

# Evaluation of maize farmers' attitude towards risk management and preference for crop insurance in Nigeria

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## Abstract

This study focused on evaluation of maize farmers' attitude towards risk management and preference for crop insurance in Nigeria. Multi-stage method of sampling was used. One hundred (100) maize producers were sampled and selected. Primary sources of data were used for this study and the data were collected through the use of well-structured and well-designed questionnaire. Econometrics and statistical tools employed were used for data analysis. The results obtained show that 51% of maize farmers were risk averse, 21% were risk preferring, and 28% were risk neutral. Age, gender, and education level were statistically and significant predictors influencing risk averse attitudes of maize farmers. Age, farm size, household size, gender, risk aversion, education level, and access to agricultural extension services were the statistically and significant predictors influencing preference of maize farmers for crop insurance policy. Garrett index ranking technique employed for risk management strategies and crop insurance policy adopted by maize farmers show that crop diversification was ranked 1<sup>st</sup>, weather information was ranked 2<sup>nd</sup>, crop insurance was ranked 3<sup>rd</sup>, and off-farm activities was ranked 4<sup>th</sup> respectively. The results of constraints faced by maize producers revealed that lack of extension services was ranked 1<sup>st</sup>, lack of credit facilities was ranked 2<sup>nd</sup>, inadequate knowledge of agricultural insurance was ranked 3<sup>rd</sup>, high premium of agricultural insurance was ranked 4<sup>th</sup>, while lack of fertilizer was ranked 5<sup>th</sup> respectively. The constraints retained explained 74.85% of all constraints in the analysis. The study recommends that extension officers should be employed to disseminate research results, innovations and information on risk management strategies and crop insurance to maize farmers. Weather information should be made available to maize farmers, and credit facilities at low interest rate should be provided to maize farmers. Bureaucratic process and cumbersome administrative procedures in accessing credit facilities should be removed.

**Keywords:** Risk Management, Crop Insurance, Maize Farmers, Kaduna State, Nigeria

## INTRODUCTION

Agricultural production is a risky business, and maize farming is faced or characterized with risk and uncertainties such as unforeseen weather conditions, drought, fire outbreak, flood, pests, disease infestations, theft, injury, changes in government policies and market conditions which cause variations in commodity output prices and yields (Yanuarti *et al.*, 2019). Smallholder farmers

faces many risks in their maize farming business which makes their income unpredictable and unstable from year to year. The major risks in agricultural production include: marketing risk, production risk, financial risk, human risk, and institutional risk (Aminu *et al.*, 2019). Risk in agriculture has negative effects on market stability, farmers' income, food security, and can lead to long term poverty (Akinola, 2014). Smallholder or resource poor or peasant farmers are risk averse, risk averse maize farmers are less willing to take investment and activities that have higher expected outcomes with associated risk of failure. Risk averse maize farmers were those trying to avoid taking risk, risk preferring maize farmers were those open to risky options, while risk neutral maize farmers were indifferent to risky options. Resource poor farmers naturally avoid taking risk that might threaten their livelihood, they avoid investment that involve risks which are capable of increasing output (Oparinde *et al.*, 2018). In developing or sub-Saharan countries, smallholder or resource poor or peasant farmers are not willing to adopt new innovations or technologies even when these new modern technologies have higher returns to labour and land than traditional technologies. Smallholder maize farmers make difficult investment decisions on fertilizers, labour, repairs and equipment's during the production cycle, even when he does not know whether he will be able to pay back the loan obtained. Maize farmers differ in their various ways they make investment decisions under risk and uncertainties and this differences defined the differentials in their risk attitudes. Risk management strategies involves choosing among available alternative strategies with the aim of decreasing the impact of risks. Risk management strategies vary from farm to farm and it involves the use of risk assessment technique to evaluate the degree of risk, and to develop strategies to ameliorate the risk and minimize the extent of risk to acceptable level (Obike *et al.*, 2017). The farmers' behaviors are critical for proper risk management in agricultural production. Appropriate risk perception is necessary for choosing an effective risk coping strategies, maize producers that is not aware of the risk faced cannot manage the risk effectively. It is important to understand risk information at the local farm level before developing an effective policy to assist farmers. Crop insurance is a risk management tool for maize farmers to mitigate against climate and adverse natural hazards (Ngango *et al.*, 2022; Ellis, 2017). Maize farmers lack basic knowledge about crop insurance and have difficulties in obtaining information on weather, which bring about low outreach and uptake of crop insurance in sub-Saharan Africa. Crop insurance help to insure maize farmers against any losses due to drought, theft, fire outbreak, outbreak of pest, disease infestations, and natural catastrophe. It is designed to provide cover for financial loss incurred by farmers due to reduction in expected maize output. When loss occur in agricultural production, the insurer pays the policy holder a certain amount of money known

