



Research Article

Risk Management Practices Among Rice Farming Households in Anambra State, Nigeria

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Abstract

In Sub-Saharan Africa, the economy relies on agriculture as the cornerstone of its development and Nigeria is not exempted as the nation's economy depends on agriculture for its development. This study investigated the determinants of risk management practices among rice farming households in the study area. A multistage sampling technique was employed in the random sampling of 115 rice farmers. The results revealed that the most significant environmental risks included pests, diseases, flooding, erosion, and soil fertility depletion. Farmers mitigate these risks through various strategies such as diversification, use of improved inputs, and cooperative marketing. However, the adoption of these practices is constrained by factors such as limited access to finance, lack of farmland, poor technical knowledge, and insufficient access to extension services. The study examined the factors influencing the adoption of environmental risk management practices, including factors like extension contact, farm income, and farming experience. Findings revealed that increased access to extension services, farm income, and greater farming experience significantly enhanced risk management capabilities. The study concluded that reinforcing extension services and improving farmers' income and experience can significantly enhance the resilience of rice farmers to environmental risks and contribute to agricultural productivity growth in the study area.

Keywords

Risk Aversion, Rice Farming, Management Practices

1. Introduction

The steady growth in global population has significantly increased the demand for rice across the world. Over the last two decades, global rice demand rose at an average annual rate of 1.2%, reaching 481.6 million tonnes in 2017 [23]. In many developing countries, including Nigeria, cereal grains account

for nearly 60% of total caloric intake [18]. Among these cereals, rice (*Oryza sativa* L.) remains the most important in terms of caloric contribution [5, 18]. While per capita rice consumption is declining in several Asian countries, demand in sub-Saharan Africa (SSA) is rising faster than in any other region

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of the world [17]. In Nigeria specifically, rice consumption has grown at almost four times the global average and now accounts for nearly 20% of Africa's total rice consumption [23]. The average Nigerian consumes between 34.0 and 47.0 kg of rice per year slightly below the global average of 53 kg/person/year [13]. This underscores its centrality to household food consumption patterns. Consequently, boosting domestic rice production has the potential to stimulate economic growth and improve living standards.

Although Nigeria is currently the leading rice producer in Africa, it is simultaneously the second-largest rice importer in the world. In 2016, the country produced an estimated 17.5 million tons of paddy, yielding 5.7 million tons of milled rice after accounting for market surplus. Despite its importance, a substantial gap persists between rice production and consumption in Nigeria. The country relies heavily on the importation of rice to compensate for domestic shortfalls, resulting in an inelastic demand for rice [24]. Nigeria cultivates rice across all agro-ecological zones, from the Sahel in the far north, through the savannah belts, to the mangrove and swampy regions of the south [16, 17]. Despite the nation's 84 million hectares of cultivable land, about 47.62 million hectares (40%) are actively farmed, yet only 21 million hectares (10%) are devoted to rice production [10].

Despite expanding demand, the Nigerian rice subsector faces critical structural constraints. According to [11], rice production and marketing are hampered by weak and inefficient producer–market linkages, underdeveloped processing facilities, low farm productivity, poor post-harvest handling and storage systems, high input costs, inadequate market information, low capacity to meet quality standards, and inefficient distribution networks. These challenges increase uncertainty along the value chain, rendering rice production a risky enterprise. Osanyinlusi & Adeniga (2014) also linked low domestic production volumes to poor resource utilization, institutional bottlenecks and environmental factors [22]. Amusa, Okoye & Enete (2018) further emphasized that environmental conditions largely determine agricultural yield and productivity [3].

Agriculture is inherently risky, and rice production is no exception. Risk and uncertainty arise from biological, climatic and price-related factors that are largely unpredictable [11]. In Nigeria, rice farmers frequently encounter environmental risks including pest and disease outbreaks, flooding, snake bites, bird infestation, and injuries during farm or processing operations [12]. Since agricultural activities depend heavily on natural processes and biological assets, farmers are more exposed to risks than operators in most other economic sectors. Climate change is expected to further increase the frequency and severity of climatic disasters, thereby worsening production risks. Given that the Nigerian rice industry is dominated by smallholder farmers who are highly vulnerable, these challenges are particularly severe.

