *et al*. A review on evaluation of the effectiveness of agricultural extension services in adapting to climate change among subsistence farmers. Int J Environ Clim Change. 2024; 14(7):454-465. Doi: 10.9734/ijecc/2024/v14i74286
26. Sapkota M. Implications and critiques of quantitative research: A systematic review. J Learn Theory Methodol. 2024; 5(3):153-159. Doi: 10.17309/jltm.2024.5.3.09
27. Scoones I. Sustainable Rural Livelihoods: A Framework for Analysis. IDS Working Paper 72. Brighton: IDS, 1998.
28. Simane B, Berhane K, Samet J, Oguge O, Atuyambe L, Shah M, *et al*. Food security outlook for Eastern Africa by 2050: Climate change impacts and population-driven demand gaps. Curr Environ Health Rep. 2026; 13(1):8. Doi: 10.1007/s40572-026-00528-8
29. Sulekha L, Darbha S, Bahubalendra S, Sharma N, Chand K, Kashyap M, *et al*. Extension services for sustainable agriculture in integrating agroecology and indigenous knowledge: A review. Plant Arch. 2025; 25(2):1281-1297. Doi: 10.51470/PLANTARCHIVES.2025.v25.supplement-2.159
30. Thottadi BP, Singh SP. Climate-smart agriculture (CSA) adaptation, adaptation determinants and extension services synergies: A systematic review. Mitig Adapt Strateg Glob Change. 2024; 29(3):22. Doi: 10.1007/s11027-024-10113-9
31. Umar N, Gray A. Flooding in Nigeria: A review of its occurrence and impacts and approaches to modelling flood data. Int J Environ Stud. 2023; 80(3):540-561.
32. Yang Y, Tilman D, Jin Z, Smith P, Barrett CB, Zhu YG, *et al*. Climate change exacerbates the environmental impacts of agriculture. Science. 2024; 385(6713):eadn3747. Available from: https://www.science.org/doi/full/10.1126/science.adn3747