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AGROSOCIOECONOMÍA

Impact analysis, risk perception and adoption of mitigation strategies among farmers in Niger state, Nigeria, Africa

Análisis de impacto, percepción del riesgo y adopción de estrategias de mitigación entre agricultores del estado de Níger, Nigeria, África

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ABSTRACT

In this study we used a recent cross-sectional survey data in Niger state, Nigeria to examine the relationship between shock impact, risk perception and adoption of risk mitigation methods among farming households in Niger state, Nigeria. The specific objectives are to; (i) describe risks perception among the farming households; (ii) examine the determinants of future risk perception among the farmers; and (iii) describe the mitigation methods applied by the households. A frequency table was used to describe impact and future risk perception; Ordinary Least Square (OLS) regression was used to analyze the determinants of future risk perception among the farming households, and a graph was used to describe the mitigation methods applied by the households. The result showed that the majority of the respondents experienced extreme weather events with the mean of 2 times per household and experienced the highest severity. The most perceived future risks in five years were extreme weather events with a mean of 6 times per household over five years and predicted with the highest severity. OLS regression result showed that weather impact, biological impact, economic impact, socio-political impact and household head age were significant and positive determinants of future risk perception. While marital status was negatively related to future risk perception. The mitigation methods mostly employed in the area were drought-tolerant crops (63%), diversification of crop, plot and livestock (61%), buffer stock (55%), dry season irrigated rice farming (41%). The study recommends that farmers should be encouraged to diversify their sources of livelihood to boost their adaptive capacity. The government needs to invest more in the expansion of irrigation facilities to ensure all-year-round food production and to improve households' welfare.

RESUMEN

En este estudio, se utilizaron datos de una encuesta transversal reciente en el estado de Níger, Nigeria, África para examinar la relación entre el impacto de la crisis, la percepción del riesgo y la adopción de métodos de mitigación de riesgos entre los hogares agrícolas en el estado de Níger, Nigeria. Los objetivos específicos fueron: (i) describir la percepción de riesgos entre los hogares agropecuarios; (ii) examinar los determinantes de la percepción del riesgo futuro entre los agricultores; y (iii) describir los métodos de mitigación aplicados por los hogares. Se utilizó una tabla de frecuencias para describir el impacto y la percepción del riesgo futuro; Se utilizó la regresión de mínimos cuadrados ordinarios (OLS) para analizar los determinantes de la percepción del riesgo futuro entre los hogares agrícolas, y se utilizó un gráfico para describir los métodos de mitigación aplicados por los hogares. El resultado mostró que la mayoría de los encuestados experimentaron eventos climáticos extremos con un promedio de dos veces por hogar y experimentaron la mayor severidad. Los riesgos futuros más percibidos en cinco años fueron eventos climáticos extremos con una media de 6 veces por hogar durante cinco años y pronosticados con la mayor gravedad. El resultado de la regresión OLS mostró que el impacto climático, el impacto biológico, el impacto económico, el impacto sociopolítico y la edad del cabeza de familia fueron determinantes significativos y positivos de la percepción del riesgo futuro. Mientras que el estado civil se relacionó negativamente con la percepción de riesgo futuro. Los métodos de mitigación más empleados en la zona fueron los cultivos tolerantes a la sequía (63 %), diversificación de cultivos, parcelas y ganado (61 %), reservas (55 %), cultivo de arroz con riego en la estación seca (41 %). El estudio recomienda que se aliente a los agricultores a diversificar

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Keywords: Climate impact, risk exposure, diversification, adaptation strategies, climate event.

sus fuentes de sustento para aumentar su capacidad de adaptación. El gobierno debe invertir más en la expansión de las instalaciones de riego para garantizar la producción de alimentos durante todo el año y mejorar el bienestar de los hogares.

Palabras clave: impacto climático, exposición al riesgo, diversificación, estrategias de adaptación, evento climático.

