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ANALYSIS OF RISK BEHAVIOUR AND MANAGEMENT PRACTICES OF SMALLHOLDER ARABLE CROP FARMERS IN AGRICULTURAL RESEARCH ADOPTED VILLAGES IN ABIA AND RIVERS STATES, NIGERIA.

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ABSTRACT

Adopted village concept being an extension model, involves selecting villages within the location of the research institutes with the aim of encouraging large-scale adoption of improved technologies to empower resource poor farmers and ensure food security. The study investigated the risk behaviour and management practices of participants in Agricultural Research Adopted Villages in Abia and Rivers States. Specifically, the study examined sources of risk to the participants, risk management strategies adopted, their risk behaviour as well as determined the factors affecting their risk behaviours. Data were sourced from 119 farmers in adopted villages in Abia and Rivers States using well structured questionnaires and analyzed using descriptive and inferential statistics such as seemingly unrelated regression (SUR). The results showed that the most severe risk to the participants were pests and diseases, limited funding, theft, perishability of output, high cost of labour, glut and unstable weather. Risk management strategies were widely adopted by the respondents as indicated by the grand mean of 3.69. Pesticide/herbicide application, technology replacement, market information, off farm investment, multiple farm enterprises, bit harvesting and use of resistant varieties were the mostly adopted risk management strategies. The result also showed that the participants were heterogeneous in their risk behaviour but majority (69.7%) of the farmers were risk takers. The result of the SUR model showed age, gender, educational level, farming experience, extension visit, farm size, membership of farmers' organization and access to credit influenced the risk takers. The study therefore concludes that farmers in agricultural research adopted villages were confronted with numerous risk; adopted appropriate risk management strategies; majority of them were risk takers and therefore recommends adoption of more villages for better impact.

Keywords: risk sources, risk management, risk behaviour, smallholders, participants, adopted villages

Introduction

Agricultural production generally has been known to be riskier than any other business. The inherent risk involved in agricultural production in the world over is more burdensome on the smallholder farmers (Nwaru, 2018 and Osondu and Simonyan, 2019). The incidence of risk in arable crop production among the smallholder farmers needs not to be treated with laxity because it is unavoidable and affects every decision made by the farmers. NAERLS and FDAE and P & PCD (2018) categorised the risk faced by farmers into production, market, financial, human and institutional risks. Echebiri and Onu (2019) outlined the risk factors as climate variability, input price variability, technology change, theft, insecurity, incidence of pest and diseases, equipment breakdown, high cost of inputs, change in government policy, borrowing money with sudden change in interest rates, scarcity of labour at peak time and change in health and wellbeing of the farmers. The effect of risk is more

pronounced where production is almost totally dependent on nature like in Nigeria. Ndem and Osondu (2018) noted that risk plays important role in decision making in the farm. It affects the level of production, input/output prices, the expected profit, can result in severe income losses and even fluctuation in household consumption (Aminu, Balogun and Oke, 2019). According to Jirgi (2013) apprehension of risk induces certain behaviour into a farmer. Farmers' risk behaviour is dynamic and as diverse as the risk they face. Van Winsen (2014) defined risk behaviour as the choice of individuals to act upon risk and it depends on the individuals' assessment of the risk involved. The farmers' behaviour is a reflection of their risk attitude and risk perception which both serve as target for risk management practice (Enstrom and Erikson, 2018). Aminu, Mohamed, Akhigbe- Ahonkhai and Samuel (2021) noted that risk management involves making selection among alternatives that degrade the economic reliable enterprise, diversification, intercropping,

irrigation, pest control, sale of assets, money lending, revolving fund, exchange labour, bit harvesting, engaging in non-farm work and so on. The risk behaviour of farmers can be that of preferring risk or avoiding risk. Though farmers in the adopted villages have been found to be adopters of improved technologies available to them, they are not insulated from the inherent risk in arable farming. The farmers are not equipped against risk and the incidence of risk will continue to increase due to challenges associated with climatic change. Therefore, proper assessment of risk, management strategies and farmers' behaviour in the face of risk will help design better and improved risk management strategies for farmers. Hence, the above scenario forms the justification for study. The study broadly investigates the risk behaviour of participants in research adopted villages and specifically examines the farmers' sources of risk, their risk management strategies and categorise the farmers into various risk behaviour as well as determine the factors affecting their risk behaviours.