as premium to secure his life and property (Gbigbi and Ndubuokwu, 2022). The high premium payments created barrier for the maize farmers not to register for insurance, in developed countries, government subsidize premium and makes insurance coverage more attractive (Nwosu *et al.*, 2012). Effective and sustainable risk management strategies for maize producers requires coordination at three different levels which involves the state, farm and markets (Sulewski and Kloczko-Gajewska, 2014). The unsatisfactory image of the insurance industry regarding low compensations, low income of maize farmers, poverty, small farm holdings, and burden of payments of premium were factors impeding willingness of maize farmers to register for insurance coverage.

Maize (*Zea mays*) ranks third after sorghum and millet as the most significant and important cereal in Nigeria. Maize can be used for food for man, for livestock feed and as resource input or raw materials for industries (Alabi and Abdulazeez, 2018). Maize is an essential material for the industrial production of fuel, starch, medicine, and food sweeteners (Egwuma *et al.*, 2019; Amanza *et al.*, 2021). Nigeria produces 10 million metric tonnes of maize in 2020 and 11.6 million metric tonnes of maize in 2021, this is about 16% increase over the previous year 2020 (USDA, 2021). Maize is a source of income for smallholder farmers and also source of foreign exchange earnings for sub-Saharan or developing and developed countries. In Nigeria, maize is used by brewing industries for producing various types of beer, production of maize flour by milling industries, corn flakes and confectionary for human consumption. Maize is a good source of minerals, protein, carbohydrates, iron, and Vitamin B.

### Objectives of the Study

This study focused on evaluation of maize farmers' attitude towards risk management and preference for crop insurance in Nigeria. Specifically, the objectives were:

- determine the attitudes of maize farmers towards risk and uncertainty,
- evaluate factors influencing risk attitudes of maize farmers,
- evaluate factors influencing preference for crop insurance policy by maize farmers,
- determine the risk management strategies, and crop insurance policy adopted by maize farmers, and
- examine the constraints facing maize farmers in the area of study.

### METHODOLOGY

This study was carried out in Kaduna State, Nigeria. Kaduna State occupies between Longitudes 06° 15' and 08° 50' East and Latitudes 09° 02' and 09° 02' North of the equator. The State has land area totaling 4.5 million hectares. The state vegetation is divided into two (2), the

Southern guinea savanna and Northern guinea savanna. There are 2 seasons in Kaduna State. The seasons are: dry and wet seasons, the dry season is between October to March, and the wet season happens to starts from April to October, in between the dry and wet seasons is the brief harmattan period which span from November to February. The mean or average rainfall is about 1,482mm, the temperature of Kaduna State ranges from 35°C to 36°C, which can be as low as 10°C to 23°C during the harmattan period. The population of Kaduna as at 2021 was 8.9 million people. They are involved in agricultural activities. Crops grown include: tomatoes, okra, pepper, maize, ginger, sorghum, rice, yam, cassava, and millet. Animal reared include: cattle, goats, sheep, rabbit, and poultry. Multi-stage method of sampling was used. One hundred (100) maize producers were selected. Data obtained from maize producers were of primary sources and the data were collected using well-designed and also well-structured questionnaire. The questionnaire was administered to maize producers using well trained enumerators. Data were analyzed using the following statistical and econometrics tools:

**Cobb-Douglas Production Function Model**

The model is stated thus:

$$\begin{aligned} \log Y = & \alpha_0 + \alpha_1 \log X_1 + \alpha_2 \log X_2 + \\ & \alpha_3 \log X_3 + \alpha_4 \log X_4 + \alpha_5 \log X_5 \\ & + \alpha_6 \log X_6 + U_i \dots \dots \dots (1) \end{aligned}$$