To mitigate the adverse effects of these risks, farmers must adopt appropriate risk management strategies, and in some

cases, rely on government support when risks exceed their capacity to cope. Risk management involves selecting among available options to reduce the negative impacts of different types of risks. It often requires weighing trade-offs between income variability and expected income [9]. Although some risks may appear inconsequential due to low probability or limited potential loss, effective risk management is essential to prevent unfavorable outcomes and ensure the survival and income stability of farm enterprises [7].

2. Literature Review

Agricultural production is inherently exposed to multiple sources of risk due to its dependence on climatic conditions, biological processes, price fluctuations and institutional uncertainties. In rice production, these risks manifest in various forms ranging from erratic rainfall, pest and disease outbreaks, political instability, market volatility, limited access to credit and weak extension support. Researchers have consistently emphasized the importance of understanding these risks and the strategies adopted by farmers to cope with them, particularly in smallholder-dominated environments where vulnerability is high. The literature generally classifies agricultural risk management into cause-oriented and effect-oriented strategies [14]. Cause-oriented risk management focuses on the identification and minimization of root causes of risk, such as the adoption of improved seeds, timely planting, and proactive information sharing among farmers [15]. Effect-oriented risk management, on the other hand, aims to mitigate the negative impacts of risk events after they occur through practices such as insurance, hedging, and compensation mechanisms.

Empirical studies across Nigeria provide insight into the nature and severity of risks faced by rice farmers. Nto et al. (2014) in a study conducted in Abia State, identified technical and political risks as the most significant production threats with mean ranks of 1.29 and 2.29 respectively. His findings indicated that variability in production technology, input quality, and governance-related issues strongly influence rice output [20]. Complementing this, [1] employed econometric tools and found that financial, marketing, currency and production risks constitute the greatest threats to agro-allied enterprises, highlighting the multidimensional nature of agricultural risk.

Aminu, Balogun & Oke (2020) revealed that farmers in Imo State frequently face pest and disease outbreaks, flooding, bird invasion, soil fertility depletion and injury during field operations [1]. Their results further showed that socioeconomic characteristics such as education, gender, household size, cooperative membership, credit access, extension contact, farm size and income significantly influence farmers' adoption of environmental risk management measures. Evidence from Ogun State by [1] showed that arable crop farmers encounter severe production, personal, marketing, financial, and institutional risks including erratic rainfall, pest and disease attack,

low produce prices, poor access to credit, and lack of government subsidies. The study also reported that preventive, mitigation and coping strategies such as agrochemical use, diversification, cooperative membership, off-farm income participation, hired labour, and borrowing were widely adopted to counteract these risks.

Recent studies have also examined broader resilience strategies such as crop diversification. [6], investigating crop diversification in Northern Ghana, found that occupation, technology adoption, labour availability, extension access and farm size significantly shape diversification decisions, which in turn enhance household food security. Similarly, [21] studied risk management practices in Soba Community, Kaduna State, and found that rice producers strongly favour cause-oriented strategies. Information exchange among producers, market familiarization, and enterprise diversification were the most preferred practices, with mean values of 4.13, 4.11 and 3.81 respectively.

Although these studies provide valuable insights into the sources of risk and the strategies employed by farmers to manage them, they also reveal significant methodological and contextual limitations that justify further research. Most existing studies have been conducted in states such as Abia, Ogun, Kaduna, Imo and regions outside Nigeria, leaving a notable gap in empirical evidence for Anambra State despite its growing engagement in rice farming. Accordingly, there was a compelling need for a study that investigates the determinants of risk management practices among rice farming households in Anambra State, providing context-specific evidence to inform policy, extension delivery, and farmer-support interventions aimed at improving resilience and productivity.

