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RISKS AND DETERMINANTS OF RISK MANAGEMENT STRATEGIES AMONG RURAL CASSAVA-BASED FARMERS IN IMO STATE

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ABSTRACT

Cassava-based farmers are faced with a lot of risks and uncertainties and this results to low agricultural output and hinders the rural farmers from pursuing their farming activities as an enterprise. The study assessed the risks and determinants of risk management strategies among rural cassava-based farmers in Imo State. A multistage sampling technique was used in the selection of respondents. Data were collected with the use of structured questionnaire administered to 180 respondents. Multinomial logit regression model was used to determine the factors influencing the choice of risk management strategies among rural cassava-based farmers in the study area. Results of the study showed that the farmers were of middle-age, fairly educated and have average farm size of one hectare. Majority of the farmers identified loss of crop due to disease (76.11%) and loss due to erosion (73.89%) as sources of risk farmers were exposed to. Also greater number of the respondents adopted practicing of mixed cropping and planting of disease resistant species as risk management strategies. The result of the study also confirmed that age, gender, educational level and farm income were the major determinants of the farmers' choice of risk management strategies. It was recommended that government should make extension services functional and provide policies that will help boost the socio-economic welfare of farmers as this will significantly propel an increase in the choice effective risk management strategies in the area.

Keywords: *Risk management, risk management strategies, cassava based farmers.*

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INTRODUCTION

Cassava *(Manihot esculenta Crantz)* was introduced into West Africa by the early Portuguese traders in the seventeenth century (Njoku and Banigo 2006). Nigeria is the largest producer of cassava in the world, accounting for 19% of world production and 35% of total African production (Sanni *et al*., 2009). Its production is put at about 52 million metric tonnes a year

(FAO, 2011). Cassava is a very important crop in Nigeria in general, and Imo State in particular. Cassava productions in Imo State have been concentrated in the hands of smallholder farmers (Eze, *et al*., 2012). Smallholder farmers are those who produce on small-scale bases, not involved in commercial agriculture but produce at a subsistence level.

Cassava-based farmers face a lot of risks and uncertainties. At farm level, the production costs for cassava in Nigeria are high; resource poor farmers have limited resources (capital) to hire labour and to make effective or optimal use of their lands. Risk" and "uncertainty" are two basic terms to any decision making framework. According to Taiwo and Ayanwale (2005); Dismukes (2006) and Salimonu and Falusi (2012) risk refers to imperfect knowledge where the probabilities of the possible outcome are known, and uncertainty exists when these probabilities are not known. Under uncertainty, the decision maker does not know the probability of alternative outcomes. Risk and uncertainty are ubiquitous in agriculture and have numerous sources: the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of producers and end users of agricultural products, the unique and uncertain political economy of food and agriculture within and among Nations (Soham and Vikas, 2013). Risk is a central issue that affects many different aspects of people's livelihoods in the developing world (Kouame, 2009). Risk hinders the rural farmers from pursuing their farming activities as an enterprise which therefore threatens food security in the country.

Risk management according to business dictionary is defined as the practice of identifying the potential risks in advance, analyzing them and taking precautionary steps to curb or reduce them. Risk management in agriculture is an essential tool for farmers to anticipate, avoid and react to shocks (OECD, 2011). Managing agricultural risk is particularly important for smallholder cassava growers, who are usually vulnerable to poverty and lack the resources to absorb shocks (Cole *et. al.*, 2008). Proactively, managing risks is the process of looking at the probability of the event occurring, what the potential outcome might be, and how that outcome might change if certain risk management tools were used (Catlett and Libbin, 2007). Risk management helps the farmer to identify, assess and quantify the risk; having clear understanding of all the risks will help measure and prioritize them thereby making proper decisions to reduce losses. Effective risk management reduces the opportunity for finances to be used fruitlessly making sure that all resources are utilized efficiently (Hurley, 2010).

