Analysis of Risk Sources and Management Strategies among Maize Farmers in Niger State, Nigeria

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ABSTRACT

The study examines risk sources and management strategies among maize farmers in Niger State, Nigeria. Multi-stage sampling techniques were employed to select 180 respondents on which primary data were elicited from the respondent with the aid of a structured questionnaire complemented with interview schedule using kobo tool box. Data collected were analyzed using descriptive statistics (such as mean, frequency distribution count and percentages) and inferential statistics (such as ordered logit regression model). The study revealed that rise in cost of inputs ($\bar{X} = 4.5$), theft and pilfering ($\bar{X} = 4.5$), pest attack ($\bar{X} = 4.4$), death of the farmer ($\bar{X} = 4.4$) and disease outbreak ($\bar{X} = 4.4$) were the major sources of risk among maize farmers. Also, farming experience (P<0.01), educational level (P<0.05) and farm size (P<0.10) were the major factors influencing farmer's risk attitude in maize production. Lastly, early planting ($\bar{X} = 3.4$), diversification of income ($\bar{X} = 3.2$), local monitoring of weather ($\bar{X} = 3.2$), marketing strategies ($\bar{X} = 3.1$) and financial strategies ($\bar{X} = 3.1$) were the major management strategies adopted by maize farmers. The study recommended that farmers should adopt cost-effective agricultural practices.

Key words: Risk; Sources; Management; Maize and Strategies

INTRODUCTION

Maize (*Zea mays*) is an important cereal crop in Nigeria. It serves as a staple food and a raw material for various agro-based industries. Its cultivation spans across all agricultural zones of the country, and it has transitioned from subsistence farming to commercial production. The demand for maize has increased due to its usage in industries such as beverages, soaps, and pharmaceuticals (Aye and Mungatana, 2017). In addition to its utilization in industrial sectors, maize has multiple agricultural usages. Ohajianya *et al*. (2016) reported that the vegetable part of maize is used for making silage. The crop residue, such as maize stalks and husks, is an essential source of feed for cattle during the dry season. Furthermore, maize grains are a significant component of poultry and pig diets, contributing to the livestock sector's growth and development (Opaluwa *et al*., 2018). Despite its importance, maize production in Nigeria still face challenges, resulting in a supply-demand gap. The current production level is around 11 million tonnes, with an average yield of 1.5 tonnes per hectare (Nto and Mbanasor, 2018). This production level falls short of meeting the increasing demand for maize in various sectors, including food, livestock feed and industrial processing (Aye and Mungatana, 2017). The low yield per hectare can be attributed to risk associated with agricultural production.

Risk is an inherent characteristic in agricultural production and smallholder farmers in particular face numerous

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risks that hinder their ability to operate their farms as businesses. Ermakov and Anisimov (2019) defined risk as an uncertainty that affects an individual's welfare and is often associated with adversity and loss. In the context of smallholder farmers, these risks can have significant implications for their livelihoods and overall agricultural productivity. Committee of Sponsoring Organizations of the Treadway Commission (COSO) (2017) added that risk is characterized by the probability of an event or action occurring and the potential consequences it may have on an organization's objectives. These objectives can vary and encompass a wide range of areas, including financial performance, operational efficiency, reputation, compliance, and strategic goals. The adverse or beneficial effect of risk entails the potential negative or positive outcomes that can result from the occurrence of an event or action. Adverse effects may include financial losses, operational disruptions, reputational damage, legal liabilities, or failure to meet customer expectations. On the other hand, beneficial effects can include opportunities for growth, competitive advantage, innovation, or improved performance (International Organization for Standardization, 2018). Previous studies (Abdul-Rahman *et al.*, 2018; Salisu 2018; Ugochukwu *et al.*, 2019) focus on the challenges faced by maize farmers, there is a need for a more detailed analysis that specifically focuses on the risk sources prevalent in maize farming and the risk management strategies employed by maize farmers in the study area. Other existing literature (Ogunniyi *et al.*, 2017; Ermakov and Anisimov, 2019; Ugochukwu *et al.,* 2019) provides insights into the general risks faced by farmers in the agricultural sector, including factors such as climate variability, pests and diseases, market fluctuations, financial constraints, and production-related issues. However, there is a knowledge gap regarding the specific risk sources that are prominent in the maize farming sector in Nigeria. This identified gap necessitated the conduct of the research which on the risk source and management strategies among maize farmers in Bosso LGA, Niger State, Nigeria. Based on the foregoing the study aimed to:

i. Identify the major sources of risk to maize farmers in the study area
ii. examined the determinants of the maize farmers' attitude to risk in the study area and
iii. identify the management strategies adopted by maize farmers in managing risks in the study area