Methodology

The study was carried out in Abia and Rivers State, Nigeria. A four staged sampling technique was used involving purposive selection of Abia and Rivers States in the first stage due the presence of functional adopted villages in the states, this was followed by purposive selection of eight local government areas from the states and twelve villages in the second and third stages respectively. Ten respondents were randomly selected from each of the villages in the last stage, using a well structured questionnaire. One hundred and twenty respondents were sampled en route cost but 119 respondents were useful for the study. The villages were adopted by Michael Okpara University of Agriculture, Umudike Extension Centre (MEC) and National Agricultural Extension Research and Liason Services (NAERLS), South - south and South - east zones. Data collected were analysed using descriptive statistics and Seemingly Unrelated Regression (SUR) model. Statement relating to risk management practices adopted by respondents on a five-point Likert-type rating scale were obtained and result evaluated using mean ratings to obtain risk behaviour of participants. SUR model was used to determine factors influencing the risk behaviour of respondents. Theoretically, Seemingly Unrelated Regression (SUR) model was originally proposed by Arnord Zellner in 1962 and it explains the variations of a set of m dependent variables (Gujarati, Porter and Gunasekar, 2013). It is a collection of two or more regression relations that can be fitted with data on the dependent variables (Zellner,

2006). The SUR model differs from the multivariate regression model only in the sense that it takes account of prior information concerning the absence of certain explanatory variables from certain equations of the model and such exclusions are highly realistic in many economic situations (Baltagi, 2003 and Osuji, 2017). The SUR model is specified implicitly as:

$$Y_i = \beta_{ij}X_{ij} + \varepsilon_i, \quad i = 1, 2, 3 \text{ and } j = 1, 2, 3 \dots 11 \dots 1$$

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{11} X_{11} + \varepsilon_1 \dots 2$$

$$Y_2 = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \dots + \alpha_{11} X_{11} + \varepsilon_2 \dots 3$$

$$Y_3 = \varphi_0 + \varphi_1 X_1 + \varphi_2 X_2 + \dots + \varphi_{11} X_{11} + \varepsilon_3 \dots 4$$

Where β , α and φ are the parameter estimates of the respective equations, Y_1 = Risk aversion behaviour, Y_2 = Risk neutral behaviour, Y_3 = Risk taking behaviour, X_1 = age of farmer (in years), X_2 = gender (1 for male and 0 for female), X_3 = educational level (in years), X_4 = off farm income (in naira), X_5 = household size (in number), X_6 = farming experience (in years), X_7 = extension visit, X_8 = farm size (in hectares), X_9 = membership of farmers' organization (1 for membership and 0 for non- membership), X_{10} = credit (in naira) and X_{11} = no of dependents and ε_1 to ε_3 = residual of each equation.