Risk management strategies are defined as the methods applied to remove or reduce partly the effect of factors creating risk in agriculture. To reduce effects of risk or survive in the poor conditions for farm activities, it is necessary to use risk management strategies. The selection of good risk management strategies depends on the farm operator, the financial situation and risk attitudes of the farmer (Korir, 2011). Cassava-based farmers' decisions are subject to risk, much of their income is highly vulnerable to drought, lack of alternatives to rain-fed agriculture, widespread environmental degradation, poor access to commodity market, poor access to extension services. This has led to huge losses in crops and income of these rural farmers. It therefore becomes important for farmers to obtain accurate cost-effective, risk management strategies on cassava production, processing and marketing of the product to maximize profit. Cassava-based farmers are predominantly small-holders with farms of two hectares and below, produce significant amount of staple crop with virtually no or little fertilizers and improved seeds. They rely mainly on nature (International Fund for Agricultural Development, (IFAD), (2011), Altieri, (2009) Altieri and Koohafkan, (2008), which affects their productivity and thus growth and development of the nation. According to COMESA (2010), Cassava- based agricultural system under a primarily rain-fed system with one growing season using low-input technology is in most areas not going to provide a viable pathway out of poverty. In recent years, a number of researchers (Salimonu and Falusi (2012); OCED (2013); Cervantes-Godoy *et al*., (2013) and World Bank (2013), have carried out studies on risk management strategies amongst farmers. To reduce effects of risk or survive in the poor conditions for farm activities, it is necessary to use risk management strategies. The selection of good risk management strategies depends on the farm operator, the financial situation and risk attitudes of the farmer (Korir, 2011). In Imo State, empirical evidence remains largely scanty and devoid of in-depth analysis of the effects of socio-economic characteristics of the farmers on the choice of risk management strategies. There is therefore a need to assess risks; choice of risk management strategies and the determinants of risk management strategies among small holder cassava-based farmers. These can help government take policy decisions that can help boost productivity and increase in the farmers' profit. It will also help extension workers on how to educate the farmers. It is against this background and dearth of empirical literature that this study is set to ascertain the determinants of risk management strategies among rural cassava-based farmers as well as determine the socio-economic factors influencing their choice of risk management strategies.

MATERIALS AND METHODS

The study was carried out in Imo State, Nigeria. The State lies within Latitudes 5^0 $40^I$and 7^05^Inorth and Longitudes $6^o35^I$and 8^o30^Ieast. The state is selected for this study because of its agrarian status and is well suited for production of arable crops such as cassava, yam, etc. Imo state is bounded on the east by Abia State, on the west by River Niger and Delta State, by Anambra State on the north and Rivers State on the south. The State covers a land area of 7,480km^2 with a population of 3,939,899 people (NPC, 2006). The State has an average annual temperature of 28°C, an average annual relative humidity of 80%, average annual rainfall of 1800 to 2500mm and an altitude of about 100m above sea level (Imo State Agricultural Development Programme, (Imo-ADP), 2010). A multistage sampling technique was adopted in the selection of the respondents. Across each stage a proportionate sampling technique was used to select 1/3 of the LGAs, communities and villages. At the first stage, a proportionate random sampling technique was used to select 9 LGAs from the 27 LGAs in the 3 agricultural zones, 4 LGAs were selected from Owerri zone, 3 and 2 from Orlu and Okigwe zones respectively. At the

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second stage; 18, 13 and 10 communities were proportionately selected from the selected LGAs in the 3 Agricultural zones. At the 3rd stage; 20 villages from the selected communities in Owerri zone, 15 and 10 villages from selected communities in Orlu and Okigwe zones, respectively were randomly selected, to give a total of45 villages sampled for the study. At the final stage, 4 cassava-based farmers were randomly selected from each of the selected villages in the three zones to give a total sample size of 180 farmers for the study. The sample was drawn from the sampling frame compiled with the help of Local Government officials. Primary data were used for the study and were collected by the use of structured questionnaire. The data collected were analyzed using descriptive statistics such as frequency, percentages and multinomial logistic technique.

