Investigating the Deployment of Takaful for Farmers in Flood and Drought-Prone Regions in Nigeria

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ABSTRACT

This study has investigated the deployment of takaful for farmers in flood- and drought-prone regions in Nigeria. The study used a quantitative research design with cross-sectional survey data from smallholder farmers in some climate-prone zones. The results of agricultural losses were modelled as a dependent variable, with participation in Takaful and farm and farmer characteristics as independent variables, using descriptive statistics, tests of means, and multiple regression. It was found that farmers with Takaful schemes experienced a much lower proportion of crop loss than those who were not insured. Regression estimates revealed that Takaful insurance minimised the severity of agricultural losses, holding constant farm size, farming experience, access to extension services, and the region's climatic exposure. The results provided empirical evidence that Takaful insurance increased farmers' ability to absorb climate shocks and stabilise their outcomes after disasters. The research found that Takaful insurance is a suitable risk management instrument for agricultural flood and drought losses in Nigeria. The policy initiatives to enhance climate resilience should thus incorporate agricultural Takaful within the broader adaptive and rural finance policies.

Keywords: Takaful insurance, agricultural risk management, floods and droughts, climate resilience, Nigeria

INTRODUCTION

Agriculture is among the most vulnerable sectors of the Nigerian economy, which still employs a large share of the rural population and is a major contributor to food security, livelihoods, and national development. Nonetheless, the industry has been more exposed to climate-induced shocks, especially floods and droughts, whose frequency, intensity, and spatial extent have increased over the last 20 years. Empirical research has consistently indicated that some of the most pernicious agricultural risks currently encountered in Nigeria are floods and droughts, which are eroding farm productivity, farm incomes, and the long-term incentive to invest among smallholder farmers. Such climatic shocks have resulted in frequent crop failures, post-harvest losses, volatile food prices, and rural poverty, particularly in flood- and drought-prone regions such as the Niger Basin, Benue Trough, portions of North-Central Nigeria, and the semi-arid North West and North East. The continued occurrence of such shocks has revealed structural deficiencies in the current systems of agricultural risk management that expose the inefficiency of informal coping methods, government relief programmes, and traditional insurance systems to provide timely, fair, and sustainable protection to the vulnerable farming families (Hassan & Knight, 2023; Akinkuolie et al., 2025).

The conventional risk-coping strategies used by farmers in Nigeria, such as crop diversification, liquidation of assets, informal savings groups, and reliance on post-disaster government support, have proven inadequate in addressing systemic and covariate climate risks. Droughts and floods occur simultaneously and affect vast geographic regions, making informal risk-sharing inefficient and overwhelming people's relief systems. The literature on Africa and similar developing nations indicates that these mechanisms tend to result in distress sales of productive factors, reduced investment in farms, and intergenerational poverty traps, rather than resilience-building (Yiran et al., 2022; Ncube et al., 2018). Traditional agricultural insurance is theoretically appropriate for addressing risk. However, it has not achieved high penetration in Nigeria due to high premiums, information asymmetry, lack of trust, moral hazard, and ineffective institutional capacity. These constraints have heightened

academic and policy interest in other context-sensitive insurance patterns that can address both exposure to climatic risks and the socio-religious aspects of rural communities.

Takaful insurance has become a potentially life-changing risk management tool for agricultural systems, not only in Muslim-majority and religiously diverse cultures such as Nigeria but also elsewhere. Taking its foundation in the principles of Islamic finance, Takaful is based on cooperation, risk sharing, and collective responsibility, which makes it fundamentally different from conventional insurance, which is often seen as risk transfer and profit-based. The ethical principles of Takaful, such as the ban on excessive uncertainty, interest, and speculative activities, extend beyond social justice and inclusivity, making them especially attractive in areas of vulnerability and lack of trust. Nigeria has experienced a slow emergence of Islamic finance institutions and regulations. The use of Takaful in managing agricultural risks remains in its infancy and has not been well investigated, particularly regarding climate-induced risks such as floods and droughts. Adewusi, A. A. (2025).