- Y = Yield of Maize in Kg,
- X<sub>1</sub> = Age of Farmers in Years,
- X<sub>2</sub> = Farm Size in Hectares,
- X<sub>3</sub> = Labour Input in Mandays,
- X<sub>4</sub> = Chemical Input in Litres
- X<sub>5</sub> = Seed Input in Kg
- X<sub>6</sub> = Fertilizer Input in Kg
- U<sub>i</sub> = Error Term,
- α<sub>1</sub> – α<sub>6</sub> = Regression Coefficients,

The input price, output price, elasticity of production of the input of interest, and coefficient of variation of maize yields were used to estimate the value of risk parameter. This was used to specifically achieve objective one (i).

**Risk Analytical Tool**

The formula for calculating risk parameter is stated thus:

$$K(s) = \frac{1}{\theta} \left[ 1 - \frac{P_i X_i}{P f_i \mu y} \right] \dots \dots \dots (2)$$

- Where,
- K(s) = Risk Parameter
- θ = Coefficient of Variation of Yield
- P<sub>i</sub> = Factor Price (Fertilizer Price per Kg)
- X<sub>i</sub> = Input Level of Interest (Fertilizer in Kg/ha)
- μy = Mean Yield of Maize
- f<sub>i</sub> = Elasticity of Production of the Input of Choice (Fertilizer Input)
- P = Price of Output Maize/Kg

The coefficient of variation of maize yield was calculated as follows:

$$\theta = \frac{\sigma y}{\mu y} \dots \dots \dots (3)$$

- Where,
- σy = Standard Deviation (Units)
- μy = Mean Yield (Units)

Maize farmers can be classified as follows:

- Risk Preferring = K < 0
- Risk Neutral = 0 ≤ K < 0.4
- Risk Averse = 0.4 ≤ K < 2.0

This was used to specifically achieve objective one (i).

**Multinomial Logit Regression Model**

The general multinomial Logit model is stated thus:

$$\Pr(y_i = j) = \frac{\exp(X_i \beta_j)}{1 + \sum_{j=1}^j \exp(X_i \beta_j)} \dots \dots \dots (4)$$

And to ensure identifiability,

$$\Pr(y_i = 0) = \frac{1}{1 + \sum_{j=1}^j \exp(X_i \beta_j)} \dots \dots \dots (5)$$

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U_i \dots \dots \dots (6)$$

Y=Dichotomous Response Model (1,Risk Preferring;2,Risk Averse;3,Risk Neutral),

$X_1$ =Age of Maize Farmers in Years,

$X_2$ =Farm Experience in Years,

$X_3$ =Household Size (Units)

$X_4$ =Gender (Dummy,1,Male;0,Otherwise)

$X_5$ =Marital Status (Dummy,1,Married;0,Otherwise)

$X_6$ =Level of Education(Likert,0,Non-Formal;1,Primary;2,Secondary;3,Tertiary)

$X_7$ = Extension Contacts (Number)

$X_8$ =Membership of Cooperative Organizations (Dummy,1,Member;0,Otherwise)

$U_i$ =Error Term,

$\beta_1$ - $\beta_8$ =Regression Coefficients,

$\beta_0$ =Constant Term,

This was used specifically to achieve objective two (ii).

### Probit Dichotomous Regression Model

The dichotomous response model is defined as follows:

$$Y = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \alpha_7 Z_7 + \alpha_8 Z_8 + U_i \dots \dots \dots (7)$$

Y= Dichotomous Response Model (1,Preference for Crop Insurance Policy;0,Otherwise),

$Z_1$ = Age of Maize Farmers in Years,

$Z_2$ = Farm Size in Hectares,

$Z_3$ = Household Size in Units

$Z_4$ = Gender (Dummy,1,Male;0,Otherwise)

$Z_5$ = Risk Aversion(Dummy,1 High;0,Otherwise)

$Z_6$ = Level of Education(Likert,0,Non-Formal;1,Primary;2,Secondary;3,Tertiary)

$Z_7$ = Access to Extension Services (Dummy,1,Access;0,Otherwise)

$Z_8$ = Memberships of Cooperative Organization (Dummy,1,Member;0,Otherwise)

$U_i$ = Error Term,

$\alpha_1$ - $\alpha_8$ = Regression Coefficients,

$\alpha_0$ = Constant Term,

This was used specifically to achieve objective three (iii).