Results and Discussion

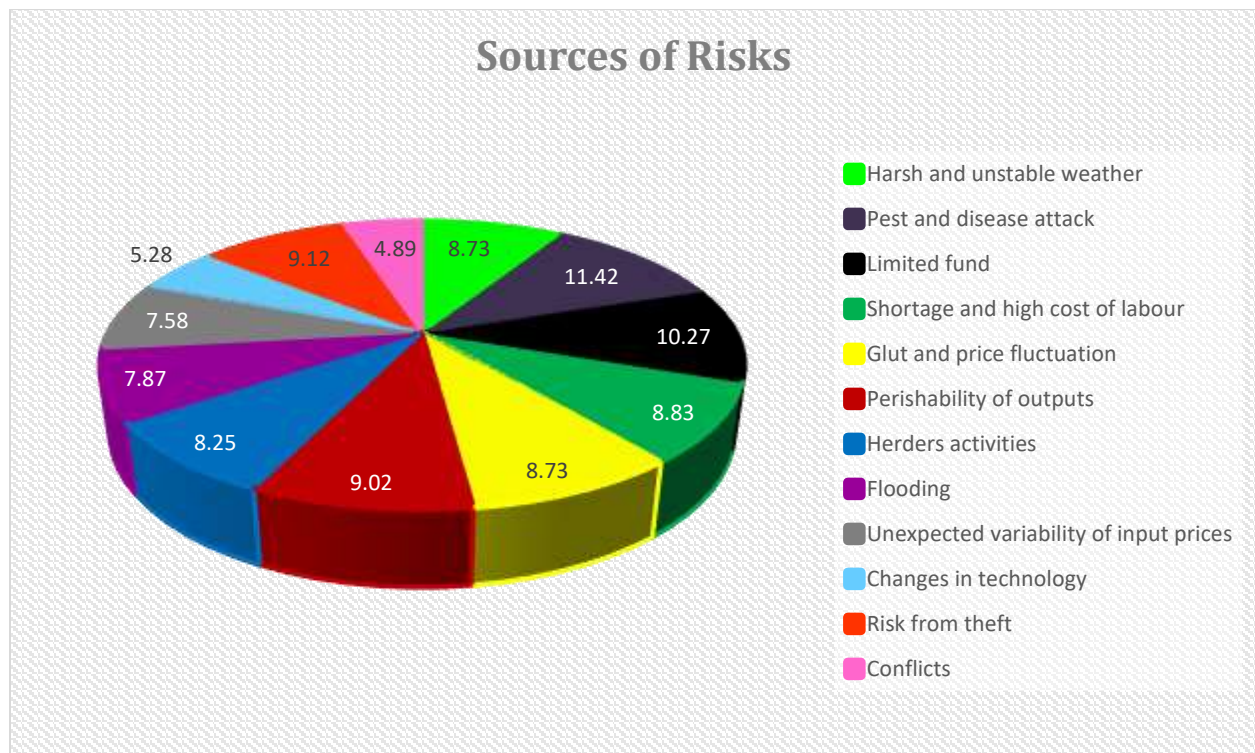
Risk Sources to Smallholder Arable Crop Farmers in the Adopted Villages

The frequency and percentage distribution of sources of risks based on severity were computed and presented in a pie chat. The results of study showed that pests and diseases, limited fund, theft, perishability of outputs, shortage and high cost of labour, harsh and unstable weather, glut and price fluctuation, herders' activities, flooding and unexpected variability of input prices were the severe risks faced by the respondents. The implication is that farmers in the adopted villages were still dependent on weather for production. They also experience postharvest loses without proper regulation in the input and output market. Rising unemployment level and continuous rise in food prices may have triggered the incidence of theft. These factors may have negative effect on the total output, income and food security of respondents. Aminu *et al.* (2019) who noted that risk factors have negative effect on the output and income of farmers.

Table 1: Frequency and Percentage Distribution of Sources of Risks faced by Participating Smallholder Arable Crop Farmers in the Adopted Village Project

SN	Sources of Risks	Frequency*	Percentage
1	Harsh and unstable weather	91	8.73
2	Pest and disease attack	119	11.42
3	Limited fund	107	10.27
4	Shortage and high cost of labour	92	8.83
5	Glut and price fluctuation	91	8.73
6	Perishability of outputs	94	9.02
7	Herders activities	86	8.25
8	Flooding	82	7.87
9	Unexpected variability of input prices	79	7.58
10	Changes in technology	55	5.28
11	Risk from theft	95	9.12
12	Conflicts	51	4.89

*shows multiple responses of respondents



Risk Management Strategies Adopted by the Smallholder Arable Crop Farmers in the Adopted Villages

There are strategies employed by the participants in the adopted village project to deal with risk, though majority of these strategies provide temporary protection against risk. Table 2 showed the various management strategies

employed by the farmers and investigation on adoption level were ascertained on a 5.0 likert rating scale with reference mean of 3.0 used.