Much of the existing literature on agricultural insurance in Nigeria has focused on weather-index insurance, traditional crop insurance programmes, and government intervention, with little empirical research on Takaful as a tool for mitigating weather risk. In instances where Takaful has been reviewed, the focus has been more on awareness, intention to embrace, and general viability, rather than on whether Takaful has been found effective in insuring losses incurred by farmers due to extreme weather conditions. For example, Bello et al. (2024) investigated farmers' intentions to adopt Takaful in a Northwestern region of Nigeria. They found that religious compatibility, trust, and perceived fairness were important factors in determining their intention to use the product. Although these results are informative, the intent does not necessarily translate into effectiveness, nor does it measure the extent to which Takaful mechanisms make people less vulnerable, more stable in their incomes, or more successful in recovering from flood and drought shocks. The need to fill this gap is underscored by the fact that current research does not go beyond behavioural predispositions to examine the actual performance experience of Takaful implementation in high-risk agricultural settings.

The global experience can offer valuable but partial knowledge. Research on the innovative initial paddy-crop Takaful scheme in Malaysia highlights the potential and difficulties of applying Takaful to the management of agricultural risks. Sulaiman (2024) found that crop Takaful schemes can enhance farmers' post-disaster recovery capacity and reduce reliance on government compensation. However, their success depends on institutional design, premium subsidies, and proper risk pricing. The comparatively developed financial infrastructure, availability of data, and the business-friendly climate in Malaysia, however, are markedly different from those in Nigeria and limit the direct transferability of the results. Such a departure requires context-based empirical research that explains the distinct climatic conditions, agricultural organisation, regulatory framework, and social and cultural forces in Nigeria.

The risk of floods and droughts in Nigeria has both temporal and spatial peculiarities that complicate the implementation of insurance. Flooding, often associated with heavy rain, inadequate drainage systems, and overflow from rivers and dams, can cause sudden and widespread crop destruction, especially in low-lying and riverine regions. Droughts, on the other hand, occur slowly, in the form of rainfall deficits and prolonged dry seasons, and mostly affect rain-fed agriculture and animal pastures in semi-arid areas. The two risks result in correlated losses that are difficult to model with traditional actuarial models and increase systemic risk for insurers. The fact that Takaful can pool risks, mobilise collective reserves, and spread losses equally among participants implies that it has a theoretical advantage in managing such covariate risks. However, there remains a lack of empirical data in the Nigerian context.

This study is based on the theoretical foundations of risk-sharing theory and institutional economics, which provide the broader context for Islamic finance. According to risk-sharing theory, welfare outcomes can be enhanced when economic agents share risks rather than offloading them to the market, especially in an uncertain and incomplete market. In agricultural environments where there is exposure to climate variability, risk-sharing arrangements can stabilise consumption, promote productive investment and reduce exposure to shocks. Takaful operationalises this principle by having participants contribute funds to a mutual risk fund, which they use to pay indemnities in the event of loss. Unlike traditional insurance, where premiums are the source of the insurer's earnings, Takaful contributions are considered donations (tabbaru) to help one another, with any excess cash

either returned or held as a contingency fund. The structure has the potential to reduce moral hazard and adverse selection and promote trust and collective ownership (Salaudeen, 2026)

The relevance of Takaful in Nigeria can also be explained through the lens of institutional economics, which emphasises norms, beliefs, and governance structures that influence economic outcomes. Religious values shape much of the financial behaviour, institutional trust, and participation in formal schemes in most Nigerian farming communities. Traditional insurance has been viewed as not fitting with religion or exploitative in application, and consequently, adoption and performance have been low. The ethical and participatory orientation of Takaful could boost institutional legitimacy and compliance, thereby improving operational performance in managing climate risks. However, these hypothetical benefits must be empirically validated, at least in terms of quantifiable impacts such as the sufficiency of loss compensation, income stability, and the rapid recovery of the post-flood/post-drought economy.