3. Materials and Methods

Study Area

Anambra State is situated between 5 °32' and 6 °45' N, and 6 °43' and 7 °22' E. The State has an estimated land area of 4,865 km² with a population of 4,177 828 people [19]. Anambra state is located in the southeastern part of Nigeria, and comprises 21 local government areas. Ayamelum is a local government area (LGA)20 in Anambra State, with headquarters in Anaku. The towns that make up the local government

are Anaku, Umueje, Omasi, Igbakwu, Umumbo, Omor, Umuerum, and Ifite Ogwari. The communities in the area are notable for food production.

Ayamelum LGA has economic and agricultural potential that can generate funds and create employment. Anaku, Ifite Ogwari, and Omor in Ayamelum are noted for their rice production. The community benefits from the Anambra-Imo River Basin Development Authority (AIRBDA) which enhances its agricultural activities.

Data collection and analysis

The study used primary data collected through questionnaires administered to rice farming households. A multistage sampling procedure was used in selecting the respondents for the study. The first stage was the purposive selection of a rice producing local government area (Amayelum) in the state. The second stage was the purposive selection of five rice-producing communities in Ayamelum local government area (LGA): Anaku, Igbakwu, Umumbo, Ifite Ogwari, and Omor. The third stage involved a random selection of 115 rice-farming households from the five communities. The list of the rice-farming households from each of the five communities was obtained from the Agricultural Development Programmes (ADP) office in Anambra State. The data obtained was subjected to descriptive and regression analyses.

Objectives 1, 2, and 3 were analyzed using descriptive statistics such as frequency, percentage, mean, and Likert scale, whereas objective 4 was achieved using regression analysis. The regression model specification:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \dots \beta_nX_n + U$$

Where:

Y = Risk management practices

β_1X_1 = Age

β_2X_2 = family size

β_3X_3 = Contact with extension agent

β_4X_4 = Farm income

β_5X_5 = Farming experience

β_6X_6 = Educational qualification

U = error term

4. Results

Table 1. Socioeconomic characteristics of the rice farming households.

Variables	Frequency (115)	Percentage	Mean
Gender			
Male	83	72.17	
Female	32	27.83	
Age (Years)			

Variables	Frequency (115)	Percentage	Mean
21-30	8	7.0	46
31-40	21	18.3	
41-50	49	42.6	
51-60	37	32.1	
Educational qualifications			
Informal	26	22.6	4
Formal	89	77.4	
Family size			
0-2	32	27.8	
4-6	75	65.2	0.7
7-9	8	7.0	
Farmland size (ha)			
0.1-0.5	37	32.2	
0.6-1.0	66	57.4	26456.52
1.1-1.5	12	10.4	
Monthly income (₦)			
1,000- 10, 000	28	24.4	
11, 000 – 20, 000	17	14.8	21
21, 000 – 30, 000	12	10.4	
31, 000 – 40, 000	32	27.8	
41,000 – 50, 000	26	22.6	
Extension contact			
Yes	80	69.6	18.26
No	35	30.4	
Farming experience (years)			
1-10	12	10.43	
11-20	49	42.61	21
21-30	33	28.70	
31-40	21	18.26	

Field study 2024

Table 2. Environmental risks encountered in rice farming among rice farming households.

Variables	Mean	Standard deviation	Rank
Pest and disease outbreaks	4.01	1.17	3
Occasional flooding	4.1	1.19	1
Erosion	3.76	1.29	6
Drought	3.68	1.44	10

Variables	Mean	Standard deviation	Rank
Destruction by birds	3.8	1.33	5
Fire outbreak	3.72	1.42	7
Excessive heat	3.71	1.41	8
Soil fertility depletion/degradation	4.02	1.31	2
Injury during field operation	3.4	1.57	11
Snake bite or animal attack	3.4	1.55	11
Land slide in farmlands	3.17	1.61	12
Theft of farm produce	3.86	1.32	4
Unfavorable government policy environment	3.7	1.39	9

Field study 2024

Table 3. Risk management practices adopted by the rice farming households.