### Henry Garrett Index Ranking Technique

According to this technique, maize farmers were employed to specify the rank for all risk management strategies and crop insurance policy as factors and the results of the ranking were converted into appropriate score value. The percentage score is calculated as follows:

$$\text{Percentage Score} = \frac{100(R_{ij} - 0.5)}{N_j} \dots \dots \dots (8)$$

Where,

$R_{ij}$  = Rank  $i^{\text{th}}$  Item  $j^{\text{th}}$  Individual,

$N_j$  = Number or Item Ranked by  $j^{\text{th}}$  Individual,

This was used specifically to achieve part of objective four (iv)

### Principal Component Analysis

The constraints facing maize farmers was subjected to principal component analysis. This was used specifically to achieve objective five (v).

## RESULTS AND DISCUSSION

### Attitudes of Maize Farmers towards Risk and Uncertainties

The risk attitudes of maize farmers towards risk and uncertainty was evaluated and the results were presented in Table 1. About 51% of sampled respondents were risk averse maize farmers,28% were risk neutral, while 21% were risk preferring maize farmers. Risk averse maize farmers tried to avoid taking risk, risk preferring maize farmers were open to risky options, while risk neutral maize farmers were indifferent to risky options. Smallholder, smallscale, resource poor, peasant, farmers had low income thereby do not like taking risk. Risk ability are linked to financial ability of maize farmers to take loss or small gain, they can only involve in risky situations when the maize farmers had opportunity of making more profits.

### Factors Influencing Risk Attitudes of Maize Farmers

The predictors influencing risk attitudes of maize farmers was examined using multinomial Logit model. The regressors under consideration in the multinomial Logit model were age of maize farmers, farm experience, gender, household size, education level, marital status, extension contacts, and member of cooperatives. The risk preferring maize farmers was used as reference group. The regression coefficients of gender, age, education level marital status, and membership of cooperatives of risk averse maize farmers were positive. This signifies that the probability of being risk averse maize farmers tend to increase with the positive signs of

the predictors. The statistically and significant predictors influencing risk averse attitudes of maize farmers were age, education level at ( $P < 0.05$ ), and gender at ( $P < 0.01$ ). The Log Likelihood (value of 96.241 was significant

**Table 1.** Attitudes of Maize Farmers towards Risk and Uncertainties

Risk Attitudes	Frequency	Percentage
Risk Preferring	21	21.00
Risk Neutral	28	29.00
Risk Averse	51	51.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

Source: Data Computation (2021).

at ( $P < 0.01$ ) and this confirmed that all the gradients of the coefficients from regression were statistically and significantly different from zero. The Pseudo- $R^2$  value of 0.5820 confirmed that the model is of good fit and all the gradients of the coefficients from regression were statistically and significantly from zero.

**Factors Influencing Maize Farmers Preference for Crop Insurance**

The results of Probit dichotomous regression model of factors influencing maize farmers'

preference for crop insurance was shown in Table 3. The predictors under consideration in the Probit regression dichotomous model were age, farm size, gender, risk aversion, level of education, access to agricultural extension services, and membership of cooperative organizations. The results show that farm size, household size, gender, risk aversion, level of education, access to agricultural extension services were statistically and significant regressors influencing preference for crop insurance policy by maize farmers at ( $P < 0.05$ ). Age of maize farmers was statistically significant predictor influencing preference for crop insurance policy at ( $P < 0.01$ ). The negative coefficient of age shows that the

probability of preference for crop insurance policy decreases as maize farmers get older keeping all other regressors constant. This signifies that older maize farmers are more conservative and risk-averse than younger ones who are receptive to ideas and more innovative. The gender of maize farmers was positive and statistically significant at 5% probability level, male respondents had higher probability of preference for crop insurance policy compared to female counterparts because male farmers are decision makers among the farming households with regards to their access to resources and partaking in agricultural insurance projects. Risk aversion negatively affects the preference for crop insurance policy, this implies lack of trust in the credibility of the insurer and this is likely to affects their insurance preference. Diagnostic statistics showed that the Probit regression dichotomous model had a good fit with Wald chi-square test statistics that was statistically significant at 1% probability level. This shows the regressors variables were relevant in explaining the preference decisions. The diagnostics statistics of Pseudo  $R^2$  value was 0.7213, this is another measure of goodness of fit of the model.