Although there is growing academic interest in climate resilience and adaptation measures in Nigeria, insurance-based risk management has yet to develop as much as other interventions. Akinkuolie et al. (2025) found that Nigerian adaptation strategies have been primarily focused on agronomic practices, livelihood diversification, and community-based coping mechanisms, with little consideration of formal financial instruments. On the same note, Mohammed and Favretto (2025) emphasised the importance of livelihood diversification among women farmers in flood-resilient drylands. However, they noted that women would continue to experience income shocks in the absence of high-quality insurance coverage. These results indicate that adopting adaptation strategies is required; however, they alone cannot mitigate the economic impacts of extreme climatic events. Tailored to local values and institutional realities, insurance is an underused component of comprehensive climate risk management.

The use of Takaful in flood- and drought-affected areas in Nigeria as a farmer insurance cover thus raises basic empirical questions about the effectiveness of this risk management tool. Being effective means more than being accessible or embracing; the extent to which Takaful cover cushions income loss improves normalcy after a shock and increases the resilience of insured farmers compared with uninsured farmers. It also implies assessing the ability of Takaful schemes to operate in Nigeria amid climatic instability and socioeconomic limitations. The need to answer these questions has been especially acute, given that Nigeria is becoming more vulnerable to climate extremes and that post-disaster interventions are fast becoming costly fiscal liabilities for government budgets.

It is within this context that the main objective of this study was to discuss the success or failure of implementing Takaful insurance as a risk management tool to cover agricultural losses among farmers in flood- and drought-prone areas of Nigeria. It was based on a single objective: to offer depth, analytical rigour, and policy relevance. This analysis avoided conceptual dilution by focusing solely on effectiveness and provided an empirical evaluation of Takaful's performance in a high-risk agricultural setting. This goal was achieved through a quantitative framework that enabled the statistical recording of the results and their comparison with the available evidence on the management of agricultural risks.

This research has a three-fold contribution. First, it augments the body of literature on Islamic finance by offering one of the first quantitative assessments of the performance of agricultural Takaful in the Nigerian climate risk environment. Second, it contributes to the body of knowledge in climate risk and agricultural economics by incorporating insurance-based risk-sharing into empirical research on the impacts of floods and droughts. Third, it provides policy-relevant insights for regulators, insurers, and development stakeholders to help identify sustainable ways to protect farmers and increase resilience to rising climate threats. By embedding Takaful in the Nigerian context of climatic, institutional, and socioeconomic specificities, the research contributes to a more detailed intervention on how alternative forms of insurance can be applied to agriculture and rural well-being.

LITERATURE REVIEW

The deployment of Takaful to address climate change-related challenges in developing economies is particularly pertinent in regions like Sub-Saharan Africa, where there is a growing demand for Sharia-compliant financial

products to meet diverse economic needs, including agricultural finance (Mahboob et al., 2025). For instance, integrating Islamic social finance instruments into agricultural Takaful models shows promise in enhancing agricultural resilience and farmers' food security (Sulaiman et al., 2025).

In Nigeria, where agricultural development faces numerous challenges, including limited access to finance and climate change, Takaful, a system that provides risk protection based on Islamic principles, offers a viable alternative to conventional insurance (Atah et al., 2024; Dikko, 2016).

Nevertheless, Takaful penetration remains low among Nigerian farmers in flood- and drought-prone regions due to insufficient awareness, entrenched misconceptions, and affordability barriers for low-income households, underscoring the urgency for awareness campaigns and micro-Takaful innovations (Atah et al., 2024; Salaudeen & Zakariyah, 2022; Saleh et al., 2016). Such initiatives could draw lessons from the successful implementation of index-based livestock Takaful products in Kenya, despite initial operational challenges, and explore integrating Takaful education into sermons and leveraging media platforms, as suggested for broader Takaful adoption in Northern Nigeria (Shehu & Abdullahi, 2025).

This approach aligns with findings that emphasise the critical role of culturally and religiously congruent financial products in fostering trust and increasing uptake within communities in Nigeria that are affected by floods and droughts (Nshakira-Rukundo et al., 2021).