RESEARCH METHOLOGY

The study was carried out in Niger State, Nigeria. Niger State is located between Latitudes $8^0$22'N and $11^0$30'N and Longitudes $3^0$30'E and $7^0$20'E. The State is bordered by Zamfara and Kebbi States in the North and North-west respectively, Kogi and Kwara States in the South and South-west respectively; while Kaduna State and the Federal Capital Territory (FCT), Abuja, border the State to the Northeast and Southeast respectively. The State shares an international boundary with the Republic of Benin at Babanna, in Borgu Local Government Area. Currently, the State covers an estimated total land area of 74.244sq.km, which is about 8% of Nigeria's total land area (Oni *et al.*, 2021). The population of the State is 3,950,249, comprising 2,082,725 males and 1,867,524 females (National Population Commission (NPC), 2006). As of 2023, the projected population was 5,830,328 at a growth rate of 3.2%.

Multistage sampling technique was used to select 180 respondents for the study from three one LGA from each of the agricultural zones in Niger State. Primary data were elicited from the respondent with the aid of a structured questionnaire complemented with interview schedule using kobotool box, also secondary data from journal and market price data were used. Data collected were analyzed using descriptive statistics (such as mean, frequency distribution count and percentages) and inferential statistics (such as ordered logit regression).

Ordered Logit Regression

The empirical specification of equation is presented as:

$$Y_i = \beta_0 + \beta_i X_i + \varepsilon_i \quad (1)$$

The explicit form of the function is specified as follows:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X+\ldots\ldots\ldots\ldots\ldots\ldots+\beta_nX_n + e_i. \quad (2)$$

The dependent variable (Y) in this case, ordered variable indicating the choice of risk pattern by the various

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farmers.

Where;

Y= Perception of risk. (3= risk averse, 2=risk neutral, 1=risk taker/ preference)

X_1= Age (years)

X_2= Gender (1 if male, 0 otherwise)

X_3= Household size (number)

X_4= Educational status (years of former education)

X_5=Access to extension contacts (1 if yes, 0 if no)

X_6= Primary occupation (1 if full time farmer, 0 other wise)

X_7= Membership of cooperative societies (1, if member, 0 otherwise).

X_8= Marital Status (1 if married, 0 otherwise)

X_9= Access to credit (1 if yes, 0 if no)

X_{10}=Years of farming experience (years)

X_{11}=Cost of improved maize seed (₦)

X_{12}= Farming income (₦)

X_{13}= Farm size (hectares)

X_{14}= Method of land acquire (1 if by inheritance, 0 otherwise)

X_{15}=Total labour employed (man days)

X_{16}= Total investment capital (₦)

β_0 = Constant

$\beta_1 - \beta_{16}$ = Coefficient of the independent variables

RESULTS AMD DISCUSSION

Major Sources of Risk to Maize Farmers

The result in Table 1 presents the major sources of risk to maize farmer in the study area. The study revealed that that maize farmers agreed to all the included variables, however, rise in cost of inputs ($\bar{X} = 4.5$), theft and pilfering ($\bar{X} = 4.5$), pest attack ($\bar{X} = 4.4$), death of the farmer ($\bar{X} = 4.4$) and disease outbreak ($\bar{X} = 4.4$) were the highest rank sources of risk in maize farming. The high costs of agricultural inputs in Nigeria, such as seeds, fertilizers and pesticides, directly affect farmers. Higher input costs reduce farmers' profit margins, making it challenging for them to invest in quality inputs or adopt modern agricultural practices. This can lead to decreased yields, lower overall productivity and potentially hamper the competitiveness of maize farming in the market.

Theft and pilfering pose a direct threat to maize production by causing physical losses and undermining the farmers' sense of security. Stolen crops, machinery or equipment can result in financial setbacks for farmers, disrupting their operations and affecting their ability to invest in future planting seasons. Pest attacks have a

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significant detrimental effect on maize production. Pests can damage crops, leading to reduced yields and lower-quality produce. Beyond immediate losses, recurring pest issues can disrupt planting schedules and necessitate increased use of pesticides, contributing to environmental concerns.