**Risk Management Strategies and Crop Insurance Policy Adopted by Maize Farmers**

**Application of Garrett Index Ranking Technique**

The risk management strategies and crop insurance policy adopted by maize farmers was examined by Garrett index ranking technique and was adequately shown in Table 4. Based on the ranks assigned by the maize farmers, the order of importance of risk management strategies and crop insurance policy was identified. To find the most significant factor influencing the maize farmers' preference for risk adaptation strategies and crop insurance policy, Garrett index ranking technique was employed. The technique was calculated as percentage score, and the scale value was estimated by employing Garrett scale conversion Table. The percentage score for

**Table 2.** Multinomial Logit Results of Factors Influencing Risk Attitudes of Maize Farmers

Factors	Parameters	Risk Averse		Risk Neutral		Risk Preferring
		Coefficient	t-value	Coefficient	t-value	Coefficient
Age of Maize Farmers ( $X_1$ )	$\beta_1$	0.1724**	2.91	-0.0032	-0.27	-0.1702
Farm Experience ( $X_2$ )	$\beta_2$	-0.2410	-1.29	0.0218	0.02	0.0721
Household Size ( $X_3$ )	$\beta_3$	-0.1201	-1.45	0.0161	0.49	0.0923
Gender ( $X_4$ )	$\beta_4$	0.3421***	3.91	0.2980	0.42	-0.3198
Marital Status ( $X_5$ )	$\beta_5$	0.3930	0.79	-0.1287	-1.10	0.4120
Level of Education ( $X_6$ )	$\beta_6$	0.1923**	2.87	-0.2109	-0.65	-0.0642
Extension Contacts ( $X_7$ )	$\beta_7$	-0.2208	-1.21	-0.3108	-0.57	0.4509
Membership of Cooperative ( $X_8$ )	$\beta_8$	0.1132	1.09	0.0236	0.24	-0.4509
Constant	$\beta_0$	-3.2109**	-2.65	0.4035	0.34	5.5203
Log Likelihood = 96.241***						
Wald Chi Square=1092.24***						
Pseudo =0.5820						

Source: Data Analysis (2021). \*Significant at ( $P < 0.10$ ), \*\*Significant at ( $P < 0.05$ ), \*\*\*Significant at ( $P < 0.01$ ).

each rank from 1 to 12 was estimated. The percentage score evaluated for all the twelve ranks were converted appropriately into scale values using Garrett scale conversion table. The estimated scale values for 1<sup>st</sup> rank to 12<sup>th</sup> ranks were 84, 73, 67, 61, 57, 52, 48, 44, 40, 34, 27, and 17 respectively. The ( $fx$ ) (score value) was evaluated for each factor appropriately by multiplying the obtained number of respondents ( $f$ ) with respective calculated

scale values ( $x$ ). The total scores were found by adding the score values ( $fx$ ) of each rank for every factor. The mean score was then estimated to know the appropriate order of importance or preference given by the maize farmers for the factors. In Table 4, it is clear that maize farmers were giving more importance to crop diversification (58.67), followed by weather information (53.95), crop insurance (52.29), off-farm activities (51.69), and the least

**Table 3.** Results of Probit Dichotomous Regression Model of Factors Influencing Maize Farmers Preference for Crop Insurance Policy

Factors	Parameters	Coefficients	P-value
Age ( $Z_1$ )	$\alpha_1$	-0.035***	-0.001
Farm Size ( $Z_2$ )	$\alpha_2$	0.231**	0.041
Household Size ( $Z_3$ )	$\alpha_3$	-0.142**	-0.032
Gender ( $Z_4$ )	$\alpha_4$	0.301**	0.039
Risk Aversion ( $Z_5$ )	$\alpha_5$	-0.290**	-0.028
Level of Education ( $Z_6$ )	$\alpha_6$	0.430**	0.033
Access to Extension Services ( $Z_7$ )	$\alpha_7$	0.329**	0.021
Memberships of Cooperative Organization ( $Z_8$ )	$\alpha_8$	0.371	0.481
Constant	$\alpha_0$	0.261	0.642
Wald Chi <sup>2</sup>	67.21***		
Pseudo R <sup>2</sup>	0.7213		
Prob > Chi <sup>2</sup>	0.0000		
Number of Observations	100		

Source: Data Analysis (2021) \*Significant at (P<0.10), \*\*Significant at (P<0.05), \*\*\*Significant at (P<0.01).