Moreover, Takaful and micro-Takaful schemes, grounded in Islamic tenets of taʿāwun and social solidarity, demonstrate potential to shield low-income farmers in Nigeria's flood- and drought-prone areas from climate-induced losses, thereby bolstering agricultural resilience and curtailing poverty cycles (Atah et al., 2019; Hossain et al., 2019).

This becomes particularly relevant in contexts where conventional insurance models are often inaccessible or misaligned with community values, creating a significant gap in financial protection for vulnerable populations (Sukmawan & Sukiman, 2024). The observed limitations in Islamic financial literacy, coupled with restricted institutional outreach and a lack of specific products, further impede the widespread adoption of such instruments in agrarian regions (Masruroh, 2025).

Consequently, bridging this knowledge gap and developing tailored Sharia-compliant products are crucial for leveraging Islamic finance to enhance food security and sustainable development in these vulnerable agricultural communities (Sri Herianingrum etal, 2026). Moreover, the widespread lack of awareness of the importance and benefits of Takaful, especially among small farmholder groups, perpetuates the unavailability of suitable protection schemes, thereby exacerbating financial vulnerability (Fauzi, 2024; Mohammed, 2025).

Most small-scale farmers and individuals operating in the informal sectors of the Nigerian economy face unprotected challenges resulting from floods. In the event of a natural disaster, the assets of these small-scale business owners and individuals are wiped out due to their limited or no access to traditional insurance coverage (Adewusi, 2025).

Atino et al. (2020) extended the conversation beyond crop farmers, asserting that livestock insurance, an important risk management tool, is gaining popularity in Ethiopia. A proper investigation is needed to expand its adaptability nationwide. They explore farmers' willingness and payment capacity in Southern Ethiopia to pay for index-based livestock insurance as an alternative to climate risk mitigation.

Financial intermediaries such as Banks and Insurance companies need to actively support a greener environment, implement "green" policies, and help customers' enterprises adopt clean technology. Hence, to maintain overall sustainability, every financial institution needs to develop a long-term strategy to monitor the environmental impact of its clients. In Sub-Saharan African countries, the livelihoods of the population are severely affected by climate change, leading to declines in crop and livestock production. According to other studies, the amount of arable land per capita in densely populated East African regions is diminishing. In the Horn of Africa, climate change and severe environmental deterioration in forest regions have had a substantial impact on the livestock and agricultural subsectors in recent decades. Due to their limited ability to adapt to the changing environment

and their subpar political systems, Sub-Saharan African countries (SSA) are more vulnerable to it than other regions. Notably, Africa accounts for a tiny fraction of global greenhouse gas (GHG) emissions yet bears the largest burden of climate change impacts. Barre et al., (2024:

South Africa is classified as a semi-arid country with a highly developed and industrialised agricultural sector that contributes substantially to food security in Africa. The country, an upper-middle-income economy with diversified economic activities, produces 17% of Africa's maize crop (Davis-Reddy & Vincent, 2017), where maize is a major staple food, for both human and animal consumption. In addition, maize plays a key role as a base material in the manufacturing sector. The agricultural sector in South Africa is commonly referred to as a dual economy, in which well-capitalised, mostly White commercial farmers operate alongside the majority of resource-constrained Black African smallholder farmers. It is estimated that smallholders, excluding a projected 1.5 million subsistence farmers, outnumber commercial farmers by a factor of 10, with a projected 400,000 smallholder farmers and 40,000 commercial farmers (Chummun & Mathithibane, 2021).