The MLM Model is shown as

$$P(Yi = j) = \frac{\exp(\beta j Xij)}{[1+\sum \exp(\beta j Xi)]} \quad j=1,2,3\text{-----}6 \qquad \text{.......Eqn. 3.1}$$

For the reference category,

$$Pr(Yi = 0) = \frac{1}{[1+\sum \exp(\beta j Xi)]} \quad j=0 \qquad \text{.......Eqn. 3.1.2}$$

Where:

Pij denote the farmer's probability of adopting any of the risk management strategies between 1,2, … 6 Pio is the probability of being in the reference category.

The explicit function is stated as follows:

$Yi=In(Pj/Po)=\beta_1X_1+\beta_2X_2+ \beta_3X_3+\beta_4X_4+ \beta_5X_5+ \beta_6X_6+ \beta_7X_7+ \beta_8X_8+ei$….. Eqn. 3.1.3

Yi= Adoption of risk management strategy (i=1,2,…6)

(1) Improved production practice (2) Irrigation (3) Market Oriented Production, (4) Crop Insurance (5) Use of Organized information data (6) Diversification into non-farm activities, and the base category being improved production practice.

Where:

X1= age (years)

X2= Sex (Dummy: i=male, o=female)

X3= Educational level (years)

X4= Farming experience (years)

X5= Household Size

X6= Farm Size(ha)

X7= Marital Status (Dummy: i=male, o=female)

X8= annual Income (₦)

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Rural Cassava-based Farmers

Frequency and percentage distribution of farmers based on their socio-economic characteristics of the rural cassava-based farmers are shown in Table 1. The result showed that majority of the farmers fell within the age bracket of 51 – 60 years, with mean of 57 years. This implied that majority of the farmers in the study area were at their middle age. The result indicated that majority of the respondents (51.1%) are females. This implied that cassava production is regarded as a gender enterprise task because of its simplicity in cultivation (Eze, *et al.*,2012). The result of the marital status of the rural cassava-based farmers showed that majority of the respondents (91.1%) are married and most of the respondents (66.1%) had family size within the range of 5 - 8 persons with the mean of 6 persons. This can be attributed to labour optimization.

The result on level of education of the farmers showed that (47.8%) of the respondents had formal education with mean of 11 years. From the result, it could be said that farmers in the study area are semi-literate and it is expected that the level of education will contribute significantly to decision making of farmers to risk management strategies. About 38.8% of the population of the respondents had farm experience of 21 -30 years with mean of 35 years. This showed that the farmers were experienced. The farmer's experience in farming determines the rate of his exposure to risk and the use of risk management strategies. The findings on the farm size showed that 40.6% of the farmers have farm size within the range of 0.2 – 0.7 hectares with mean size of 1.0 hectare. This indicates that the respondents were smallholder farmers. Majority of the farmers (88.3% belong to one form of cooperative or the other. Membership of cooperatives is known to confer on entrepreneurs several benefits especially in relating with governmental agencies, financial institutions and non-governmental organizations.

Sources of Risk among Cassava-Based Farmers

Table 1 show the multiple responses and percentage distribution of farmers by various sources of risk. Results showed that majority (76.11%) of the rural cassava-based farmers reported loss of crop due to diseases while (73.89%) identified loss due to erosion. This could be attributed to the flood disaster which occurred in most part of Nigeria, Imo State inclusive in 2012. This implied that farmers in the study area are bound to have low output which can affect their profit.

Risk Management Strategies Adopted by Cassava-Based Farmers

Risk management strategies adopted by the rural cassava-based farmers is presented in table 3. The table showed that majority of the respondents (92.78%) adopted practicing of mixed cropping while (88.89%) and (87.22%) adopted planting of disease resistant stem and diversification into nonfarm activities. This may be attributed to high rate of loss of crops due to diseases in the area. It also suggests that farmers diversify production because of impending risk and uncertainties. This is in consonant with the findings of Taiwo and Ayanwale (2005) and Nto *et al.,* (2014) who noted that crops diversification is the major risk management strategies of farmers and also in line with Korir (2011) who asserted that off-farm investment is the key risk management farmers usually adopt in the face of impending agricultural risk. Small proportion, (2.87%) of farmers adopted crop insurance as risk management strategy. The low usage of insurance services can be likened to rural farmers' inability to pay for insurance services or being unaware of it.