Risks are the potentials for uncertain events to present adverse consequences on lives, livelihoods, ecosystems and species, economic, and service provisions including environmental services and infrastructure (Feed the Future, 2017). Risk is said to be an event that means some losses or damages which may occur with some likelihood. It implies the existence of some uncertainty but, unlike the latter, the term "risk" emphasizes the loss or negative side of the uncertainty. Sometimes these two terms are used differently: risk implies the knowledge of some probabilities associated with an uncertain event, while uncertainty is applied to situations during which the chances are not known (Antón, 2008). Risks in agriculture are interconnected, sometimes compounding and sometimes offsetting one another. If the prices of inputs (such as fertilizer) and outputs (such as agricultural commodities) move within an equivalent direction, as an example, the impact on net returns is reduced [Organization of Economic Cooperation and Development (OECD, 2016)].

Risks are parts of experiences of life for several farming households in poor countries (Banerjee and Duflo, 2011). These risks can transform into a selection of varied 'impact', which are defined as adverse events that are costly to individuals and households in terms of lost income, reduced food consumption or the sale of assets (Dercon *et al.* 2005). Risks are often divided into two types, covariate and idiosyncratic risks; a typical household in rural areas of developing countries is exposed to covariate and/or idiosyncratic risks. Thanks to the variable economic and biophysical environment, agricultural activities are subjected to kind of risks and uncertainties (Weinberger and Jütting, 2000). Ullah *et al.* (2016) identified two major kinds of risk in agriculture- the first kind is the business risk which includes production, marketing, institutional and private risks. Secondly, financial risks result from different methods of financing the farm business. Ortmann et al. (1992) identified prices and variability in crop and livestock production to be the foremost important sources of risk. Nmadu and Dankyang (2015) presented a lack of technical know-how of improved farming technologies, livestock diseases outbreak and high cost of inputs as perceived most risky in Nigeria. According to Mathur and Singh (2005), the vulnerability of agricultural producers arises on the account of two kinds of risks that the agricultural producers face, one is the danger of loss of production or output because of unfavoured weather and soil conditions. The other is the danger of depressed prices because of various kinds of market conditions, resulting from changes in overall supply and demand situations and export – import policies of the governments.

Given the changing structure of the agricultural industry, managing risks has become vital to the success of agricultural operations. Because, outputs are the most sources of revenue for agricultural operations, so farmers must acknowledge and manage risks. There are many strategies available to help farming households to manage risks. Which methods a farmer adopts would depend on individual farm situation, risk-bearing ability and willingness to manage risks, individual characteristics, government policies, and farmers' skills to manage risks. Thus, understanding those methods available for managing risks can help agricultural producers to develop better production plans which may reduce those risks and increase profitability. Risk management tools are essential to enable farmers to anticipate, avoid and react to impact (OECD, 2011). The study said efficient agricultural risk management systems will preserve the standard of living of those who depend on agriculture, strengthen the viability of farm businesses, and make an environment which facilitates investment within the agricultural sector.

More than 80% of farmers in Nigeria are small holder farmers; they make significant contributions to the national products; they produce about 99% of total crops output. The small-scale farmer is the foremost producer of 98% of the food consumed in Nigeria except for wheat (Mgbenka *et al.*, 2015). Among Nigerian farmers around 88% are considered small holder family farms. They depend on various ranges of crops, livestock and fish for their livelihoods. Despite their importance to the domestic economy and the sector's productivity limitations, quite 72% of Nigeria's small holder farming households live below the poverty line of USD 1.9 daily [Food and Agricultural Organization (FAO, 2018)]. Agriculture was the pillar sector of the economy of Nigeria which accounted for almost 70% of the Gross Domestic Product (GDP) and about 75% of Nigeria's export earnings before Nigeria's independence (Udemezue, 2019). The author argued that today agricultural sector is dwindling in performance, leading to a dramatic increase in poverty incidence and severity. Constraints in agricultural production in Nigeria include high cost of labour, transportation problem, pests and diseases outbreak, inadequate storage facilities, marketing problems, inadequate capital, poor access to credit facilities and high cost of inputs (Odoemenem and Adebisi, 2011; Girei *et al.*, 2018).

