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Assessment of risk management strategies among poultry farmers in Anambra State, Nigeria

Oluwaseun Joseph KOMOLAFE[1,*], Sunday Onalo ADEJOH[1], Ann Amaka MADUKA[2]

[1]Nnamdi Azikiwe University, Faculty of Agriculture, Department of Agricultural Economics & Extension, Awka/NIGERIA
[2]Nnamdi Azikiwe University, Faculty of Social Sciences, Department of Sociology & Anthropology, Awka/NIGERIA

[*]Corresponding author: joe.komolafe@yahoo.com

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Abstract

The greatest threat to profitability and sustainability of the poultry enterprise is risk. Identification and assessment of risk mitigation level is important for policy formulation. Therefore, this study assessed risk management strategies among poultry farmers in Anambra State, Nigeria. A two-stage sampling technique that purposively selected six Local Government Areas: Ogbaru, Ihiala, Awka South, Anambra West, Anaocha and Idemili North based on the State Agricultural Development Program information on poultry farmers' concentration. Twenty poultry farmers were then selected randomly from each LGA. A structured questionnaire was used to elicit information from farmers. Data collected were socio-economic characteristics, risks encountered, and the management strategies used. Data were analyzed using descriptive (mean, standard-deviation and bar-chart) and inferential statistics, Multinomial logit model at 0.05 level. The categories of risk identified with the level of exposure were production/technological and health risks (100%), market/price risk (81.2%), institutional risk (55.2%), financial/credit risk (94.2%), environmental risk (67.2%) and human and personnel risk (59.1%). The categorization of farmer by their risk management strategies showed: biosecurity strategies (4.32±0.22), production strategies (4.22±0.43), mitigation/risk reduction strategies (3.30±0.68), other risks coping strategies (2.42±0.89), transfer measures/institutional strategies (1.05±0.30), marketing strategies (3.98±0.71), and financial strategies (2.4±0.87). Capital invested (p<0.001), cooperative society (p<0.001), disease outbreaks (p<0.001), livestock insurance (p<0.001), and government policy(p<0.001), were the major determinants of the risk management level. The study recommended adequate funding, insurance policy and training to minimize risk.

Keywords: Poultry risk, Management strategies, Assessment, Multinomial logistic regression

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1. Introduction

Eliminating hunger by 2030 in the continent of Africa seems to be a mirage. Malnutrition has risen from 17.6 percent in 2014 to 19.1 percent in 2019 (FAO, 2019) and is still increasing. Challenges of food insecurity and hunger in Nigeria have remained a critical subject for consideration by stakeholders (Ejikeme et al., 2017; Osabohien et al., 2020). It is well-documented that Nigeria has a gap in its protein consumption (Nigerian Protein Deficiency Report, 2020 as cited in Daily Trust, 2021; Komolafe et al., 2023). By the targeted year 2030 for the elimination of hunger, this problem is bound to escalate if adequate measures to deal with the situation are not put in place.

Poultry production which is eyed to be the way out of the problem is cumbered with numerous risks and uncertainty such as theft, flood, fire outbreaks, and other unpredictable and unplanned events (Eleri et al., 2012). The contribution of poultry to animal proteins consumed globally was about 30% (AGRA, 2014). Globally poultry population is about

16.2 billion, 71.6% of which were in developing nations, producing 67,718,544 tons of meat and 57,861,747 tons of eggs (Gueye, 1998; Komolafe et al., 2023). The Nigerian poultry firms contribute to the economy by providing employment, income and quality protein thereby, reduces food security and alleviating poverty (Nasiru et al., 2012). Poultry contribution to Nigeria's agricultural GDP is above 25% (Oduntan, 2016) as sited in National Daily Newspaper, 2016. Poultry products (meat and egg) offer considerable potential for bridging the nutritional gap due to the adaptability capacity of high-yielding exotic birds to Nigerian weather and the production technology is simple with high returns on investment (Yusuf et al., 2016). The contributions of poultry to Nigeria's GDP could have been greater than what it is at present provided the risks associated with the sector could be reduced to the barest minimum.