METHODOLOGY

The study used a quantitative research approach grounded in positivist epistemology to empirically investigate the deployment of takaful among farmers in flood- and drought-prone regions in Nigeria (Noor, 2008). Climate change remains one of the most critical challenges confronting Nigeria's farming sector. The country's agriculture is mainly rain-fed (not irrigated). This makes it highly vulnerable to climate change and extreme weather events, such as prolonged droughts, erratic rainfall, flooding, and rising temperatures. The flood-prone regions in Nigeria, according to the Nigerian Meteorological Agency (NiMet), are: Zamfara, Nasarawa, Kwara, Oyo, Lagos, Ogun, Ekiti, Delta, Imo, Anambra, Enugu, Ebonyi, Akwa Ibom, Cross River, Rivers, Edo, Ondo, and Bayelsa. Quantitative methodology was deemed suitable, as it can measure the relationship between variables objectively, test hypotheses, and generalise the results of sampled observations to a defined population, provided that the assumptions of statistics are met (Kothari, 2004; Bhattacharyya, 2006). The selection of this method was also informed by the need to generate numerical evidence to draw policy-relevant conclusions about the effectiveness of insurance in climate-vulnerable agricultural systems (Goundar, 2012; Gupta & Gupta, 2022).

The table below indicates the survey sample, location and size

S/N	State	Location 1	Location 2	Location 3	Number of Farmers (Respondents)
1	Lagos	Epe	Badagry	0	20
2	Oyo	Akinyele	Egbeda	0	21
3	Ekiti	Ado-Ekiti	Ikere	0	16
4	Ogun	Ifo	Abigi	0	20
5	Ondo	Owo	Akure	0	12
6	Zamfara	Bakura	Gusau	Maradun	20
7	Nasarawa	Akwanga	Keffi	0	18
8	Kwara	Iponrin	Apado	Oke-Oyi	20
9	Kogi	Okene	Koton-Karfe		15
10	Adamawa	Jimeta	Damare	Gire	20

11	Borno	Maiduguri	Jere	0	20
12	Delta	Effurun	Ozoro	0	15
13	Imo	Oguta	Ohajiegbema	0	20
14	Anambra	Ayamelum,	Ekwusigo,	Idemili South	20
15	Enugu	Nsukka LGA,	Nkanu-east LGA	0	15
16	Rivers	Abua/Odual,	Ahoada-East,	Ahoada-West	15
17	Kaduna	Kaduna South	Birnin Gwari	0	20
	Total Respondents				307

The study design adopted was an explanatory cross-sectional survey. Such a design was appropriate, as it allowed data to be gathered on the farmers at a single point in time and enabled causal inference about the relationship between participation in Takaful insurance schemes and observed agricultural losses during floods and droughts (Ørngreen & Levinsen, 2017). Explanatory designs are especially suitable when the aim is to evaluate the size and direction of relationships between variables, rather than to describe phenomena alone (Rajasekar & Verma, 2013; Davidaviciene, 2018). The design was also congruent with the study objective, which was centred on the effect and not the process or perception.

The area of study encompassed agricultural zones in Nigeria prone to floods and droughts, as well as the selected states in the North Central, North West, and North East regions of the country, where climate-related agricultural losses are common. The target market consisted of smallholder crop farmers working in these areas. A multistage sampling process was used to obtain a representative sample, accounting for geographical and climatic heterogeneity. In the first stage, state identification was based on documented exposure to recurrent flooding or drought. In the second phase, the sample was randomly selected from agricultural communities in each state. At the last level, individual farming households were randomly selected from community-level registers of farmers. This sampling technique aligned with the principles of quantitative survey research, which emphasise the use of probabilistic selection to reduce sampling bias and increase external validity (Daniel & Sam, 2011; Patel & Patel, 2019).

Structured questionnaires were used to collect primary data by administering them to sampled farmers. The questionnaire was tailored to produce quantitative data on the key variables of the study aim, such as exposure to flood and drought events, Takaful insurance schemes, the extent of losses to agricultural produce, compensation, the recovery period, and stable income after the shock. Continuous and discrete numerical indicators were used to construct measurement scales for econometric analysis. The pretested instrument was to be clear, reliable, and internally consistent, in accordance with normative guidelines for quantitative research (Goddard & Melville, 2004; Saharan et al., 2024). Primary data were also used to supplement secondary data, particularly on the frequency of climatic events and the region's agricultural characteristics.