The death of a farmer directly affects maize production by disrupting farming activities and potentially leading to the abandonment of cultivated fields. The lack of a succession plan or support system can result in the discontinuity of agricultural practices, affecting not only the deceased farmer's family but also the wider community. Disease outbreaks pose a severe threat to maize production by compromising crop health and reducing yields. This corroborate with the study of Abdul-Rahman *et al.* (2018) who reported that pest infestation is the most important source of risk for maize farmers in the study area. Others sources of risk in maize production were poor soil nutrient ($\bar{X} = 4.3$), grain spoilage or contamination during processing ($\bar{X} = 4.3$), unfavourable weather condition ($\bar{X} = 4.2$), post harvest losses ($\bar{X} = 4.2$) and lack of storage facilities ($\bar{X} = 4.1$).

Table 1: Major sources of risk

Risk source	WS	WM	Rank	Remark
Rise in cost of inputs	815	4.5	1st	Agreed
Theft and pilfering	807	4.5	1st	Agreed
Pest attack	797	4.4	3rd	Agreed
Death of the farmer	794	4.4	3rd	Agreed
Disease outbreak	789	4.4	3rd	Agreed
Poor soil nutrient	774	4.3	6th	Agreed
grain spoilage or contamination during processing	773	4.3	6th	Agreed
Unfavourable weather	751	4.2	8th	Agreed
Post harvest losses	755	4.2	8th	Agreed
Lack of storage facilities	739	4.1	10th	Agreed
Lack of technical know-how of improved farming technologies	746	4.1	10th	Agreed
Inadequate market information	670	4.1	10th	Agreed
Fluctuation of prices	729	4.1	10th	Agreed
land tenure or disputes with neighboring land owners	735	4.1	10th	Agreed
difficulties in negotiating fair prices with buyers or middlemen	721	4.0	15th	Agreed
Low market demand is a major risk of maize	714	4.0	15th	Agreed
Poor transportation of maize grains to market	717	4.0	15th	Agreed
High interest rate is a major risk of maize	719	4.0	15th	Agreed
Conflict within the community	698	3.9	19th	Agreed

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Government policy is a major risk of maize	703	3.9	19th	Agreed
Inadequate agro-chemicals	685	3.8	21st	Agreed
Inadequate family labour	669	3.7	22nd	Agreed
Inadequate credit facilities is a major risk of maize	670	3.7	22nd	Agreed
Health status of maize farmer	590	3.3	24th	Agreed
High interest	590	3.3	24th	Agreed
non-accessibility of credit to rice producers	590	3.3	24th	Agreed

Source: Field survey, 2023 Note WS= Weighted sum, WM= Weighted mean

Inadequate soil fertility can lead to suboptimal crop growth, reduced yields, and compromised nutritional quality. Inadequate soil fertility hampers optimal crop growth and development, leading to reduced yields and diminished crop quality. Farmers grappling with poor soil nutrient conditions may face challenges in sustaining long-term agricultural productivity. The impact extends beyond immediate yield losses to the overall economic viability of maize farming. More so, grain spoilage, often caused by factors like inadequate storage conditions or pests can result in economic losses for farmers. Additionally, contamination during processing introduces food safety concerns, impacting both consumer health and market confidence.

Determinants of the Maize Farmers' Attitude to Risk

The result in Table 2 presented the ordered logit regression on the determinants of the maize farmers attitude to risk. The Pseudo R-squared was 0.7159 which shows a relatively good fit for the ordered logit model while the chi-square results shows that the likelihood ratio statistics was statistically significant at 1% level of significance, suggesting that the ordered logit model has strong explanatory power of the variables included in the model.

Table 4.5: Determinants of the maize farmers' attitude to risk

Variable	Coefficient	Standard error	t-value
Age	-.1241	.0329	-3.77***
Sex	.9662	1.1913	0.81
Marital status	.3334	.4633	0.72
Farming experience	.3256	.0364	8.94***
Level of education	.1565	.07445	2.10**
Household size	-.2054	.0615	-3.34***
Farm size	.1924	.1101	1.74*
Total labour	-.0206	.01469	-1.41
Cost of fertilizer	.0883	.1245	0.71
Cost of herbicide	.2101	.4677	0.45
Cost of maize	.1066	.2323	-0.46

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Total income	.0091	.3318	-0.03
Pseudo R-squared	0.7159		
LR chi2(13)	4.84		
Log likelihood	-149.51784		

Source: Field Survey, 2023 ***, **,** and ******* implies significant at 10%, 5% and 1% respectively**.**

The Table shows that farming experience, educational level and farm size were positively related to the farmer's risk attitude in maize production and statistically significant at 1%, 5%, 10% probability level respectively. These findings imply that an increase in farming experience, educational level and farm size is associated with a higher likelihood of farmers adopting risk management. This is because increased farming experience often enhances farmer's ability to anticipate and navigate risks effectively. Experienced farmers may have encountered diverse challenges over the years, allowing them to develop practical insights and coping mechanisms.