The poultry industry in Nigeria has suffered losses in the past which has affected poultry farmers as well as consumers (Ogoke, 2009). Little improvement was recorded recently in the sector, but despite this improvement, local production only meets 30 percent of the demand for poultry products. A high percentage of Nigerian poultry farmers are less equipped to mitigate risks associated with production and income and this could lead to the eventual collapse of the industry if collaborative efforts are not made by the government and stakeholders to salvage the situation (Adepoju et al., 2013). Inadequate and appropriate measures in this regard will lead to a reduction in poultry production and protein intake of people, malnutrition, ill health and lower productivity and output, and poor welfare of the farmers (Bamiro et al., 2009; Obike et al., 2017). The risks involved in the poultry business need to be addressed to be able to manage and increase the productivity of the sector to meet the demand of the consumers. It is also important to assess the risks and uncertainty surrounding one of the most important livestock sectors (poultry) with the aim of understanding and finding better ways of improving the enterprise. Some farmers do not have the understanding of risks and uncertainties as well as risk management skills or approach required to manage problems and reduce the consequences of risk and uncertainties.

The concept of risks and uncertainties are related consequently, they are used interchangeably, since there is no risk without some level of uncertainty and vice-visa. Risk entails uncertainty in the occurrence of possible damage, loss or injury, that agricultural investment will yield the expected outcome or not, while uncertainty is that there is the availability of more than one possible outcome to a course of action and the form of each possible outcome is unknown (Aimin, 2010). The danger of risk and uncertainties can result in impressive loss of money, psychological displacement, and complete business failure; thus risk management becomes imperative (Adeyemo & Onikoyi, 2012). Producers' attitude toward risk is jamming in input allocation decisions, and hence in output supply. The degree of uncertainty, the consequences of the various possible outcomes and the personality of the individuals determine the behaviour of investors under the circumstance and the choice of strategies to be adopted to minimize the effects of risks. Most farmers are risk averse, this implies that a farmer will withdraw from a production plan with the highest expected profit if it is associated with a wide range of alternative profit outcomes; he may instead opt for a lower expected profit with a narrower range of profit outcomes (Ullah et al., 2015). Risk-averse decision rules differ from risk neutrality due to the existence of marginal risk premium, which is the wedge between input cost and expected marginal product at the optimum level of input use (Ramaswami, 1993; Russo et al., 2022).

Risk-averse farmers are the most cautious risk-takers, but they do take some risks. They lose because they miss economic opportunities for profit. Risk-neutral farmers understand they must take some chances to get ahead but recognize that there are degrees of risk in every situation. Before making a decision or taking action they gather information and analyze the odds. They try to be realistic and recognize the risks and try to reduce risks to acceptable levels. Risk lovers are individuals who enjoy risks as challenging and exciting and look for the chance to take risks. Many farmers may be in this category concerning their marketing plans. As long as financial survival is not at stake, they may enjoy the adventure of playing the market. Many speculators are in this category. Some close their eyes to risk, ignore facts, and go ahead and commonly fail because they refuse to take precautions. The sources and types of risk and uncertainty in poultry are numerous and diverse, the industry is bedeviled with multiple constraints such as outbreaks of diseases, continuous increase in the cost of inputs, inadequate market, continuous rise in the price of feed, substandard day-old chicks, weather fluctuation, inadequate veterinary services, transportation problems among others (Obike et al., 2017). Livestock farming risks are classified into: Production risk (drought, heavy rainfall and diseases and pests); Marketing risk (supply/cost of inputs, demand for a product/price and cost of production); Financial risk (loan and its cost); Institutional risk (change in policy at the local, national and international levels) and Personal/human risk (accidents, illness, civil unrest and death) (Kahan, 2008). In poultry farming, farmers express their risk mitigation in diverse ways, some of which are forward pricing, production practices, insurance, holding liquid reserves, diversification, and liability management (Adnan et al., 2020). Generally, these ways of risk mitigation are at a cost too high for most poultry farmers that are mostly smallholders with little or no opportunity for diversification and insurance.