The study's dependent variable was the agricultural loss outcome, defined as the percentage of crop value lost attributable to flood or drought coverage during the reference production season. This variable provided a quantitative indicator of vulnerability and the degree of loss. The primary independent variable was Takaful insurance integration, measured as a binary indicator of whether a farmer participated in a Takaful scheme during the period under consideration. Some of the control variables were farm size, farming experience, availability of extension services, education level, and exposure to regional climatic conditions. All these controls were added to decouple the impact of Takaful implementation on losses and to minimise omitted variable bias, which is also a best practice in econometrics (Kothari, 2004; Degu & Yigzaw, 2006).

The data analysis was conducted using descriptive and inferential statistics. The initial statistics were descriptive, used to characterise the sampled farmers and to summarise the loss patterns resulting from flood and drought events. Means, standard deviations, and frequency distributions were among the measures used to determine baseline conditions. This was followed by inferential analysis to determine the effectiveness of Takaful insurance. Multiple regression analysis was the primary analytical instrument used to estimate the marginal impact of Takaful participation on agricultural loss outcomes, accounting for other explanatory variables. Regression analysis is generally considered a suitable method for studying cause-and-effect relationships in quantitative research when the dependent variable is continuous (Bhattacharyya, 2006; Gupta & Gupta, 2022).

The econometric model was defined as follows: the farm loss outcome was given as a function of Takaful participation and a vector of control variables. The model, in its estimable form, was expressed as agricultural loss = constant term + coefficients on Takaful participation and the control variables, plus an error term to capture unobserved influences. Ordinary least squares estimation was used, with the classical assumptions of linearity, independence, homoscedasticity, and normality of the error terms. Diagnostic tests were used to assess multicollinearity, heteroscedasticity, and model specification validity, thereby evaluating the strength of the estimated parameters (Rajasekar & Verma, 2013; Daniel & Sam, 2011).

To enhance causal interpretation, further analysis was conducted by comparing the mean loss between insured and uninsured farmers using independent-samples t tests. This relative methodology contributed to the regression results by directly providing statistical evidence of differences in the severity of losses attributable to Takaful participation. This triangulation within a strictly quantitative model improves the internal validity and reliability of the results, as highlighted in the methodological literature (Goundar, 2012; Davidaviciene, 2018).

The research process was conducted with ethical consideration. All respondents provided informed consent to participate, and data confidentiality was maintained. When quantitative research involves human subjects whose survival is directly influenced by the research setting, one of the key requirements is ethical rigour (Saharan et al., 2024).

RESULTS

This section introduces empirical results on the effectiveness of Takaful insurance as a risk management tool to cushion farmers against farming losses from floods and droughts in flood- and drought-prone areas of Nigeria, and presents them statistically. The findings are structured around descriptive statistics, comparisons between insured and uninsured farmers, and econometric estimation of the impact of Takaful participation on agricultural loss outcomes. The results are all quantitative and interpreted accordingly, within the framework of the single study objective.

Table 1: Descriptive Statistics of Key Variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Agricultural loss ratio	0.34	0.18	0.05	0.85
Takaful participation	0.41	0.49	0.00	1.00
Farm size hectares	2.46	1.37	0.40	8.90
Farming experience years	14.8	7.6	2.0	40.0
Access to extension services	0.52	0.50	0.00	1.00

The descriptive statistics show that the average losses of agricultural products due to flooding and drought amounted to about 34 per cent of the total crop value in one production season. This magnitude highlights the scale of climate-induced risk experienced by farmers in the study locations and aligns with existing evidence

documenting significant loss exposure in Nigerian agriculture under climate stress (Hassan & Knight, 2023; Akinkuolie et al., 2025). The average of the Takaful participation variable indicates that 41 per cent of sampled farmers were covered by a Takaful scheme, suggesting that Takaful insurance has not yet achieved significant penetration among climate-vulnerable farming communities. The standard deviation of the loss results is quite high, indicating substantial heterogeneity in exposure and impact, which explains the use of control variables in the subsequent econometric analysis.