Effects of Socio-Economic Characteristics of the Farmers on their Choice of Risk Management Strategies Adopted

The effects of socio-economic characteristics of farmers on their choice of risk management strategies are shown in Table 2 and 3 respectively.

It shows the influence of the socio-economic characteristics on the risk management strategies which were classified into six categories namely; improved production practices, irrigation, market oriented production, crop insurance, organized information data, diversification into non-farm employment. The effect of the socio-economic characteristics of farmers on their choice of risk management strategies employed was analyzed using multinomial regression. Multinomial logit regression is a choice model with mutually exclusive categories of dependent variable. Therefore, it is desirable to choose a reference category to compare with a given choice. Hence, improved production practices was chosen as default because improved production practices was the most frequent amongst the choice categories hence comparism of other choices were drawn with respect to the base category. Based on the fact that parameter estimates of multinomial logistic model gives only the direction and not the actual probabilities, marginal effects were used for the interpretation.

The result of the multinomial logit regression model showed that log likelihood was -283.06426.The likelihood ratio Chi Square of 149.59 with a P-value which was significant at 5% probability level gives the impression that the dependent and independent variables included in the model fits significantly better than an empty model (i.e., a model with no predictors) which indicated that slopes of the coefficients are significantly different from zero and they jointly have significant determinant effects on the choice of the socioeconomic characteristics for a particular strategy adopted. It also means that the model has a good explanatory power. The Pseudo R^2 was 0.3805 and this value was considered high enough for providing sufficient explanation about the model. The Pseudo R^2 value shows the variance explained by the model and gives a good impression regarding the model's goodness of fit. Previous studies, Zepeda (1990) and Rahji and Fakayode (2009) had reported pseudo R^2 values of 0.25 and 0.3145 respectively as representing a relatively good-fit for a multinomial logit model. Hence, the pseudo R^2 value of 0.3805 in this study is indicative of good fit and the correctness of the estimated model.

The data were tested for the validity of the independence of the irrelevant alternatives (IIA) assumptions by using the Hausman test for IIA. For the Hausman test, the chi-Square ($\chi 2$) ranged from -3.07 to 0.43 with p-value (1.00), the test failed to reject the null hypothesis of independence of the risk management strategies, suggesting that the multinomial logit (MNL) specification was appropriate to model risk management strategies. Also, this implied that the application of the MNL specification to model the determinants of risk management strategies was justified. The likelihood ratio statistics as indicated by $\chi 2$ = -283.06426 are highly significant ($p < 0.05$), this also suggest that the model has a strong explanatory power. The coefficients of the parameter estimates shown only provided the direction of the effect of the independent variables on the dependent variables estimates but do not represent actual magnitude of change or probabilities. The marginal effects and Quasi-elasticity shown in Table 2 were used to measure the change in dependent variable as a result of a unit change in independent variables and their derivation techniques implicitly indicate that neither the sign nor the magnitude of the marginal effects need bear any relationship to the sign of the coefficients used in obtaining them (Greene, 1993; Rahji and Fakayode, 2009).

For irrigation model, the result showed that age, farm experience, household size and marital status had positive significant relationship with the choice of irrigation as risk management strategies relative to choice of improved production practices. For market oriented production, age, educational level and farm experience had positive relationship with the choice of market oriented production relative to improved production practices. Also, age, gender, educational level, farm experience had positive relationship with choice of crop insurance relative to improved production practices. In the choice for organized information data, age, gender, farm experience and farm income had positive relationship with choice of organized information data relative to improved production practices. For the diversification to non-farm employment, age, educational level, farm experience and farm income had positive relationship with choice of diversification to non-farm income relative to choice of improved production practices. According to Rahji and Fakayode (2009), the positive sign implies that the probability of a farmer’s choice of other categories relative to the reference group (which in this case is improved production practices) increases as these explanatory variables increase. In other words, the probability that a farmer would adopt other categories of risk management strategies other than the reference group (improved production practices) is higher when the parameter(s) is positive. The negative parameter means that the probability of being in the other choice categories is lower relative to the probability of choosing the reference group. The values of the estimated marginal effects and the quasi – elasticity calculated at the overall sample means following Basant (1997) and Rahji and Fakayode (2009) for the significant variables. The significant variables affect both the probability of choice amongst the management strategies adopted. It is noteworthy that estimates not significantly different from zero indicate that the regressor or explanatory variable concerned does not affect the probability or utility derivable in choice decision relative to the reference group into the other five management strategies.