Risk management in poultry farming is expedient, failure of which the farmer bears the brunt of low income, market

instability and food insecurity (Lamine, 2018). Risk management strategies in livestock can be categorized majorly into three: Preventive strategies (reducing the probability of an adverse event); Mitigation strategies (reducing the potential impact of an adverse event); and Coping strategies (relieving the impact of the risky event after occurrence). Risk managing decisions begin with identifying. The greatest risks for farmers were understanding the potential impacts and likelihood of desirable outcomes and identifying the possible steps to lessen the impacts and avert failure (Howell & Hazard, 2012). The identification of the sources of risk is key to choosing an appropriate management strategy even at the planning stage of an investment to minimize loss, improve profitability and ensure the sustainability of the business. In developing countries, farmers lack access to adequate risk management policies such as futures contracts or guarantee funds, agricultural insurance and government assistance. Consequently, farmers rely on traditional coping risk mitigation strategies, unfortunately, most of these traditional techniques are inefficient. Adequate risk management in poultry farming will keep debt low, therefore lowering the cost of production and affording farmers good liquidity status (Asogwa et al., 2014). Since risk and uncertainties influence investment decisions, it is, therefore, imperative to assess the risks and uncertainty surrounding poultry enterprise which is one of the most important sectors of livestock with the vision of finding ways to improve the enterprise which this study addressed.

Much work has been done on the analysis of risk in agriculture and poultry production. Some of these works were the work of Vihi et al. (2018) on the analysis of farm risk and coping strategies; Aminu et al. (2019) on-farm risks and management strategies; Akinbile et al. (2013) on risk management strategies utilized by poultry farmers; Adeyonu et al. (2021) on risk perceptions of poultry farmers and the management strategies; Ebong and Awatt (2023) on analysis of risk management in poultry production enterprises and Obike et al. (2017) on risk management and output determinants among poultry farmers. Of all these studies none made mention of the determinants of the level of risk strategies employed by farmers which is the focus of this study.

The objectives of this study to assess the risks management strategies employed by poultry farmers were therefore: (*i*) to identify the risks and uncertainties encountered by the poultry farmers, (*ii*) to identify the risk management strategies employed by the poultry farmers, and (*iii*) to estimate the determinants of the level of risk management strategies.

2. Material and Method

The population of the study was poultry farmers in Anambra state. This study adopted a multistage sampling technique. Purposively selected six Local Government Areas (LGAs): Ogbaru, Ihiala, Awka South, Anambra West, Anaocha and Idemili North based on the State Agricultural Development Program (ADP) list of poultry farmers showing a high concentration of the farmers in the areas. In the second stage, twenty poultry farmers were selected randomly from each LGA; five in each community as shown in Table 1. A structured questionnaire was then used to elicit the required information from a total of one hundred and twenty poultry farmers taking 5 respondents randomly from four communities/towns in each GA. Data collected were socio-economic characteristics, risks encountered, and the risk management strategies employed by the farmers.

Table 1. Sampling technique and sample size

State	L.G.A.	Commun	Towns/Villages		No analyzed
Anambra	Ogbaru	Atani	5		
		Mputu	5		
		Odekpe	5		
		Umuodu	5	Total=20	20
	Ihiala	Ihala	5		
		Mbosi	5		
		Azia	5		
		Iseke	5	Total=20	20
	Awka South	Ifite-awka	5		
		Isiagu	5		
		Nibo	5		
		Nise	5	Total=20	20
	Anambra West	Odekpe	5		
		Oroma-etiti	5		
		Ukalla	5		
		Owelle	5	Total=20	20
	Anaocha	Agulu	5		
		Adazi-enu	5		
		Neni	5		
		Obeledu	5	Total=20	20
	Idemili North	Abatete	5		
		Umuoji	5		
		Nkpor	5		
		Ogidi	5	Total=20	20
				Total	120

2.1. Data analysis

Model specification

Risk management strategies level index:

The risk management strategies level index for poultry farmers was constructed to classify the farmers into different classes of the severity of management strategies levels. This was based on the number of identified management strategies variables that a poultry farmer is exposed to, based on their responses on the questionnaire yes=1 and no=0. The maximum number of actionable steps allowed to state in the questionnaire was thirty-four. A farmer who did not take any action get a score of zero, if 1 action was taken the farmer get a score of 1, and 2 actions get a score of 2 up to score of 34. The composite score was then used to classify farmers to different risk severity

levels: high, intermediate and low; classification is done based on: High level: mean plus standard deviation and above, Intermediate level: between upper and lower categories, Low level: between mean minus standard deviation point to zero.

The result was used as the dependent variable (Y_i) for the multinomial logistic regression model.

Ordered probit regression:

Ordered probit regression is a statistical modelling technique. It is used in place of ordinary least squares regression, which assumes a continuous dependent variable, when the dependent variable is ordinal (ordered categories with unequal distances between them (McKelvey & Zavoina, 1975). Ordered probit regression model the probability that an observation is within a specific category. In ordered probit regression it is assumed that there is an underlying continuous latent variable, which determines the observed ordinal outcome. The latent variable can be expressed as: $Y^* = X'\beta + \mathcal{E}$ where X represents a vector of independent variables and β is a vector of coefficients to be estimated, and $\mathcal{E}$ is a normally distributed error term with mean zero and constant variance (Greene, 2000). The observed ordinal categories Y are determined by threshold values such that:

$Y=0$ if $Y^* \leq 0$, $Y=1$ if $0 < Y^* \leq \mu_1$, $Y=2$ if $\mu_1 < Y^* \leq \mu_2$

where $\leq \mu_1$ and $\leq \mu_2$ are the cut points (threshold variables in the probit model).

The model is estimated using maximum likelihood estimation which finds parameter values that maximize the probability of observing the given data. The coefficients in an ordered probit model do not directly represent marginal effects but instead indicate the direction and relative strength of the relationship between each independent variable and the latent outcome variable (Greene, 2000). To interpret results meaningfully, researchers often compute marginal effects, which provide the change in the probability of each outcome category for a unit change in an independent variable (Long & Freese, 2014).

The ordered probit regression model;

$Y^* = X'\beta_i + \mathcal{E}$

Where; Y: the response categories for the level of adaptation or mitigation strategies, β_i: parameters to be estimated, X_i: vectors of socioeconomics, $\mathcal{E}$: a normally distributed error term with mean of zero and constant variance.

The independent variables were itemized below:
X_1: Age (years), X_2: Sex (*1* if male and *0* if female), X_3: Education (years), X_4: Capital invested, X_5: Years of experience (years), X_6: Flock size (*1* if size is big; > 5000 birds, *0* if size is small; < 5000 birds), X_7: Distance of farm to residence (km), X_8: Access to agricultural extension (*1* if farmer has access and *0* if otherwise), X_9: Membership of cooperative society (*1* member, *0* otherwise), X_{10}: Management system (battery cage system =*1*, deep litter system =*0*), X_{11}: Diseases prevention &treatment, X_{12}: Frequency disease outbreak (X_{12}=*1* if outbreak is frequent and 0 if otherwise), X_{13}: Involvement in livestock insurance (*1* if yes and *0* if otherwise), X_{14}: Credit Constraint (*1* if yes and *0* if otherwise), X_{15}: Fluctuating in prices of products (*1* Fluctuating and *0* if otherwise), X_{16}: Government policy (*1* if favorable and *0* if not).

3. Results and Discussion

From Figure 1 below as classified by the authors seven major risks were identified among the poultry farmers included in the study. These risk categories were production/technological risk, market/price risk, institutional risk, financial/credit risk, environmental risk, human and personnel risk and health risk. Production/technological and health risks (100%) were experienced by all the farmers included in the study. Market/price risk was experienced by 81.2% of the farmers, while institutional risk was experienced by only 55.2%, financial/credit risk (94.2%), environmental risk (67.2%) and human and personnel risk (59.1%). This corroborates the findings of Obike et al. (2017) and Olarinde et al. (2010). The result implies that the majority of farmers were exposed to various categories of risk which makes it very important to analyze and come up with policies that will help farmers reduce exposure to risk.