**Table 4.** Garrett Index Ranking Technique of Risk Management Strategies and Crop Insurance Policy Adopted by Maize Farmers

Strategies/ Insurance Policy	Rank Given by Maize Farmers												Total	Mean	Rank
	1 <sup>st</sup> 84	2 <sup>nd</sup> 73	3 <sup>rd</sup> 67	4 <sup>th</sup> 61	5 <sup>th</sup> 57	6 <sup>th</sup> 52	7 <sup>th</sup> 48	8 <sup>th</sup> 44	9 <sup>th</sup> 40	10 <sup>th</sup> 34	11 <sup>th</sup> 27	12 <sup>th</sup> 17			
Crop Diversification	12 (1008)	16 (1168)	10 (670)	15 (915)	7 (399)	8 (416)	10 (480)	3 (132)	4 (160)	9 (306)	6 (162)	3 (51)	<b>5867</b>	<b>58.67</b>	<b>1<sup>st</sup></b>
Wealth Savings	8 (672)	7 (517)	6 (402)	7 (427)	4 (228)	11 (572)	8 (384)	12 (528)	8 (320)	7 (238)	10 (270)	12 (204)	<b>4762</b>	<b>47.62</b>	<b>10<sup>th</sup></b>
Loan Facilities	6 (504)	7 (511)	10 (670)	9 (549)	10 (570)	8 (416)	7 (336)	9 (396)	8 (320)	8 (272)	9 (243)	9 (153)	<b>4940</b>	<b>49.40</b>	<b>7<sup>th</sup></b>
Extension Services	6 (504)	7 (511)	9 (603)	11 (671)	8 (456)	11 (572)	7 (336)	4 (176)	8 (320)	8 (272)	10 (270)	11 (187)	<b>4878</b>	<b>48.78</b>	<b>8<sup>th</sup></b>
Selling Assets	8 (420)	9 (657)	7 (469)	4 (244)	8 (456)	11 (572)	6 (288)	7 (308)	11 (440)	9 (306)	5 (135)	12 (204)	<b>4499</b>	<b>44.99</b>	<b>11<sup>th</sup></b>
Crop Insurance	7 (588)	13 (949)	11 (737)	15 (915)	5 (285)	7 (364)	8 (384)	4 (176)	10 (400)	3 (102)	4 (108)	13 (221)	<b>5229</b>	<b>52.29</b>	<b>3<sup>rd</sup></b>
Cooperative Societies	6 (420)	9 (657)	13 (871)	6 (366)	4 (228)	12 (624)	7 (336)	10 (440)	7 (280)	11 (374)	5 (135)	10 (170)	<b>4901</b>	<b>49.01</b>	<b>8<sup>th</sup></b>
Insurance Awareness	11 (924)	7 (511)	9 (603)	10 (610)	9 (513)	6 (312)	8 (384)	5 (220)	9 (360)	4 (136)	12 (324)	10 (170)	<b>5067</b>	<b>50.67</b>	<b>5<sup>th</sup></b>
Off-Farm Activities	13 (1092)	8 (584)	6 (402)	7 (427)	9 (513)	3 (156)	12 (576)	14 (616)	5 (200)	6 (204)	11 (297)	6 (102)	<b>5169</b>	<b>51.69</b>	<b>4<sup>th</sup></b>
Use of Agrochemicals	7 (588)	9 (657)	10 (670)	14 (854)	12 (684)	6 (312)	4 (192)	5 (220)	3 (120)	10 (340)	9 (243)	11 (187)	<b>5067</b>	<b>50.67</b>	<b>5<sup>th</sup></b>
Use of Resistant Varieties	8 (672)	9 (657)	5 (335)	6 (366)	7 (399)	9 (468)	6 (288)	11 (484)	13 (520)	9 (306)	7 (189)	10 (170)	<b>4854</b>	<b>48.54</b>	<b>9<sup>th</sup></b>
Weather Information	9 (756)	12 (876)	11 (737)	9 (549)	8 (456)	7 (364)	6 (288)	10 (440)	11 (440)	10 (340)	3 (81)	4 (68)	<b>5395</b>	<b>53.95</b>	<b>2<sup>nd</sup></b>

Source: Data Computation (2021).  $fx$  = Figures in Brackets

importance is given by selling assets (44.99).