Variables	Mean	Standard deviation	Rank
Use of improved inputs (seeds, fertilizers and herbicides) according to recommended specification	4.08	1.25	2
Diversification across various enterprises as an alternative source of income	4.2	1.18	1
Cooperative marketing (group selling)	4.05	1.18	3
Selling or distributing in familiar markets	3.	1.57	4

Field study 2024

Table 4. Determinants of risk management practices among rice farming households.

Variables	Standard error	Coefficient	P-value
Constant	0.341	1.544	1.556
Age	0.152	-0.019	0.899
Family size	0.179	-0.136	0.448
Contact with extension agent	0.117	0.237	0.045*
Farm income	0.108	0.200	0.066*
Farming experience	0.209	0.625	0.003***
Educational qualification	0.201	-0.266	0.188
R Square	0.433		
Adjusted R Square	0.401		
F statistics	13.744		

Field study 2024.

Note. *** = significant at 1%, ** = significant at 5%, * = significant at 10%

5. Discussion

Socioeconomic characteristics of the rice farming households

The socioeconomic characteristics examined were the gender, age, educational qualifications, family size, monthly income, extension contact, and farming experience (see Table 1 above).

Gender

The result reveals that 72.17% of the respondents were male while 32% of the respondents were females. The result agrees with [2] who found that the rice respondents in their study area were majorly male (73.1%). The gender distribution of farmers in this study, where the majority are male, reflects common trends in agricultural settings, especially in sub-Saharan Africa.

Age

The finding reveals that 42.6% of the respondents were within the age range of 41-50 years, 32.1% of the respondents were within the age range of 51-60 years, 18.3% of the respondents were within the age range of 31-40 years, and 7.0% of the respondents were within the age range of 21-30 years. With an average of 46 years, the farmers in this study align with the typical middle-aged farming population found in many developing economies. The result is in conformity with [2] who found that the mean age of the rice farmers in their study was 48 years. The younger demographic (7%) could be seen as a promising sign of the new generation's interest in agriculture, which is essential for the future of the sector.

Educational qualification

The relatively high proportion (77.4%) of farmers with formal education is crucial as it increases the likelihood of adopting improved farming practices. However, the 22.6% of farmers without formal education represents a barrier to effective technology adoption and agricultural innovation, as uneducated farmers may be less likely to benefit from extension services or policy interventions.

Family Size

The study reveals that 65.2% of the respondents have households of 4-6 persons, 27.8% of the respondents have households of 0-2 persons, and 7% of the respondents have households of 7-9 persons. The mean household size was of 4 persons, which is common in rural farming communities. Larger families can provide additional labor, which is essential for smallholder farming. The finding corroborates with [2] who found that the mean (average) household size was 6 persons per farm household in their study area.

Farmland size

The results show that most of the respondents (57.4%) have farmland size of 0.6-1.0 ha, 32.2% of the respondents have 0.1-0.5 ha, and 10.4% of the respondents have 1.1-1.5 ha. The mean farmland size was 0.7 ha. The study agrees with [2] who found that the mean farm size of the correspondents was 0.6ha in their study area.

Monthly income

The monthly income for most of the rice farmers (27.8%) ranged between ₦31,000 and ₦40,000. Another 24.4% earned

between ₦1,000 and ₦10,000, 22.6% between ₦41,000 and ₦50,000, 14.8% between ₦11,000 and ₦20,000, and 10.4% between ₦21,000 and ₦30,000. The average monthly income of ₦26,456.52 is relatively low, reflecting the financial limitations of smallholder farmers. This low income also is indicative of broader poverty trends in rural areas, where the agricultural sector often remains subsistence-based. The findings of this study is consistent with that of [2] who found that the mean (average) rice farm income was ₦485,628.00 in their study area. This shows that rice production is profitable in the area depending on the scale of production.

Extension contact

The relatively high level of contact with extension services (69.6%) suggests that farmers have access to agricultural support, which can lead to improved productivity. However, the remaining 30.4% without extension contact indicates a gap that could be hindering potential improvements in farming techniques.