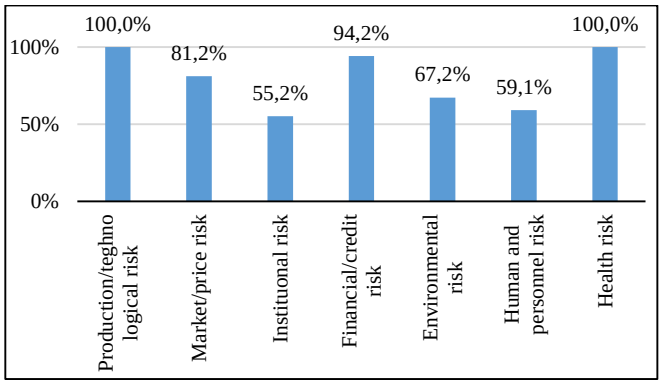

Figure 1. Poultry farmers' distribution by main sources of risks (*Source: Authors' computation from field survey data, 2023*)

Following Akinola (2014), Olarinde et al. (2010) and Obike et al. (2017), the categories of risk identified were decomposition into various components and the mean rating of the components was done in Table 2. The Health Risk was decomposition into eight categories with high cost of medication and vaccines (4.62±0.33) ranking first followed by frequent cases of a disease outbreak (4.39±0.56), then medication and vaccine failure (3.54±0.23). others in this group that were considered severe and of great importance, because they meet the cut-off point of 3, were inadequate veterinary services (3.37±0.22), inadequate space for poultry business expansion (3.34±0.52) and droppings

Table 2. Decomposition of the categories of risk identified

SN	Identified risk	Mean ($\bar{X}$)	Std. Dev.
1. Health Risk	High cost of medication and vaccines	4.62	0.33
	Frequent cases of disease outbreak	4.39	0.56
	Medication and vaccines failure	3.54	0.23
	Inadequate veterinary services	3.37	0.22
	Inadequate space for poultry business expansion	3.34	0.52
	Droppings accumulation	3.26	0.55
	Overcrowding/ Stampeding in poultry	2.48	0.62
	Cannibalism in poultry	2.28	0.32
2. Human and Personnel Risk	Inadequate improved poultry information on management technic	2.64	0.62
	Poor personal management	2.57	0.64
	Ill-health of farmer/worker	1.25	0.22
3. Environmental Risk	Weather variability	3.61	0.34
	Snake attack	3.23	0.42
	Shortage of water	2.94	0.35
	Natural disaster	1.44	0.66
4. Financial/Credit Risk	Credit constraint	4.56	0.48
	High interest rate	4.46	0.62
5. Production/Technological Risk	Inadequate technical know-how	4.12	0.54
	High labour cost	4.10	0.53
	Low output	3.23	0.22
	Poor quality day old chicks	3.01	0.22
	Poor quality feed	2.93	0.75
	Theft and burglary	2.09	0.80
	High mortality rate	2.67	0.67
6. Market/Price Risk	Fragility of poultry products (eggs)	4.37	0.74
	Lack of storage facilities	4.03	0.72
	Unstable price of products in the market	3.99	0.67
	Transportation problems	3.85	0.33
	Rise in cost of inputs	3.64	0.57
	Fluctuation in prices of output	3.32	0.23
	Fluctuations in price of exotic day old chicks	2.99	0.52
	Erratic demand for poultry products	2.77	0.46
	Accident during egg transportation	2.67	0.32
7. Institutional Risk	Low institutional support from government	3.39	0.70
	Erratic power supply	3.92	0.44
	Unfavourable Government policy	2.68	0.62
	Insecurity	2.67	0.64