However, farming households in Nigeria face many risks that are capable of leading to production and food crises. Such risks include extreme weather risks like droughts and floods, biological risks like pests and diseases, sickness and deaths of farming household members. Others include economic risks, social risks like conflicts, theft and fire accident, loss of land, and loss of fishing equipment. All those factors are affecting their welfare especially household income and food consumption. The farming households are making efforts to manage these risks; intrinsically, the issues of poverty and food insecurity have not been fully addressed by these attempts as many folks are still in poverty and food insecure. Thus, the majority of rural Nigeria is involved in agricultural production as their main source of livelihood, they are making efforts to increase their production and improve their welfare. Repeatedly, the results of farmers' efforts within the production of livestock and crops are erased by extreme events like harsh weather, negative social-political events as well as an economic failure. With all the mitigation strategies applied many of the farm families are still living in poverty.

Impact and adoption of climate risk mitigation methods among farmers have been assessed by many available studies, but few of the studies focused on future risk perception and their determinants among farmers. Such studies include Akanbi *et al.* (2022), that assessed the risk attitude among farmers and management methods employed in Ogbomoso, Oyo State, Nigeria; Jha and Gupta (2021) examined farmers perceived climate change risks and factors that determine the adaptation decisions to cope with the risks in India. Harvey *et al.* (2014) assessed the vulnerability of smallholder farming households to agricultural risks and climate change and variability in Madagascar; Schattman *et al.* (2016) presented farmers' perceptions of climate variability risks and on-farm risk management strategies associated with them in Vermont, north-eastern United States. Völker *et al.* (2011) analysed the climate risk perception and ex ante mitigation strategies employed by rural households in Thailand and Vietnam. No studies have worked on the relationship between impact, risk perception and the adoption of mitigation methods among farming households in Nigeria.

Hence, it is vital to know the severity of impact as well as perceived risk levels in the long term and mitigation methods applied by the households; this is often a matter of policy. Understanding the impact with attendant severity, and risk level perceived and risk management strategies employed by farming households is extremely important for harnessing institutional support and providing proper and adequate resources to reinforce the households' welfare. Households, communities, and planners will need to enact adaptive initiatives to manage various risks among the farm families.

The main objective of this paper is to assess the relationship between impact, risk perception and the adoption of mitigation methods among farming households in Niger state, Nigeria. The specific objectives are to: (i) describe risk perception among the farming households; (ii) examine the determinants of future risk perception among the farmers; and (iii) describe the mitigation methods applied by the households. We used survey data collected in 2020 from 30 villages in Niger state to examine the nexus between impact experiences, risks perception and mitigation strategies employed by farming households. This study fills the gap of previous studies by focusing on the connection between impact, risk perception and their attendant severity on farming households in Nigeria. The result of this study is useful for policy formulation by the government at all levels. It will serve also as reference material for researchers and students alike.

MATERIAL AND METHODS

Study area. The study was conducted in Niger state; it is located within the Southern Guinea Savanna zone of Nigeria. The state has a share in the three dams of the Niger-Dams Project including one at Shiroro Gorge on the Kaduna River and one at Jebba (in Kwara state), the reservoir of which lies partly in Niger state. It lies on latitude 08° to 11°30' North and longitude 03°30' to 07°40' East. The state is bordered to the south-west by Kwara state, to the north by Zamfara state, to the north-east by Kaduna state, to the west by Kebbi state, to the south by Kogi state, and to the south-east by Federal Capital Territory. The state also has an international boundary with the Benin Republic along Agwara and Borgu Local Government Areas to the north-west. The state covers an area of 76,469.90 square Kilometers, which is about 10% of the entire expanse of Nigeria out of which about 85% is arable. The 2006 population and housing census put the state's population at 3,950,249 [Niger State Bureau of Statistics (NSBS, 2012)]. The foremost predominant soil type is that of the ferruginous tropical soils which are basically derived from the basement complex rocks, also as from old sedimentary rocks. Such ferruginous tropical soils are ideal for the cultivation of grains such as sorghum, maize, millet and groundnut Ikusemoran *et al.* 2014). Niger state experiences distinct dry and wet seasons with annual rainfall varying from 1,100mm within the southern parts to 1,600 mm within the northern parts. The utmost temperature (usually less than 34 °C) is recorded between March and June, while the minimum is typically between December and January. The rainy seasons last for about 120 days within the northern parts to about 150 days within the southern parts of the state (NSBS, 2012).