The result of the Quasi-elasticity was presented in Table 3 below. The positive value of quasi-elasticities indicates that 1% increment in the explanatory variable results to a percentage increment in the choice of a risk management strategy relative to reference category while negative quasi-elasticities implies a percentage decrease in the choice of a risk management strategies relative to reference category as a result of 1% increment in the explanatory variable. Also, a value greater than unity indicates elastic values which implies that 1% change in the explanatory variables result in a more proportionate change in the choice of a particular strategy relative to reference category and a value that is lesser than unity indicates inelastic values which means that 1% change in explanatory variable result in a lesser proportionate change in the choice of a particular strategy relative to reference category.

Based on the significant variables of the choice of irrigation, quasi-elasticity of age of the farmers was -4.1994 ($p<0.05$) which means it is elastic, significant at 5% statistical level and that 1% increment in the age of the farmer would results in a more proportionate reduction in his choice of irrigation relative to improved production practices by 419.9%, the educational level which value was -0.9552 ($p<0.01$) is inelastic and significant at 1%, implies that 1% increment in educational level of the farmer results to a less proportionate reduction in the choice of irrigation relative to improved production practices by 95.52%. the quasi-elasticity of farm experience, farm size and farm income were 0.9976 ($p<0.01$), 0.9491 ($p<0.01$) and 0.9430 ($p<0.01$) which indicate significant at 1% and inelastic to choice of irrigation and 1% increment in these explanatory variables result to a lesser proportionate increment in the choice of irrigation relative to improved production practices by 99.76%, 94.91 and 0.94.30% respectively. The quasi-elasticity of marital status is 0.84553 ($p<0.1$), more married farmers choose irrigation than single individuals relative to improved production practices.

For choice of market oriented products; age, educational level, farm experience and farm income had quasi-elasticity of -0.0834 ($p<0.05$), 0.3671 ($p<0.01$), -0.8443 ($p<0.01$) and -0.5055 ($p<0.01$). This indicated that these explanatory variables were inelastic and significant at 5% statistical level. A percentage increases in age, educational level, farm experience and farm income results in lesser proportionate of 8.34% decrease, 36.71% increase, 84.43% increase and 50.55% decrease in the choice of market oriented product relative to improved production practices respectively.

The quasi-elasticities of educational level, farm size and farm income were 1.0305 ($p<0.1$), 0.7135 ($p<0.05$) and -0.9205 ($p<0.05$) respectively. This means that educational level is elastic and 1% increase in years of educational level result to a more proportionate increase by 103.05% in the choice of crop insurance strategy rather than improved production practices. Both farm size and income were inelastic and it indicated that 1% increase in farm size and income results to lesser proportionate 71.35% increase and 92.05% decrease in choice of crop insurance relative to improved production practices respectively.

For Organized information category; age, gender, educational level, and farm income were 1.9976 ($p<0.1$), 0.3492 ($p<0.1$), -1.3531 ($p<0.01$) and 0.9337 ($p<0.01$). This indicated that age and educational level were elastic and 1% increases leads to 199.76% increase and 135.31% decrease in choice of use of organized information data relative to improved production practices. Gender and farm income were inelastic and 1% increase results to 34.92% increase and 93.37% increase in choice of organized information relative to improved production practices.

In the diversification to non-farm income and off farm employment option, age, gender and farm size had quasi-elasticity values of 1.9096 ($p<0.1$), -0.3720 ($P<0.05$) and -0.9285 ($p<0.01$) which indicated that choice of diversification to non-farm employment has elastic response to age but inelastic to gender and farm size at 10%, 5% and 1% statistical level respectively. This implies that 1% increase in age and farm size results to 190.96% increase and 92.85% decrease in choice of non-farm employment relative to improved production practices relatively. It also shows that male farmer has a 37.20% higher choice of diversification to non-farm employment than female individuals relative to improved production practices.