Source: Authors' computation from field survey data, 2023

accumulation (3.26±0.55). The least in this group is cannibalism in poultry (2.28±0.32). This showed that there are eight major variables identified as health risks and six of them required serious attention. Human and Personnel Risk was decomposed into the second category. The components were just 3 inadequate improved poultry information on management technic (2.64±0.62), poor personal management (2.57±0.64) and ill-health of farmer/worker (1.25±0.22). These results corroborate the findings of Effiong et al. (2014) and Ebong and Awatt (2023). The third category was Environmental Risk with the following components: Weather variability (3.61±0.34), snake attack (3.23±0.42), shortage of water (2.94±0.35) and natural disaster (2.44±0.66). The next category was Financial/ Credit Risk of which credit constraint (4.56±0.48) and high-interest rate (4.46±0.62) were the components. Production/Technological Risk has five components but only four meet the cut-off point of 3. These components were inadequate technical know-how (4.12±0.54), high labour cost (4.10±0.53) output (3.23±0.22), poor quality day-old chicks (3.01±0.22), poor quality feed (2.93± 0.75), theft and burglary (2.09± 0.80) and high mortality rate (2.67±0.67). Market/Price Risk was decomposed

into nine components, but only seven were severe. These were fragility of poultry products (eggs) (4.37±0.74), lack of storage facilities (4.03±0.72), unstable price of products in the market (3.99±0.67), transportation problems (3.85±0.33), rise in cost of inputs (3.64±0.57), fluctuation in prices of output (3.32±0.23) and fluctuations in price of exotic day-old chicks (2.99±0.52). Institutional Risks were decomposed into four, but only two were server: Low institutional support from the government (3.39±0.70) and erratic power supply (3.92±0.44).

Table 3 categorized the farmers on the basis of their risk behaviour and it was discovered that 65.83% of the farmers averse risk, 22.50% were risk neutral and only 11.67% were risk takers. This corroborates the findings of Ebong and Awatt (2023).

Table 3. Risk attitude of poultry farmers

Risk	Frequency	Percentage (%)
Risk averse	79	65.83
Risk neutrality	27	22.50
Risk takers/preference	14	11.67
Total	120	100

Source: Authors' computation from field survey data, 2023

Following Olarinde et al. (2010) and Obike et al. (2017) the farmers were categorized by their adoption of risk management strategies as shown in Table 4. The categorization with mean and standard deviation as follows: biosecurity strategies (4.32±0.22), production strategies (4.22±0.43), mitigation/ risk reduction strategies (3.30±0.68), other risks coping strategies (2.42±0.89), transfer measures/institutional strategies (1.05±0.30) marketing strategies (3.98±0.71), and financial strategies (2.4±0.87). Biosecurity strategies have the highest mean follow by production and then marketing strategies, followed by mitigation/risk reduction strategies. All the strategies had a mean value of ≥3 that is the cut-off point except financial strategies, transfer measures/institutional strategies and other risks coping strategies.

In Table 5, the categories of risk management strategies adopted were decomposed as follows. For the Biosecurity strategies category, we have adequate and timely vaccination (94.17%), adequate ventilation of poultry buildings (95.83%), quarantine of sick birds (95.00%), controlled visitors access to poultry buildings (93.33%), proper disinfection pens/cages (85.00%), prevention of rodents/pests (73.33%), adequate fencing and netting (68.33%) and foot dips with effective disinfectant (63.33%). For Production strategies the following were identified: avoid overcrowding (95.83%), separation of birds by species (95.83%), aeparation of birds by age (94.17%), use of wood shaven (82.50%), disease tolerant breed (74.17%), and adequate feed /nutrition in feed (72.50%). For the Mitigation/risk reduction strategies category, source day-old chicks from certified/authorized sellers (96.67%), administration of safe water always (92.50%), proper collection of eggs (73.33%), enterprise diversification (55.83%), feed from certified millers (53.33%), feed producing by self (46.67%), buying input in bulk/advance (43.33%), ensuring constant lightening/power supply (37.50%), adequate/proper record keeping (25.00%). The Coping strategies category has off-farm income (38.33%), adequate storage of input/products (21.67%), training/workshops attendance (20.63%) and cash liquidity for emergencies (17. 50%). Transfer measures/Institutional strategy has only insurance policies (6.67%). Marketing strategies have securing the market in advance (72.50%) and credit sales (69.17%). Financial strategies have loaned from friends and relatives (82.50%), loan from cooperatives (51.67%), advance from buyers (36.67%) and loan from bank/financial institutions (6.67%).