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Sampling technique. A three-stage sampling technique was used to select the sample of households for this study. This study utilized the Digital Elevation Model (DEM) map (which shows a bare ground topographic surface without trees and buildings) of Niger state in Figure 1 for the selection of floods and droughts affected villages. This is because the lists of flood and drought-affected villages were not available. In the 1st stage, all the three agricultural zones in Niger state were selected and therefore the study area was stratified into two. In the 2nd stage, 15 villages were randomly selected each from a drought-affected upland area which is the 1st stratum and a floods-affected lowland area which is the 2nd stratum. Within the last stage, in each village 10 farming households were selected with a simple random technique and 300 respondents were selected for the study but 293 had adequate information fit for analysis. Primary data was used for the study; the data was collected through the questionnaire to collect information from the households. Information was collected on the socio-economic characteristics of farming households within the study area, sources of livelihood available to farming households, household total income; expenditure of farming households, household food intake data, and data on food prices were collected. With respect specifically to impact, data were collected on the frequency and estimated severity of impact and mitigation strategies.

Data analysis. Descriptive statistics which include a frequency distribution table, graph and percentages were used to analyse the socio-economic characteristics of the respondents, severity of impacts and perceived future risk level and the mitigation methods applied by the households. Ordinary least square regression (OLS) was employed to analyse the determinants of future risk perception among the farmers. Regression analysis is a statistical technique employed to relate variables. Its basic aim is to create a mathematical model to relate dependent variables to independent variables. Generally, a regression model is going to be defined as one algebraic equation (Anghelache and Sacala, 2016). The respondents were asked about the impact of weather, environmental, biological, and economic stresses on them and their livelihoods in terms of food and households' income within the past 12 months. They were also asked about their perception of the long-term impact in another five years. Their responses were taken using likert type scale ranged from 0 which indicated the impact was not severe to 3 which showed that the impact was highly severe, these were used for both impacts experienced and future risk perception. These were used to create stress impact indices for each category of stress and future risk perceived of different categories of stress, then the indices for future risk perception were used to generate risk score. The risk score was used as the outcome