CONCLUSION AND RECOMMENDATION

Cassava-based farmers face a lot of risks and uncertainties; especially in Imo State, farmers are compelled to make decisions based on imperfect information and knowledge. This result in low agricultural output and hinders the rural farmers from pursuing their farming activities as an enterprise. The study estimated the determinants of risk management strategies among the rural cassava-based farmers in the study area. Based on the result of the findings, the study concluded that the cassava-based farmers were mainly middle aged, married, experienced, smallholder farmers and highly prone to risk as majority 76.11% of the rural cassava-based farmers reported loss of crops due to diseases and 73.89% reported loss due to erosion. The empirical results from marginal effects and quasi elasticity confirmed that age, gender, educational level and farm income were the major determinants of the farmers' choice of risk management strategies. To this effect, efforts should be made by the government to promote functional extension services and provide policies that will help boost the socio-economic welfare of farmers as this will significantly propel an increase in the choice effective risk management strategies in the area. Diversification into non-farm investment should be encouraged among farmers in the area as it reduces risks by increasing resistance and offsetting the seasonal nature of agricultural income.

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APPENDIXES

Table 1: Frequency Distribution of the farmers' socio-economic characteristics

Socio-economic characteristics	Frequency	Percentage
Age		
31- 40	7	3.9
41- 50	35	19.5
51- 60	71	39.4
61 70	58	32.2
Above	9	5
Total	180	100
Mean	57years	
Gender		
Male	88	48.9
Female	92	51.1
Total	180	100
Marital Status		
Single	16	8.9
Married	164	91.1
Total	180	100
Household size		
1- 4	44	24.5
5- 8	119	66.1
9- 12	17	9.4
Total	180	100
Mean		6persons
Years of formal Education		
1- 6	31	17.2
7-12	86	47.8
13- 18	63	35
Total	180	100

Farming Experience		
1- 10	5	2.8
11- 20	54	30
21- 30	69	38.8
31- 40	42	23.3
41- 50	10	5.6
Total	180	100
Mean	5years	
Farm Size		
0.02- 0.70	73	40.6
0.71- 1.30	64	35.6
1.31- 1.90	31	17.2
1.91- 2.50	12	6.6
Total	180	100
Membership of Association		
Cooperative Society	159	88.3
None	21	11.7
Total	180	

Source: Field survey Data, 2016

Table 2: Distribution of Farmers by Sources of Risk

Sources of Risk	Frequency*	% Distribution
Loss of crop to diseases	137	76.11
Loss due to erosion	133	73.89
Loss due to lack of adequate credit	131	72.78
Loss due to low market value	129	71.67
Loss due to theft	125	69.44
Fire outbreak in farmland	123	68.33
Loss due to pests attack	118	65.56

Loss due to herds men	114	63.33
Loss due to lack of storage facilities	107	59.44
Loss of crop due to poor processing facilities	103	57.22
Loss due to lack of market to sell cassava	76	42.22
Loss due to high interest rate	72	40.00
Loss due to insincerity of business associates	69	38.33
Loss due to land conflicts	68	37.78
Flood (excess of water on farmland)	66	36.67
Loss due to out-dated asset	66	36.67
Drought (excessive dry weather)	61	33.89
Loss of crop due to sickness of family member	61	33.89
Loss due to government laws	38	21.11

Source: Field Survey Data, 2016

Table 3: Percentage distribution of Respondents by Risk Management Strategies

Risk Management Strategies	Frequency*	% Distribution
Practice of mixed cropping	167	92.78
Planting of disease resistance stem	160	88.89
Diversification into non-farm activities	157	87.22
Fertilizer application	153	85.00
Mixing cropping	146	81.11
Mixed farming	130	72.22
Value addition to cassava products	125	69.44
Clearing of bush around farm borders	124	68.89
Change in planting dates	120	66.67
Involvement in thrift and cooperative societies	113	62.78
Use of insecticide	103	57.22
Making of bunds and channels	94	52.22