More so, higher level of education contributes to improved decision-making skills, access to information and the ability to analyze and understand market dynamics. Farmers with a higher educational background may be more receptive to adopting innovative risk management practices. In addition, larger farm sizes often imply greater financial stakes and resource commitments. Farmers managing larger farms may have a stronger incentive to protect their substantial investments, leading them to prioritize risk management. This corroborates with Aye and Mungatana (2017) who reported that level of education has direct relationship with the risk attitude of farmers.

The Table also shows that age and household size were negatively related to the farmer's risk attitude in maize production and statistically significant at 1% probability level. This implies that as age and household size increase, there is a lower likelihood of farmers adopting risk management strategies. Older farmers may be more conservative in their approach to risk, possibly due to a preference for stability and a reluctance to adopt new or unfamiliar practices. With increasing age, there may be a tendency to rely on traditional farming methods that are perceived as safer and more familiar. Larger household size can be associated with increased financial responsibilities and resource constraints. In such households, the focus may shift towards meeting immediate needs and ensuring food security rather than taking on additional risks associated with experimenting with new agricultural practices.

Management Strategies Adopted by Maize Farmers in Managing Risks Risk

Table 3 presented the management strategies adopted by maize farmers in managing risks risk in the study area. It revealed early planting ($\bar{X} = 3.4$), diversification of income ($\bar{X} = 3.2$), local monitoring of weather ($\bar{X} = 3.2$), marketing strategies ($\bar{X} = 3.1$) and financial strategies ($\bar{X} = 3.1$) were the highest ranked among the management strategies adopted by maize farmers. Early planting is a crucial risk management strategy in agriculture. By planting early, farmers aim to capitalize on favourable weather conditions, optimize crop growth and potentially avoid adverse weather events during critical stages of crop development.

Table 3: Management strategies adopted by maize farmers in managing risks risk

Management strategies	WS	WM	Rank	Remak
Early planting	609	3.4	1st	Agreed
Diversification of income	575	3.2	2nd	Agreed
Local monitoring of weather	575	3.2	2nd	Agreed
Marketing strategies	556	3.1	4th	Agreed

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Financial strategies	555	3.1	4th	Agreed
Crop insurance	554	3.1	4th	Agreed
Crop rotation	544	3.0	7th	Agreed
Production strategies	541	3.0	7th	Agreed
sustainable farming practices	534	3.0	7th	Agreed
Soil testing	547	3.0	7th	Agreed
Integrated farming	530	2.9	11th	Agreed
Fertilizer application	520	2.9	11th	Agreed
Proper record keeping	494	2.7	13th	Agreed
Using genetically modified maize varieties	432	2.4	14th	Disagreed

Source: Field survey, 2023

Diversifying income sources is a prudent risk management practice. Farmers who engage in multiple income-generating activities spread their financial risks. Diversification can include cultivating different crops, engaging in livestock farming or participating in non-farming ventures. Local monitoring of weather conditions allows farmers to make informed decisions based on real-time observations. By closely monitoring local weather patterns, farmers can adjust planting schedules, implement protective measures during adverse conditions, and optimize resource allocation. Effective marketing strategies contribute to minimizing market-related risks. Farmers employing sound marketing practices, such as timing sales to coincide with favorable market conditions or accessing diverse markets, can better manage price volatility and market uncertainties. Understanding market dynamics and having a strategic approach to selling agricultural produce are key components of risk mitigation in farming. Financial strategies encompass various practices, including securing insurance, managing debt, and building financial reserves. Farmers adopting financial strategies aim to protect themselves against economic uncertainties.

CONCLUSION AND RECOMMENDATION

From the findings, it can be concluded that the major sources of risk to maize farmer in the study area were rise in cost of inputs, theft and pilfering, pest attack, death of the farmer and disease outbreak. More so, farming experience, educational level and farm size were the major determinant of risk attitude of maize farmers. Lastly, early planting, diversification of income, local monitoring of weather, marketing strategies and financial strategies were the highest ranked among the management strategies adopted by maize farmers. Given the significant concern over the rise in the cost of inputs, the study recommended that farmers should adopt cost-effective agricultural practices. This may involve exploring alternative, more affordable inputs, negotiating bulk purchase discounts with suppliers or participating in cooperative buying initiatives.

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