### Constraints Faced by Maize Farmers: Application of Principal Component Model or Factor Analysis

The constraints faced by maize farmers was subjected to principal component analysis or factor analysis and the result was presented in Table 5. Lack of extension services was ranked 1<sup>st</sup> with Eigen-value of 1.9834 and this explained 19.34% of all constraints included in the

facing maize producers include: lack of extension services (1<sup>st</sup>), lack of credit facilities (2<sup>nd</sup>), inadequate knowledge of agricultural insurance (3<sup>rd</sup>), high premium of agricultural insurance (4<sup>th</sup>) and lack of fertilizers (5<sup>th</sup>). This research work provides the following recommendations:

- Extension officers should be employed to teach and disseminate research results, new ideas and innovations on risk management strategies and crop insurance among others to maize farmers.

**Table 5.** Principal Component Analysis of Constraints Faced by Maize Farmers

Constraints	Eigen-Value	Difference	Proportion	Cumulative
Lack of Extension Services	1.9834	0.3425	0.1934	0.1934
Lack of Credit Facilities	1.8210	0.2756	0.1536	0.3470
Inadequate Knowledge of Agricultural Insurance	1.7521	0.2664	0.1435	0.4905
High Premium of Agricultural Insurance	1.6342	0.2338	0.1373	0.6278
Lack of Fertilizers	1.5362	0.2201	0.1207	0.7485
Bartlett Test of Sphericity				
KMO	0.723			
Chi Square	3051.39***			
Rho	1.000000			

Source: Computed from Data Analysis (2021). \*\*\*-Significant at 1% probability level

principal component model. Lack of credit facilities was ranked 2<sup>nd</sup> with Eigen-value of 1.8210 and this explained 15.36% of all constraints included in the model. All the constraints included in the model explained 74.85% of all constraints included in the model. The chi-square value of 3051.39 was significant at 1% probability level. This signifies that the model is of good fit.

### CONCLUSION AND RECOMMENDATIONS

This study has basically established that the attitudes of maize farmers to risk and uncertainties can be categorized into risk preferring, risk neutral and risk averse. Risk averse maize farmers tried to avoid taking risk, risk neutral were those that were indifferent to risky options, while risk preferring were maize farmers open to risky options. Age, gender, and level of education were the statistically and significant predictors influencing risk averse maize farmers. Age, farm size, household size, gender, risk aversion, level of education, and access to extension services were the statistically and significant predictors influencing maize farmers' preference for crop insurance policy. Garrett index ranking technique revealed that crop diversification, weather information, and crop insurance were ranked 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> among the risk management strategies and crop insurance policy employed by maize farmers respectively. The remaining risk management strategies and crop insurance policy examined by Garrett index ranking technique include: off-farm activities (4<sup>th</sup>), insurance awareness (5<sup>th</sup>), use of agrochemicals (5<sup>th</sup>), loan facilities (7<sup>th</sup>), cooperative societies (8<sup>th</sup>), use of resistance varieties (9<sup>th</sup>), wealth savings (10<sup>th</sup>), and selling assets(11<sup>th</sup>). The constraints

- Credit facilities at low interest rate should be given to maize farmers, and bureaucracy and
- cumbersome administrative procedures in accessing the credit facilities should be removed.
- Fertilizers input, improved seeds input, resistance varieties and agrochemicals should be provided for the maize producers.
- Weather information, risk and insurance awareness should be provided for the maize producers.

### COMPLIANCE WITH ETHICAL STANDARDS

#### Conflict of interest

Authors do not declare any conflict of interest.

#### Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

#### Ethical approval

Ethics committee approval is not required.

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#### Data availability

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#### Consent for publication

Not applicable.

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