Use of herbicide	92	51.11
Proper record keeping	82	45.56
Use of modern planning & management tools	60	33.33
Use of meteorological information	48	26.67
Contract cassava production	38	21.11
Irrigation during drought	32	17.78
Use of organized information/data	25	13.89
Operate an insurance policy	5	2.78

Source: Field Survey Data, 2016

Table 4: Coefficients and Marginal Effects of the Determinants of Choice of Risk Management Strategies Adopted by cassava based farmers

	Irrigation		Market oriented prodn		Crop insurance		Organized information data		Diversified	
Variables	Coeff	dy/dx	Coeff	dy/dx	coeff	dy/dx	Coeff	dy/dx	coeff	dy/dx
Age	0.0904	-0.0003	0.0426	-0.0103	0.0867	0.0094	0.0642	0.0131	0.0778	0.0064
Gender	-0.2576	-0.0103	-0.1610	-0.0107	0.1957	0.0247	0.6012	0.1104	-0.8740	-0.1457
Education	-0.5060	-0.0230	0.0702	0.0198	0.0898	0.0096	-0.0158	-0.0065	0.0372	0.0321
Farm exp	0.1177	0.0097	0.0454	-0.0013	0.1188	0.0054	0.0369	-0.0022	0.0918	0.0878
Hh size	0.0486	0.0090	-0.1093	-0.0596	-0.2097	-0.0106	-0.1153	-0.0259	-0.1130	-0.0069
Farm size	-0.1143	0.0014	-0.2272	-0.0807	-0.0790	0.0744	-0.2159	-0.0126	-0.1874	-0.0901
M. status	1.1510	0.1007	-0.6896	-0.0964	-0.8099	-0.0441	-0.3882	-0.0201	-0.3212	-0.0121
Farm inc.	5.29e-08	9.30e-09	-3.96e-07	-7.13e-08	-1.95e-06	-1.50e-07	2.47e-08	1.57e-08	8.35e-07	2.75e-07

Reference Category Improved production practices
Number of Observation 180
Pseudo R^2 0.3805 lol
LR Chi Square 149.59
Prob.> chi2 0.0424
Log likelihood -283.06426
$Chi^2$for IIA ranges from -3.07-0.43
Source: Computed Results from STATA 13 software, 2016
LR chi2(40) = 149.59

Table 3: Quasi-elasticities of the Determinants of Risk Management Strategies Adopted by the Farmers

	Irrigation		Market oriented production		Crop insurance		Organized information data		Diversified	
Variables	**Eyex**	**Z**	**Eyex**	**Z**	**Eyex**	**Z**	**Eyex**	**Z**	**Eyex**	**z**
Age	-4.1994	-2.27**	-0.0834	-2.50**	2.2903	1.33	1.9976	1.70*	1.9096	1.72*
Gender	-0.0706	-0.26	-0.0234	-0.15	0.1510	0.59	0.3492	1.77*	-0.3720	-2.08**
Education	-0.9552	-4.56***	0.3671	7.70***	1.0305	1.86*	-1.3531	-3.05***	0.0960	0.24
Farm experience	0.9976	2.64***	-0.8443	-3.24***	0.5058	1.34	-0.1079	-0.30	0.3034	1.25
Household size	0.7567	0.93	-0.1937	-0.44	-0.7974	-1.05	-0.2296	-0.41	-0.9159	-1.84
Farm size	0.9491	2.99***	-0.2253	-1.14	0.7135	2.54**	-0.1979	-0.80	-0.9285	-4.7***
M. status	0.8453	1.87*	-0.2590	-1.43	-0.3312	-1.09	-0.0782	-0.34	0.0380	-0.19
Farm income	0.9430	3.22***	-0.5055	-2.64***	-0.9205	-2.37**	0.9337	4.36***	0.3014	1.59

Eyex = Quasi-elasticities,

Z-tab are 1.64, 1.96 and 2.57 @ 10%, 5% and 1% level of significance respectively.

*, ** and ***, significant at 1% , 5% and 10% respectively.

Source: Computed Results from STATA 13 software, 2016