Table 2: Mean Comparison of Agricultural Loss Outcomes by Takaful Participation

Group	Mean loss ratio	Std. Dev.	t statistic	p value
Takaful insured farmers	0.26	0.14		
Uninsured farmers	0.40	0.19	7.84	0.000

The independent-samples t-test results also indicate a statistically significant difference in mean agricultural loss outcomes between Takaful-insured and uninsured farmers at the 1 per cent level of significance. The ratio of losses that farmers insured under Takaful schemes was 26 per cent on average, compared with 40 per cent when farmers were not covered. This 14-percentage-point difference indicates that effective loss burden reduction in the cases of floods and droughts was linked to participation in Takaful insurance. This difference in statistical significance provides a tentative indication that the deployment of Takaful was significant in reducing the severity of climate-induced agricultural damage. The observation is also consistent with experience in Malaysia with crop Takaful, where insured farmers have shown better loss absorption and recovery rates than non-participants (Sulaiman, 2024).

Although the mean-comparison analysis is useful, it does not control for confounding variables that can affect loss outcomes. To overcome this weakness, a multiple regression analysis was conducted to identify the marginal effect of Takaful participation on agricultural losses, controlling for farm and farm characteristics.

Table 3: Regression Results on Determinants of Agricultural Loss Outcomes

Variable	Coefficient	Std. Error	t value	p value
Constant	0.612	0.041	14.93	0.000
Takaful participation	−0.128	0.019	−6.74	0.000
Farm size	−0.021	0.008	−2.63	0.009
Farming experience	−0.004	0.002	−2.17	0.031
Extension access	−0.036	0.015	−2.40	0.017
Regional climate exposure	0.057	0.013	4.38	0.000
R squared	0.42			
F statistic	36.8			0.000

The regression findings will provide strong empirical support for the effectiveness of Takaful insurance in minimising agricultural losses from floods and droughts. The coefficient on the Takaful participation variable is negative and statistically significant at the 1 per cent level. In particular, joining a Takaful scheme lowered the agricultural loss percentage by about 12.8 percentage points, with other factors held constant. This level is

economically significant and supports the prior mean-comparison results, demonstrating that the differences in loss outcomes were not determined solely by farm size, experience, and regional exposure.

The argument based on the statistical significance of the Takaful coefficient is that risk-sharing systems incorporated into Takaful arrangements improved farmers' capacity to absorb climate shocks. This is consistent with theoretical risk-sharing models, which predict better welfare outcomes when risks are shared among participants rather than borne individually. The result also aligns with the study by Bello et al. (2024), who identified trust and fairness as the primary factors contributing to Takaful adoption and noted that these institutional characteristics are likely to translate into practical benefits, such as loss reduction, when the scheme is operationalised.

One of the control variables that had a negative and significant association with loss outcomes was farm size, indicating that larger farms had a relatively smaller proportion of losses. This can be an indication of economies of scale, diversified plots or access to resources. The experience in farming also reduced the severity of losses, and the effects of floods and droughts were mitigated by accumulated knowledge and individual adaptive capacity. The availability of extension services greatly reduced losses, indicating the synergistic nature of information and advisory services in managing climate risks. On the other hand, agricultural losses were positively correlated with regional climate exposure, confirming that farmers in high-risk areas were more vulnerable than those in other regions, as observed in climate resilience reports from Nigeria and neighbouring areas (Yiran et al., 2022; Mohammed & Favretto, 2025).

The R-squared value of the model is 0.42, indicating that the model explains 42 per cent of the variation in agricultural loss outcomes using the included variables. This explanatory power is deemed satisfactory in the context of cross-sectional agricultural data, where underlying heterogeneity is present, and it implies that the model has captured important determinants of loss severity. The F statistic, which is found to be statistically significant, also proves the goodness of fit in general and the joint significance of the explanatory variables.

The combined results show that the introduction of Takaful insurance in flood- and drought-affected areas of Nigeria made a statistically and economically significant contribution to minimising agricultural losses for the farmers involved. The consistency of the results across descriptive, comparative, and regression analyses enhances their validity and finalises the efficiency of Takaful as a climate risk management instrument. These results build on the existing body of knowledge by extending beyond the intention to adopt and providing quantitative performance data, thereby filling an imperative empirical gap in research on Islamic finance and agricultural insurance in Nigeria.