Table 2: Mean Ratings of Risks Management Strategies Used by Participating Smallholder Arable Crop Farmers

SN	Risks management strategies	Participants (n = 119)
1	Technology replacement	4.39 (0.60)**
2	Irrigation	1.85 (0.90)**
3	Multiple farm enterprises	3.81 (0.69)**
4	Market information	4.09 (0.85)**
5	Use of resistant varieties	3.67 (0.52)**
6	Using off farm investment	3.91 (0.73)**
7	Revolving saved fund	4.23 (0.81)**
8	Reduced consumption	3.13 (0.73)**
9	Exchange labour	3.42 (0.91)**
10	Practicing bit harvesting	3.68 (0.79)**
11	Using pesticide/herbicide application	4.51 (0.90)**
12	Fertilizer application	3.55 (0.70)**
	Grand Mean	3.69

Note: Figures in parenthesis are standard deviations; ** Risks management strategies used.

Source: Field Survey, 2021.

The result in Table 2 showed a grand mean score of 3.69 indicating a wide adoption of the identified strategies by the respondents. The use of pesticide/herbicide had the highest mean (4.51) showing wide adoption by the respondents to deal with pest and disease attack was indicated as the most severe risk among the respondents. Other strategies adopted by the farmers were replacing obsolete technologies, revolving saved fund, market information, multiple farm enterprises, off farm investment, bit harvesting, use of resistant varieties, fertilizer, exchange labour and reduced consumption. The wide adoption of these strategies may have been engendered by the activities of the researchers involved in the adopted village projects. Improved seeds, pesticides, herbicides, fertilizers as well as adequate trainings on how to apply them were incentives for participation in the project. Participants were also involved in other businesses other than arable crop production and also had multiple farm enterprises to

cover up for bad times in production. Ndem and Osondu (2018) reported that cassava farmers in Abia State, Nigeria adopted intercropping to manage the risk of crop failure. Majority of the respondents had limited fund therefore revolving saved fund was adopted by the respondents. Nto (2016) noted that saving is an appropriate risk reducing strategy in arable crop production.

However, the mean for irrigation was very low indicating very low adoption of the strategy. The implication is that respondents were not producing off season because they depended on weather for production. This may impact negatively on the food prices, income of farmers and food security of farmers, especially during the off season, due to increasing risk as well as challenges climate change.

RISK BEHAVIOURS OF SMALLHOLDER ARABLE CROP FARMERS IN THE ADOPTED VILLAGES

Farmers behave differently towards risk and the outcome of their behaviour is reflected on their decision on the farm. Table 3 classified the participating smallholder arable crop farmers based on their risk behaviours. The result showed that 69.70% of respondents were risk takers followed by the risk neutral (18.5%), then the risk averse farmers (11.8%). Though majority of the farmers were risk takers, the farmers in the adopted villages are heterogeneous in their risk behaviour. The implication is that the adopted village project helped a good number of the participants to adopt appropriate management strategies to tackle risk. The result also showed that many of the farmers (30.30%) could not perform

optimally in the face of risk, despite the interventions of the researchers. Some of the farmers were still indifferent about risk and the risk averse were still conservative and not willing to take and may impact negatively on their willingness to adopt innovations and risk management strategies which has negative implication on the income of the farmers as well as success of the adopted village project. The indication is that more work has to be done by the researchers in form of trainings, development of more affordable risk management strategies, provision of more subsidies and incentives to further motivate the farmers to take risk.