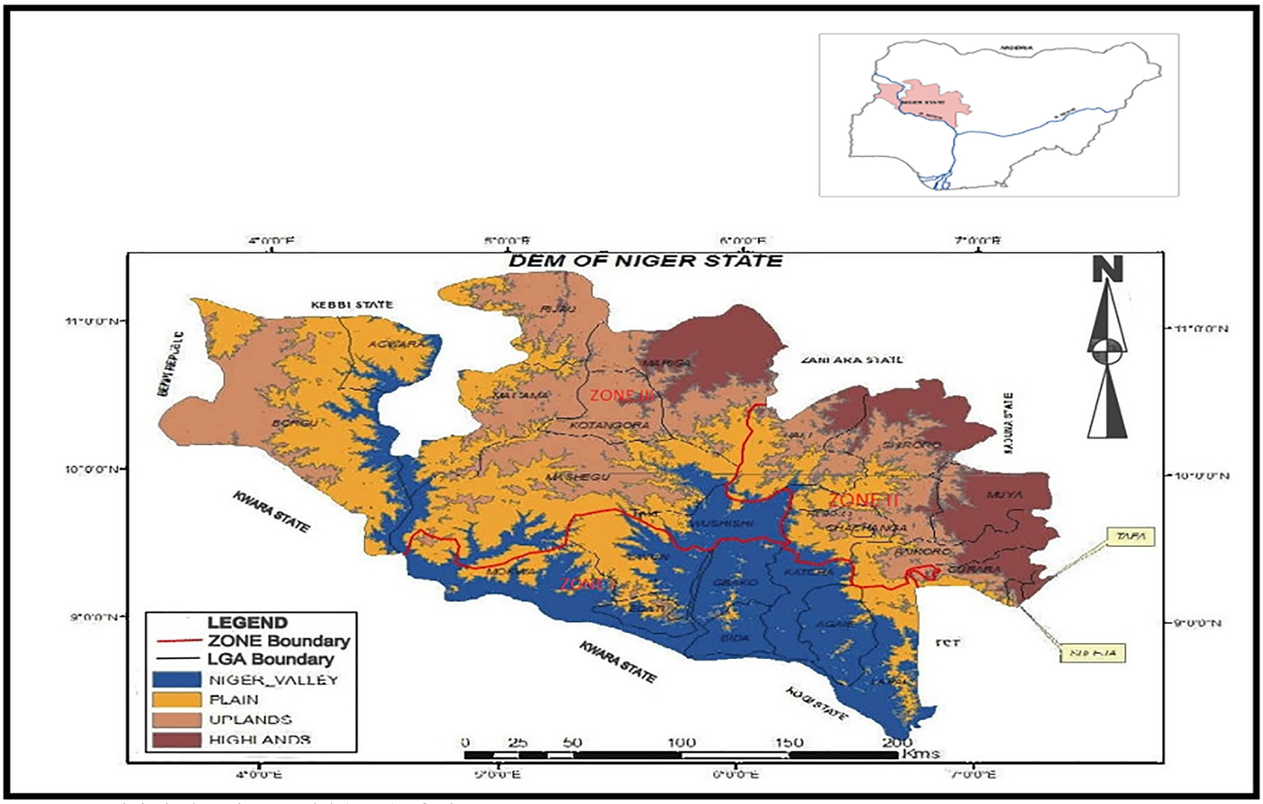

Figure 1. Digital Elevation Model (Map) of Niger State.
Source: Adekunle *et al.* (2022).

variable while vector of impact incidents, vector of household characteristics, and vector of location characteristics were the independent variables in the regression.

Following Völker *et al.* (2011); Kasie, (2017) the study estimated a household's future risk perception using ordinary least squares (OLS) regression based on the following relationship:

$$K_i = \beta S_i + \beta H_i + \beta C_\rho + \varepsilon_i \quad (1)$$

Where K_i is subjective risk levels perceived by each household indexed by i; S_i is a vector of impact incidents that a household experienced, H_i is a vector of household characteristics and C_p is a vector location characteristic, C_p is the error term, αs, βs and Ωs are the parameters to be estimated.

Model specification. The models used to achieve the objectives of the study are given below:

$$K_i = \partial_o + \alpha_1 S_1 + \alpha_2 S_2 + \alpha_3 S_3 + \alpha_4 S_4 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_8 X_8 + \beta_9 X_9 + \Omega_i L_i + \Omega_1 D_1 + \Omega_2 D_2 + \varepsilon_I \quad (2)$$

K_i = Subjective future risk score
∂_o = Constant
S_1= Weather impact index
S_2= Biological impact index
S_3= Economical impact index
S_4= Socio-political impact index
X_1 = Household head gender (male =1; 0 otherwise)
X_2= Education (years)
X_3= Household size (number of members)
X_4= Household head age (years)
X_5= Farm size (ha)
X_6= Extension contacts
X_8= Farming experience (years)
X_9= Marital status (married =1; 0 otherwise)
L_i= Livelihood area (lowland = 1; 0 otherwise)
D_1= Distance to district capital (km)
D_2= Distance to health facilities (km)
ε_i = Error term.
B = The parameters to be estimated for household characteristics
Ω = Parameters to be estimated for location characteristics
α = Parameters to be estimated for impact

Table 1. Summary statistic

Variable	Description	Mean	Std. dev
Age (years)	Age of the household head	41.41	11.313
Education	Years of the education completed by the household head	7.42	6.207
Sex	This is the gender of the household head male = 1, 0 otherwise	0.915	0.280
Marital status	The marital status of the household head, they are divided into single and married.	0.83	0.377
Household size	The number of household members	7.12	3.419
Average household education	The total household education completed by the member of the household divided by household size.	5.00	5.05
Farm size (Ha)	Total size of all the plots of land operated by farming household.	3.44	1.654
Credit obtained (₦)	The amount of credit in cash a farming household was able to access in the last 12 months	6 559.73	18 076.53
Group membership	This is to indicate social capital endowment and the level of participation of household members in social activities.	0.55	0.499
Cash transfer (₦)	This is amount of money a household received as part of the social safety net in the study area.	7 047.78	17 440.83
Lowland livelihood	This is the location of the farming households that are living and operating their farms within 2 kilometers of the bank of Rivers Niger and Gurara.	0.51	0.501
Farming experience	This is number of years the farming household heads have spent in operating farms.	21.88	11.340
Farm income	This is the estimated amount of money earned by farming households within 12 months.	433 270.3	60 4188.2
Dry season farm size (Ha)	This is the total size of farm land allocated to irrigation during dry season in the past 12 months.	0.76	1.059
Extension contacts	This is the number of days which the farming households had meetings with the extension agents	6.00	5.48

RESULTS AND DISCUSSION

This section presents the socio-economic attributes of the farming households in the study area. The characteristics examined include sex, age, household size and educational status of the household members. These are presented in Table 1.