Table 6 presented the result of the ordered probit model that revealed the determinants of the level of risk management strategies. The dependent variable was derived using composite score to order the level of risk management strategies of farmers into low, medium and high as explained in the methodology. Sixteen variables were included in the model, but only five were significant at 1% and 5% The Wald chi2(16) = 74.4, Log likelihood = -194.26222, Prob > chi2 = 0.0000 which revealed a model that is statistically significant at 1%.

The determinants of the level of risk management strategies were explained based on initial categorization:

Biosecurity strategies: Frequency disease outbreak has marginal effect t (0.65) is significant (p<0.001). This implies that the likelihood of the level of risk management increase by 65%. This is in line with Robertson (2020) work with high frequencies of disease outbreak will a farmer to be proactive in adopting risk management strategies that aid the likelihood of disease outbreak reduction.

Production strategies: Years of experience (0.26), flock size (0.017) and management system (0.48) both were significant (p<0.01). This implies that the likelihood of the level of risk management increase by 26% 1.7% and 0.48 respectively with 10% increase in these variables. Years of formal education marginal effect (p<0.001). This implies that with a 5% increase in years of formal education, the likelihood of improving the risk management strategies would increase by 38%.

Mitigation/risk reduction strategies: Farm distance to residence (0.27) was significant (p<0.01). This implies that with a 10% increase in years of formal education, the likelihood of improving the risk management strategies would increase by 38%.

Table 4. Categorization of risk management strategies adopted by poultry farmers

Categorization of risk management strategies adopted by poultry farmers	Mean ($\bar{X}$)	Std. Dev.
1. Biosecurity strategies	4.32	0.22
2. Production strategies	4.22	0.43
3. Mitigation/risk reduction strategies	3.30	0.68
4. Other risks coping strategies	2.42	0.89
5. Transfer measures/ Institutional strategies	1.05	0.30
6. Marketing strategies	3.98	0.71
7. Financial strategies	2.43	0.87

Source: Authors' computation from field survey data, 2023

Table 5. Decomposition of categories of risk management strategies adopted by poultry farmers

Strategies employed		Frequency	Percentage (%)
1. Biosecurity strategies	Adequate and timely vaccination	113	94.17
	Adequate ventilation of poultry buildings	115	95.83
	Quarantine of sick birds	114	95.00
	Controlled visitors access to poultry buildings	112	93.33
	Proper disinfection pens/cages	102	85.00
	Prevention of rodents/pests	88	73.33
	Adequate fencing and netting	82	68.33
	Foot dips with effective disinfectant	76	63.33
2. Production strategies	Avoid overcrowding	115	95.83
	Separation of birds by species	115	95.83
	Separation of birds by age	113	94.17
	Use of wood shaven	99	82.50
	Disease tolerant breed	89	74.17
	Adequate feed/nutrition in feed	87	72.50
3. Mitigation/risk reduction strategies	Source DOC from certified/ authorized sellers	116	96.67
	Administration of safe water always	111	92.50
	Proper collection of eggs	88	73.33
	Enterprise diversification	67	55.83
	Feed from certified millers	64	53.33
	Feed producing by self	56	46.67
	Buying input in bulk/advance	52	43.33
	Ensuring constant lightening/power supply	45	37.50
	Adequate/proper record keeping	30	25.00
4. Coping strategies	Off farm income	46	38.33
	Adequate storage of input/products	26	21.67
	Training/workshops attendance	25	20.63
	Cash liquidity for emergency	21	17.50
5. Transfer measures/Institutional strategies	Insurance polices	8	6.67
6. Marketing strategies	Securing market in advance	87	72.50
	Credit sales	83	69.17
7. Financial strategies	Loan from friends and relative	99	82.50
	Loan from cooperative	62	51.67
	Advance from buyers	44	36.67
	Loan from bank/financial institutions	8	6.67