Farming experience

The results show that 42.61% of the respondents had 11–20 years of farming experience, 28.70% had 21–30 years, 18.26% had 31–40 years, and 10.43% had 1–10 years of farming experience. With an average of 21 years of farming experience, the farmers in this study are likely to be highly knowledgeable about local farming conditions and practices. However, the challenge remains in applying this experience to new farming innovations. The result supports [2] who reported that the mean rice farming experience was 34 years in their study area. This shows that most of the farmers are well endowed with many years of experience in rice production activities.

Environmental risks encountered in rice farming among rice farming households

Rice farming is an essential agricultural activity in many countries, but it is subject to a variety of environmental risks that can threaten crop yields and farmers' livelihoods. The results in Table 2 show that flooding was the most common risk encountered in rice production in the study area. The second most frequently reported risk was soil fertility depletion/degradation, followed by pests and disease outbreak, theft of farm produce, destruction by birds, erosion, fire outbreak, excessive heat, unfavorable government policy, drought, and both injury during field operation and snake bite or animal attack had same mean risk. Lastly, land slide in farmlands were identified as the least common risk (see Table 2). Flooding is a major environmental risk in rice production, as rice is a water-intensive crop typically grown in flooded conditions. However, excessive flooding can lead to crop submergence, root rot, and nutrient leaching, which can severely affect crop growth and quality. Floods can also erode soils, wash away seeds, and create conditions for the spread of waterborne diseases, making them a significant threat to rice production. Soil fertility depletion is one of the most critical issues in rice production. Continuous cultivation without proper soil management practices leads to the exhaustion of essential nutrients, resulting in poor crop yields. Pests and diseases are one of the

most significant risks in rice farming. These factors are known to reduce yields substantially by damaging crops, spreading through fields rapidly, and requiring costly control measures such as pesticides or fungicides. In some cases, pest outbreaks can result in total crop loss if not controlled in time. Birds, particularly during the ripening stage of rice crops, can be a significant threat. They feed on the grains, leading to direct losses in yield. Bird damage is a common problem in rice-growing regions worldwide, and its severity varies depending on the bird species and the time of harvesting. Theft is a significant risk in rural agricultural settings, where rice crops can be stolen either during the growing season or at harvest. Fire outbreaks can destroy rice fields, particularly in regions where dry vegetation is common or where rice straw is left in the field post-harvest. Excessive heat, particularly during the flowering and grain-filling stages of rice, can reduce yields by affecting ability of the plants to photosynthesize and produce grains. With global temperatures rising, the impact of heat stress on rice farming is a growing concern, especially in tropical regions. Government policies, such as fluctuating subsidies, tax rates, or export restrictions, can create an unstable environment for farmers. Policy-related risks are often unpredictable, making it difficult for farmers to plan for the future. Farming is a labor-intensive activity, and workers are often exposed to physical risks, including injuries from machinery, tools, or accidents in the field. These injuries can range from minor cuts to severe accidents, impacting farm productivity and the welfare of the farmers. Landslides are less common but can still occur, especially in regions with steep terrain. The displacement of soil during a landslide can destroy crops, disrupt irrigation systems, and damage infrastructure. This result aligns with [8] who noted that environmental risks have a direct impact on farmers' incomes and pose a significant threat to the long-term sustainability of their farms.

Risk management practices adopted by rice farming households

Rice farmers face various environmental, economic, and social risks that can significantly affect their livelihoods. As a result, adopting effective risk management practices is essential for ensuring sustainability and profitability in rice farming. Based on the data provided, several risk management strategies are being employed by rice farmers, each with varying levels of success. The results in Table 3 indicate that the risk management practice most frequently adopted by the rice farming households was diversification across various enterprises as an alternative source of income. This was followed by the use of improved inputs (seeds, fertilizers and herbicides) according to recommended specification, cooperative marketing (selling in groups) and selling or distributing outputs in familiar markets (see Table 3 above).

Diversification is a well-known risk management practice that allows farmers to spread their financial risks. Diversification can also include varying crop types, which helps protect against crop-specific diseases and pests. Furthermore, income from non-agricultural activities provides a cushion against

fluctuating commodity prices, which can be volatile in rice markets.