Table 3: Classification of Risk Behaviours Farmers

SN	Class Boundaries	Classification	Freq.	Pert.
1	1.00 – 2.49	Risk averse	14	11.8
2	2.50 – 3.99	Risk neutral	22	18.5
3	≥4.00	Risk taking	83	69.7

Source: Field Survey, 2021.

Echebiri and Onu (2019) noted that farmers' attitude towards risk has great implication on adoption of innovations and success of rural development programmes.

Factors Influencing the Risk Behaviour of Participants in the Adopted Villages

Table 4 presented the factors influencing the various risk behaviours of participating farmers in the adopted village project. The factors that influenced the three categories of behaviours (risk averse, risk neutral and risk takers) among the participating farmers were age, education, farm size and access to credit. The R^2 for the risk averse, risk neutral, risk seeking participants were 77.70%, 75.13% and 85.25% respectively showing the goodness of fit of the model.

Age was statistically significant and positively related to the different risk behaviours of farmers at 1% except for the risk averse which is at 5% significant level. The implication is that as the participants grow older by one year, the risk averse farmers increase their risk averse behaviour by 2.57% while the risk neutral behaviours increase by 7.29%. The risk takers, on the other hand increase their risk taking behaviour by 0.6%. However, this is contrary to a priori expectation that as age of farmers increase their risk taking behaviour reduces. The deviation could be linked to the intervention of the

research institutions and adoption of improved technologies by the participants. This contradicts the findings of Oparinde *et al.* (2018) whose result showed that age had negative relationship with risk behaviour of cassava farmers.

Gender was statistically significant for the risk averse and risk takers at 1% each. While risk averse behaviour was negatively influenced by gender, the risk taking behaviour had positively affected by gender. This implied that the female gender was more risk averse than their male counterpart and vice versa. This supports the findings by Aminu *et al.* (2021) who asserts that female farmers were more risk averse than the male farmers. They further explained that the male farmers own most of the farm assets, hence their risk taking behaviour.

Educational level influenced the risk averse and risk neutral farmers negatively, statistically and significantly at 1% and 5% respectively while the risk takers were positively related to education at 5% level of significance.

Table:4 Seemingly Unrelated Regression (SUR) Model Estimate of Factors Influencing Risk Behaviour of Participating Farmers in the adopted Villages.

Regressors	Risk Averse	Risk Neutral	Risk Takers
CONSTANT	1.828 (7.582)***	3.095 (8.716)***	3.424 (12.312)***
Age of Farmers	0.0256 (2.434)**	0.073 (3.428)***	0.006 (3.694)***
Gender	-0.428 (3.349)***	0.021 (0.891)	0.073 (4.570)***
Education	-0.021 (4.659)***	-0.301 (2.690)***	0.051 (2.878)***
Off-farm Income	1.416 (2.560)**	1.141 (3.253)***	-0.003 (0.394)
Household Size	-0.018 (0.394)	-0.003 (0.336)	0.011 (0.452)
Farm Experience	0.030 (2.360)**	0.002 (1.648)	1.704 (3.498)***
Extension Contacts	-0.005 (4.288)***	-0.007 (1.914)*	0.074 (4.288)***
Farm Size	-1.25 (3.088)***	-0.094 (5.010)***	0.091 (5.549)***
Membership Cooperative	0.201 (0.956)	0.046 (1.876)*	0.060 (2.614)***
Credit	-0.087 (3.976)***	-1.028 (4.552)***	1.181 (7.726)***
No of Dependents	0.017 (0.336)	-0.000 (0.027)	-0.008 (0.273)
R ²	0.777	0.751	0.843
Adjusted R ²	0.768	0.746	0.833
F - Value	121.25	87.84	143.51
Prob>F	0.0000	0.0000	0.0000
n = 119			

Field Survey, 2021. Figures in () are std errors. *, **and * represents 10%, 5% and 1% sig. levels respectively.**

The result indicates that as the risk averse and risk neutral increases their educational level by one unit, their risk averse and neutral behaviour reduces by 2.06% and 30.10%.