The stress impact and perceived future risk levels. Table 2 presents existing impact severity as well as perceived risk levels in the future in the study area. Weather impact were reported with the highest frequency and the highest severity experienced by households, with drought ranked the highest both in frequency and severity. This shows that an average household experienced weather impact at least twice. In terms of frequency and severity of loss of land and fishing equipment, fire accidents, theft and fishing failure generally played a minor role in the study area.

The result also shows the household's perception of future risk levels using five years period from the time of the survey. There are differences between the households' impact before the time of the survey and their perception of risk levels in the future. It appears the farm families were pessimistic about the incidence of impact in a future reference period of 5 years. Weather impact were expected to reoccur at least every year with almost the same level of severity. Contrary to weather impact, the farming households appear optimistic about the severity of other impact on their welfare; the result shows that the severity of these impact would be reduced in the future. They were optimistic that impact like fire accidents and death will not occur in the next five years.

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Table 2. Mean and standard deviation of shocks impact and perceived risk levels by impact category

	Past shock experience				Future risk perception			
Event	Frequency		Severity		Frequency		Severity	
	Mean	S dev	Mean	S dev	Mean	S dev	Mean	S dev
Weather impact	**2.19**	**1.05**	**3.00**	**1.67**	**6.25**	**3.00**	**3.00**	**1.81**
Droughts	1.23	0.60	2.00	1.03	3.69	1.82	1.90	1.08
Floods	0.82	0.86	1.53	1.44	2.35	2.55	1.24	1.30
Storms	0.14	0.52	0.22	0.68	0.21	0.76	0.21	0.65
Biological impact	**1.10**	**0.86**	**2.39**	**1.94**	**2.36**	**2.21**	**2.12**	**1.92**
Crop pest/disease	0.55	0.54	1.10	1.21	1.86	2.01	1.04	1.24
Animal disease	0.08	0.34	0.10	0.37	0.11	0.55	0.10	0.46
Grave sickness	0.40	0.55	1.01	1.35	0.36	0.70	0.89	1.25
Death	0.04	0.19	0.11	0.57	0	0	0.04	0.35
Crop damage	0.03	0.17	0.07	0.39	0.02	0.20	0.05	0.31
Economic impact	**1.02**	**0.79**	**2.14**	**1.65**	**1.86**	**1.95**	**1.85**	**1.74**
Price deflation	0.60	0.50	1.59	1.38	1.16	1.34	1.28	1.28
Inflation of price	0.21	0.42	0.31	0.69	0.28	0.67	0.33	0.82
Increased food price	0.15	0.41	0.15	0.41	0.35	1.00	0.13	0.44
Fishing failure	0.03	0.19	0.06	0.34	0.07	0.45	0.06	0.38
Loan defaulting	0.03	0.16	0.06	0.36	0.003	0.06	0.04	0.30
Social impact	**0.28**	**0.56**	**0.53**	**1.06**	**1.13**	**0.49**	**0.43**	**0.92**
Conflict/Violence	0.03	0.16	0.07	0.43	0.03	0.31	0.06	0.37
Grazing on farms	0.20	0.48	0.33	0.80	0.10	0.37	0.28	0.70
Fire accident	0.01	0.10	0.02	0.18	0	0	0.02	0.19
Theft	0.05	0.21	0.11	0.52	0.01	0.12	0.09	0.44
Others	**0.03**	**0.19**	**0.06**	**0.37**	**0.03**	**0.32**	**0.05**	**0.31**
Loss of land	0.02	0.16	0.04	0.30	0.003	0.06	0.03	0.26
Loss of fishing equipment	0.01	0.10	0.03	0.27	0.03	0.32	0.02	0.18

Determinants of the future risk perception. The factors that determined the perception of future risk are presented in this section; OLS regression result with the risk score as the dependent variable is presented, this represents the risk perception as a subjective assessment of future impact frequency and severity.