Another commonly adopted risk management strategy is the use of improved inputs, such as high-yielding seed varieties, fertilizers, and herbicides. These inputs help mitigate the risks associated with pest attacks, nutrient deficiencies, and poor soil quality. Additionally, the proper use of herbicides reduces the competition from weeds, which can otherwise significantly decrease yields.

Cooperative marketing is another common practice among rice farmers. By selling their produce collectively, farmers can negotiate better prices, reduce transaction costs, and improve market access. Cooperative marketing also helps minimize the risks associated with market uncertainty, such as price fluctuations and changes in demand.

Selling to familiar markets is a risk management strategy that minimizes the uncertainty associated with market access and prices. Familiarity with the market helps farmers anticipate demand trends and adjust their production strategies accordingly.

Determinants of risk management practices among rice farming households

Risk management practices are essential for mitigating the various risks that affect rice farming, such as pests, diseases, and weather-related challenges. The table of results highlights the key determinants of these practices, which include both individual farmer characteristics and external factors (see Table 4 above).

R-Square (0.433) and Adjusted R-Square (0.401): These values indicate that the model explains approximately 43.3% of the variation in the adoption of environmental risk management practices, with the adjusted value accounting for the number of predictors.

F-statistic (13.744): The overall model is statistically significant, indicating that the included variables collectively have a meaningful relationship with the adoption of environmental risk management practices. Six variables which are age, family size, contact with extension agent, farm income, farming experience and educational qualification were regressed to assess their effect on the adoption of risk management practices by the rice farming households. Out of the seven variables, only three variables which are contact with extension agent, farm income and farming experience were statistically significant.

Contact with extension agents had a positive and statistically significant effect on the risk management practices (P -value = 0.045). The findings in this study corroborates with [4] who found that extension services positively influence farmers' decisions to diversify their crop production. Their study showed that access to extension support equips subsistence farmers with essential information that enables them to diversify their crops, thereby helping them meet their nutritional needs through their farming activities.

Farm income also has a positive relationship with risk management practices, though it is significant at the 10% level (P -

value = 0.066). This aligns with a priori expectations, as higher income enhances farmers' financial capacity to adopt improved farming techniques that support effective risk management. [12] reported that increased income enables farmers to confront additional farm risks without becoming risk-averse. Consequently, this can lead to higher output and equip farmers with the resources needed to manage further risks on the farm.

Farming experience has a strong positive and statistically significant effect on the adoption of risk management practices (P-value = 0.003). Farmers with more experience are likely to be more aware of environmental risks and better equipped to manage them through trial and error.

6. Conclusions

The analysis revealed that farmers in the study area faced several environmental risks, including pests, diseases, flooding, erosion, and soil fertility depletion. Among these, soil fertility depletion and occasional flooding were ranked as the most significant environmental risks. In terms of risk management, farmers engaged in strategies such as diversifying income sources, using improved inputs (seeds, fertilizers), and cooperative marketing. However, several factors determined the adoption of these strategies, including a contact with extension agents, access to finance and farming experience.

Based on the findings, the study suggests the following recommendations:

Improved Access to Credit and Financial Support: Since the study indicated that farm income contributes to rice farmers adopting risk management strategies, governments and financial institutions should introduce affordable credit schemes to support farmers in acquiring improved inputs, technology, and insurance.

Enhanced Extension Services: Extension services play a crucial role in educating farmers about risk management strategies and modern agricultural practices. Expanding extension networks and ensuring that farmers receive timely and relevant information could significantly improve their ability to manage environmental risks.

Training and Capacity Building: Investing in farmer education, particularly around new agricultural technologies and sustainable farming practices, will enhance their ability to manage environmental risks. Training programs on soil conservation, pest management, and climate-smart agriculture can help mitigate the impacts of environmental hazards.

Abbreviations

AIRBDA	Anambra-Imo River Basin Development Authority
ADP	Agricultural Development Programmes
PwC	PricewaterhouseCoopers

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Author Contributions

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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