While the risk takers tend to improve in their risk taking behaviour by 0.06% as they increase their educational level by one year. This is in conformity with the *a priori* expectation that higher educational attainment increases risk taking behaviour of farmers. The result is in agreement with Oshaji *et al.* (2021) whose result of study also indicated that education to be statistically and significantly influenced the risk behaviour of arable crop farmers in Imo State.

The coefficient of off farm income was positively related to the risk averse and risk neutral at 5% and 1% level of statistical significance respectively. This implies that as off income increases by one naira risk averse and neutral behaviour increases by 142% and 141% respectively. Off farm income had no statistical and significant effect on risk takers who participated in

the adopted villages. The result contradicts Oparinde *et al.* (2018) whose result concludes that farmers with higher non-farm income tend to have higher likelihood of being risk seeking.

The coefficient of Farming experience influenced the risk averse and risk takers, who are participants in the adopted village project positively and significantly at 5% and 1% levels respectively. The indication is that as the participants are increasing in the years of experience, the risk averse participants increase their risk aversion behaviour by 2.98% while the risk takers increase their risk acceptance behaviour by 170.44%. The result conforms with the *a priori* expectation for the risk takers and agrees with Okpara, Nwaru and Nze (2021). Farming experience had no statistical and significant relationship with the risk neutral farmers. The result contradicts the result of study of Nmadu, Eze and Jirgi (2012) that years of experience reduces both risk neutrality and seeking behaviour.

Extension contact was negatively and statistically significantly related to the risk neutral farmers at 10% while the factor had positive, statistical and significant relationship with the risk takers at 1% level. The result implied that as extension visit increases, risk neutral participants reduces their risk neutral behaviour by 0.69% while risk accepting behaviours increase by 7.46%. This is in line with *apriori* expectation. Intervention by the agricultural research institutions may have helped the farmers in having guided risk behaviour. This follows Ayinde (2017) whose study showed similar result.

Farm size influenced the three categories of risk behaviours of participants statistically and significantly at 1%. The factor had negative relationship with the risk averse and risk neutral behaviours but positively related to risk takers as expected. The result indicated that as the farm size of the risk averse and risk neutral farmers increased, their averse and neutral behaviours reduced by 125.45% and 9.41% respectively while the risk taker participants' ability to accept more risk increases by 9.11%. This is similar to Okpara *et al.* (2021) whose result showed negative relationship between farmers' risk behaviour and farm size.

Membership of farmers' organization was positively, statistically and significantly related to the risk neutral and risk taker participants at 10% and 1% level respectively. The result indicated that belonging to farmer group would increase the risk seeking behaviour of farmers by 4.63%. The result is as expected *apriori*. The participants were organized in farmers' groups by the researchers and this aided technology dissemination, market information sharing and thus influencing their risk seeking behaviour. This is also similar to Aminu *et al.* (2019) whose result revealed that membership to farmers' organization influenced risk seeking attitude of arable crop farmers in their study.

Access to credit influenced the risk averse and risk neutral behaviours negatively while it influenced the risk takers positively indicating that access to credit reduces risk averse behaviour by 8.71%, risk neutral behaviour by 102.79% and increases the risk taking behaviour of participants by 118.0 %. This also supports the findings of Aminu *et al.* (2019)

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that the arable crop farmers in the adopted villages were confronted with various risk situations and they widely adopted appropriate management strategies to handle most risk factors. Majority of the participants were risk takers which may

have impacted positively on adoption of technologies and risk management strategies. Since increased farm size, membership of farmers' organization and access to credit increased risk taking behaviour of participants, the study therefore recommends: activation of non functional adopted villages as well as adoption of more villages; more trainings on risk management strategies; formation and registration of farmers' groups as formal cooperatives and inclusion of credit facilities in the adopted village projects to achieve better output level, increased income of participants and achieve sustained food security.

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