The semi-log regression function was chosen from the three functions- linear, semi-log and double-log functions as the lead equation. It was based on the significance of the individual variables as expressed by their t-values. The appropriateness of the signs of the regression coefficient is based on the a priori expectation; the magnitude of the coefficient of multiple determinations and the significance of overall function as judged by the f-value. The F-value and R^2 indicate that the independent variables are jointly significant and that the model has reasonable goodness of fit. The model was tested for the problem of endogenous, heteroscedasticity and multicollinearity between explanatory variables and such problems could not be detected.

From Table 3 the household-specific characteristics hypothesized to affect future risk perception, marital status and the age of the household head were found to be significant. The marital status of the respondent was found to be negatively significant at 10% level of significance; it implies that the married household head was more likely to evaluate a higher level of future risk than the unmarried respondents. This is mainly because the married household heads have more people to feed and exert more pressure on household resources; the small magnitude of impacts may affect them more than their counterparts the unmarried household heads. The age of the household head was positively significant which means the older farmers are more likely to evaluate a higher level of future risk than the younger ones. This is mainly because older respondents have longer-term impact and have a better awareness of the trend of the risk trend than the younger farmers.

Furthermore, magnitudes of past impact experiences were found to be significantly and positively correlated with perceived future risk levels. Weather impact were positively significant at 10% level of significance; it implies that households with high degrees of weather impact in the past were likely to evaluate the future risk level higher. Biological and economic impact were positive and significant at 1% level of significance; this indicates that households with high degrees of biological and economic impact exposure in the past were likely to be pessimistic about the future occurrences of these events with an evaluation of higher levels of future risk. Socio-political impact had a positive correlation and were significant at 5% level of significance; this shows that households with high degrees of socio-political impact were likely to evaluate the future risk level higher.

However, none of the respondents' location characteristics was significant but they were positively correlated with the future risk level perception. These imply that respondents living in the river valley (lowland) areas were likely to evaluate a higher level of future risk than the farmers living in the upland. This is because they experienced flood disasters in the area which was less occurred and of lesser impacts on the upland. The respondents who were living far from the district capital and health facilities were likely to evaluate a higher level of future risk than the farmers living in the district capital and close to health facilities. This is because the farmers in the remote villages lacked access to information on how to respond to these risk events and because of their distance to health facilities, injury and sickness may impact severely their food and income than the farmers in the district facilities. The result indicates the farming households were generally pessimistic about the occurrence of the future impact.

Table 3. Regression result of the determinants of the future risk perception

Risk score	Coefficient	Standard error
Weather impact	0.3406454*	(0.1849736)
Biological impact	0.5388339***	(0.0829872)
Economic impact	0.5340087***	(0.0886555)
Socio-political impact	0.2767971**	(0.1405545)
Household head gender (male = 1)	0. .2681181	(0.19756)
Marital status (married = 1)	-0.3192879*	(0.1824225)
Household head age (years)	1.641026*	(0.3854724)
Household head education (years)	-0.0128534	(0.0360268)
Household size	0.1048393	(0.1192803)
Farming experience (years)	-0.2254333	(0.1680503)
Extension contacts (number of visit)	0.0306522	(0.0351502)
Total farm size (ha)	0.1025181	(0.0808201)
Livelihood area (lowland = 1)	0.1296822	(0.0946088)
Distance to district capital (km)	0.0048884	(0.0035852)
Distance to health facilities (km)	0.0030627	(0.0045637)
Constant	-5.418574***	(1.046992)
F-value = 33.88***		
R-squared = 0.5841		
Root MSE = 0.54797		
Number of observations = 293		

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Employed ex-ante risk management strategies. Figure 2 shows the major mitigation strategies applied by the households; it was observed that many households applied more than one strategy. Over 62% of the farmers applied drought-tolerant crops while 61% of the farmers reported the adoption of diversification of crop, plot and livestock. More than 40% of the farmers adopted dry season farming to mitigate the impacts of climate and other impact. About 23% said to be doing nothing to mitigate the impact of climate impacts in the study area. It was observed that the application of some of the ex-ante coping strategies was determined by the recourses available to the farming households in the study area.