DISCUSSION OF FINDINGS

The results of this research are good in terms of quantity, showing that the implementation of Takaful insurance had a meaningful effect in reducing agricultural losses suffered by farmers in climatically vulnerable areas of Nigeria due to floods and drought. The reported decrease in the extent of losses among insured farmers under Takaful is consistent with the broader empirical literature, which highlights the importance of well-organised risk management systems in improving adaptive responses to climate variability. Hassan and Knight (2023) also established that farming households in Nigeria that have adopted autonomous adaptation strategies are typically exposed to high residual risk, implying that insurance-based instruments are essential complements to on-farm adaptation strategies. The success of Takaful recorded in this study consequently supports the debate that the financial risk-sharing instruments can significantly enhance household-level resilience.

The findings are also consistent with regional evidence from West and Southern Africa, where socioeconomic and institutional variables have a profound influence on climate adaptation outcomes. Baffour Ata et al. (2025) found that access to formal risk-mitigation tools would enhance farmers' capacity to cope with drought shocks, and Yiran et al. (2022) showed that frequent flooding would continue to increase food insecurity without adequate financial safeguards. The Takaful loss-reducing effect implies that mutual insurance plans can mitigate this gap by stabilising after-shock incomes. Moreover, the conclusions align with vulnerability research indicating that marginalised populations, such as women farmers, are disproportionately affected by climate

change due to limited access to formal safety nets (Ncube et al., 2018; Onoh et al., 2023). By facilitating more inclusive and sustainable climate resilience in Nigeria's agricultural sector, the deployment of Takaful can reduce aggregate loss exposure.

CONCLUSION

This study explored the effectiveness of Takaful insurance as a risk management tool to protect farmers against losses of agricultural products due to floods and droughts in flood- and drought-prone areas in Nigeria. Using a purely quantitative approach, the study generated empirical data on whether membership in Takaful schemes significantly reduced the magnitude of climate-induced losses among farming families. The results clearly indicate that Takaful insurance plays a statistically and economically significant role in alleviating agricultural losses from extreme weather conditions.

The findings revealed that farmers insured under Takaful schemes had significantly lower proportional crop losses than those who were not insured. This remained strong after adjusting for farm size, farm experience, access to extension services, and exposure to regional climate. The scale and stability of the estimated impacts indicate that Takaful insurance did not simply serve as an inactive financial instrument, but has been playing an active role in stabilising farm-level outcomes in the case of flood and drought shocks. By taking risks together and offering systematic compensation measures, Takaful minimised individual farmers' losses and increased their ability to recuperate within the production cycle.

The results also show that insurance-based risk sharing does not substitute for other adaptation strategies but is rather complementary. Although exposure to climate risk was reduced by factors such as farming experience and access to extension services, it was not eradicated. Takaful insurance met this last risk because agronomic and behavioural adaptations were insufficient to cover the residual risk. This strengthens the claim that, to ensure holistic climate resilience in agriculture, financial tools need to be integrated with conventional adaptation methods.

Politically, the findings highlight the importance of Takaful insurance to the larger climate change adaptation and agricultural finance agenda in Nigeria. Since floods and droughts are becoming increasingly frequent and severe worldwide, the existing reliance on post-disaster relief and informal coping strategies is not only financially unsustainable but also socially ineffective. Well-designed agricultural Takiul schemes could reduce government compensation liabilities, enhance farmers' welfare, and support long-term investment in agriculture. However, it requires effectiveness, institutional credibility, proper risk pooling, and regulatory structures that accommodate it.

Details of AI usage are given below:

Grammarly was used to enhance grammar, spelling, and clarity.

All content was reviewed and finalised by the authors, who accept full responsibility for the work**.**

COMPETING INTERESTS DISCLAIMER

The author has declared that no known competing financial interests, non-financial interests, or personal relationships could have appeared to influence the work reported in this paper.

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