Source: Authors' computation from field survey data, 2023

Table 6. Determinants of the level of risk management strategies

Variables	coefficient	p>|t|	coefficient	p>|t|
			Marginal effect	
1. Age	0.03	0.16	0.004*	0.06
2. Sex	0.16	0.40	-0.22	0.59
3. Education	0.43	0.007	0.38**	0.005
4. Capital invested	0.44	0.000	0.34***	0.000
5. Years of experience	0.26	0.05	0.336*	0.062
6. Flock size	0.017	0.08	0.005*	0.08
7. Farm distance to residence	0.27	0.089	0.33*	0.069
8. Access to extension	0.56*	0.06	0.461*	0.05
9. Membership of cooperative	0.36	0.000	0.25***	0.000
10. Management system	0.477	0.091	0.477*	0.09
11. Diseases prevention &treatment	0.77	0.07	0.67*	0.09
12. Frequency disease outbreak	0.72	0.000	0.65***	0.000
13. Livestock insurance	0.054	0.002	0.044**	0.002
14. Credit constraint	0.022	0.04	0.006*	0.04
15. Output prices fluctuation	-0.59	0.905	-0.57	0.905
16. Government policy	-0.621**	0.006	-0.52**	0.005
Wald chi2(16) = 74.49	Log likelihood = -194.26222		Prob > chi2 = 0.0000	Obs=120
/cut1 -0.63	0.85	-1.99	0.52	
/cut2 -0.45	0.64	-1.63	0.78	

Source: Authors' computation from field survey data, 2023

Transfer measures/Institutional strategies: The coefficient of membership of cooperative is positive, and the marginal effect (0,25) is significant (p<0.001). This implies that been a member of the cooperative would increase the likelihood of risk management by 25%. This aligns with the work of Sugiyanto and Anggi (2018). This happened because farmers that belong to cooperative can access loans and advise for better risk management. The livestock insurance marginal effect (0.044) is significant (p<0.001). This implies that the likelihood of the level of risk management to increase by 4.4% for farmers that were on agricultural insurance policy. This occurs because they will be guided to put the right measure in place and avoid moral hazard claim by the insurance company. Government policy marginal effect (0.52) was negative and significant (p<0.001). This implies that the level of risk management has the likelihood of decreasing by 52% if government policies were favourable to poultry farmers.

Financial strategies: The model showed that capital invested marginal effect is significant at (p<0.001). This implies that the likelihood of the level of risk management to increase by 44% for every one percent increase in capital invested. This corroborates the work of Harvey, Liu, & Zhu et al, (2015) This may be so since most of the farmers that operate large stock had access to credit which they must repay and would not be willing to fail.

Marketing strategies: Output prices fluctuation (-0.59) was negative and not significant.

4. Conclusion

The study provided empirical evidence of the assessment of risk management strategies level determinants. Based on the result of the Multinomial logit model, it was evident capital invested, membership in cooperative society, frequency of disease outbreaks and ınvolvement in livestock insurance, credit constraint, flock size, educational and government policy were the major determinants of the level of farmers' risk management strategies

Capital invested, flock size and membership in cooperative society through which farmers can access credit were positively determinants of risk mitigation level, therefore, credit should be made available by stakeholders through cooperative societies so as to reduce farmers level of credit Constraint.

Education, frequency of disease outbreaks and involvement in livestock insurance were also positive determinants of risk mitigation level, therefore, farmers should be encouraged to be involved in livestock insurance and be trained on the best way to prevent diseases by extension workers.

Unfavourable government policies should be annulled and favourable ones should be developed and implemented.

Conflict of interest

The authors declare no conflict of interest.

Ethical Approval

This arcticle does not require ethics committee approval.

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