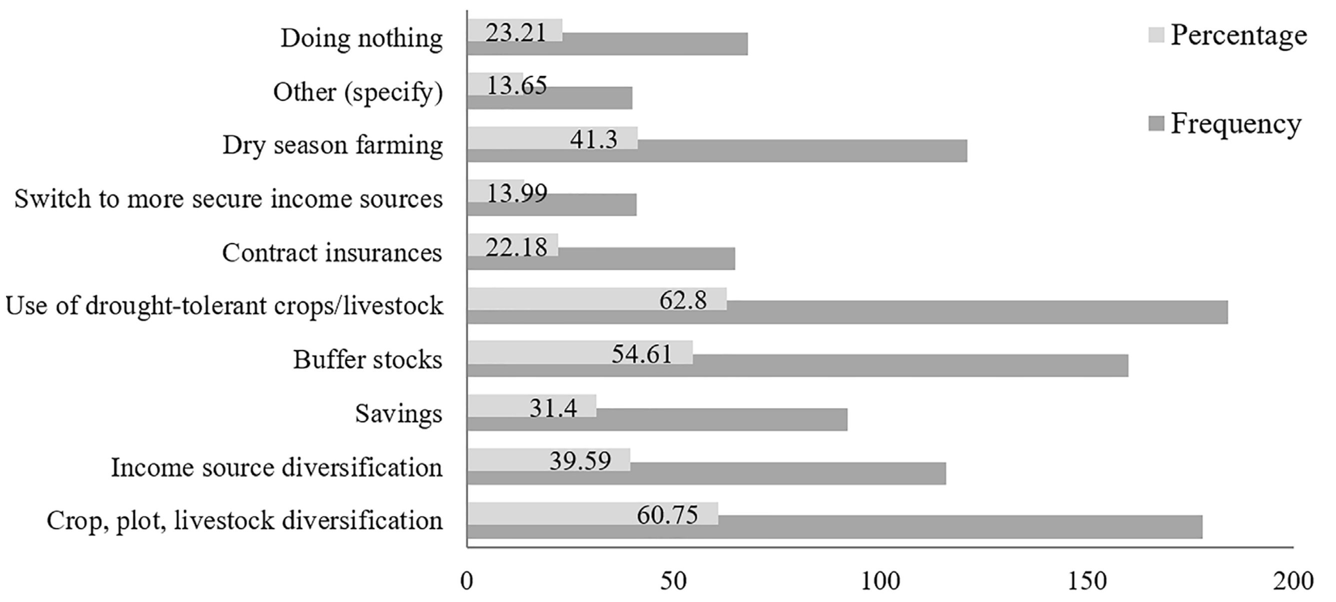

Figure 2. Risk management strategy employed by farming households.

CONCLUSION

In this study, we have examined the connection between impact, risk perception and adoption of mitigation methods among farming households in Nigeria using cross-sectional survey data collected in 2020. In this study, we used a frequency table to describe impact and future risk perception as well as the mitigation methods applied among the farming households; we also used OLS regression to examine the determinants of future risk perception among the farmers.

The result of the study has shown that the most prevailing impact event was extreme weather events and had the highest severity. It is followed by biological impact and the least experienced impact events were loss of land and loss of fishing equipment. The household's perception of future risk levels using five years period from the time of the survey showed that extreme weather events had the highest experiences with the highest severity. The determining factors of the future risk perception of households include; marital status and the age of the household heads, weather impact, biological impact, economic impact and socio-political impact. The most common employed mitigation strategies include drought-tolerant crops, diversification of crop, plot and livestock, buffer stock, dry seasons irrigated rice farming, income diversification, saving, and contracting of health insurance.

However, according to the findings of this study, the following recommendations are outlined to address the effects of impacts and the projected risk occurrences to improve the welfare of farming households. Since agriculture is the main source of rural livelihood, an improvement in farmers' welfare would be an increase in agricultural production and the main aim should be to improve productivity. Farmers need to be encouraged to diversify their sources of livelihood to boost their adaptive capacity. The promotion of agricultural policies with proper input prices and input supply needs to be revisited so that farmers can take advantage of these to increase food production. Governments need to invest more in the expansion of irrigation systems. All these are to ensure all-year-round food production and to improve households' welfare.

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