# ANALYSIS OF RISK FACTORS IN AGRICULTURAL PRODUCTION: EVIDENCE FROM CATFISH FARMERS IN ONDO STATE, NIGERIA.

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## ABSTRACT

*The study evaluated risk factors in agricultural production with a focus on catfish farmers in Ondo State, Nigeria. A multi-stage sampling technique was used to select 171 catfish farmers for the study. The data obtained were analyzed using descriptive statistics and a multinomial logit model. A larger percentage (77.19%) of the farmers used earthen ponds to culture their fish; 67.25% of the catfish farmers had tertiary education, while 50.3% had 1 to 5 years of experience in catfish farming. In terms of risk attitude, the majority of the catfish farmers were risk takers (76.02%), 15.21% were risk-averse, and 8.77% were risk-neutral. Diseases and parasites were the most prominent risk factors, with 52.05%. The estimates of the multinomial logit showed that age (2.37), extension contact (2.60), and level of education (1.80) were positive and significant determinants of catfish farmers' risk attitudes. Notable risk-coping strategies the farmers adopted include using cover nets (76.61%) and drugs when necessary (66.08%). To protect their investment in catfish production, it is recommended that farmers make informed choices and be flexible, given the physical, economic, and biological constraints that catfish production operates under.*

**Keywords**: Risk, Coping Strategies, Attitude, Catfish, Pond.

## INTRODUCTION

Risk is the probability of something negative or unfavourable happening. Hardaker et al. (2015) defined risk as exposure to an uncertain and unfavourable outcome. Risks are part of agricultural production and can minimize farm yield if not managed properly. Many of the factors that affect farmers' choices are impossible to predict with absolute certainty: weather changes, harvest prices can drop, hired labour may not be available during peak times, machinery and equipment may malfunction when they are most needed, biological processes are complex, leading to yield uncertainty, and government policy can change quickly (Kahan, 2013). These developments are just a few instances of the dangers that farmers face when managing their farms. All these risks affect the profitability of their farms, and small-scale farmers are now more vulnerable (Kahan, 2013).

Farming operates under unpredictable biological, economic, and climatic conditions. Biological condition in the sense that both crop, animal, and fish production are subjected to pests and diseases; economic condition in the sense that production inputs and farm products are affected by forces of demand and supply; climatic condition in the sense that farming is affected by factors such as rainfall, temperature, sunshine, relative humidity, etc. For instance, farmers don't know how many fish will die when they buy fish seeds (fingerlings, juveniles, and post-juveniles) and stock their ponds because they don't know the volume of rain that will fall and cause severe floods.

Farming is also affected by institutional and human factors. Institutional factors include government policies (import and export restrictions, price support, subsidies, taxes, etc.), financial institution policies (bank rate, interest rate, etc.), and pro-agriculture non-governmental organizations policies; all these factors affect farming in one way or another. Human factors have to do with the farmers falling sick or their family members and other unpredictable circumstances such as death, accidents, etc. that can affect farming.

Farmers cannot be sure of what will happen to their farm investments because of the inherent risks in agricultural production. Farm produce physical deterioration is a possibility even when the best agronomic practices, technological tools, and expertise are employed. Given the agricultural sector's importance in supporting economic growth and as a key source of livelihood for rural populations in developing nations, it's crucial to understand the risks and uncertainties that come with farming, as well as the choices for mitigating their impacts (Ullah et al., 2016). Although some research (Thompson & Mafimisebi, 2014; Folayan & Folayan, 2017; Alfred, Odefadehan, & Ukut, 2012; Olutumise, Adene, Ajibefun, & Amos, 2020) on fish processing and marketing, profitability of catfish farming in Ondo State have been conducted, none of these studies has concentrated primarily on risk analysis of catfish farming in the state. For instance, Thompson and Mafimisebi (2014) published a study on the profitability of selected operations in Catfish aquaculture, while Folayan and Folayan (2017) published a study on the socio-economic and profitability of Catfish production. This study is being carried out against this backdrop in an attempt to close the perceived gap.

## METHODOLOGY

The study area is Ondo State, Nigeria. The land area of the state is put at 14,788.723 square kilometres (Ondo State Bureau of Statistics, 2022). The state is located between latitudes $5^0 45'$ and $7^0 52'$ N and longitudes $4^0 20'$ and $6^0 5'$ E (Sunshine Liberation Forum, 2011). Ondo State is in the tropical rainforest with two unique seasons, namely, wet and dry.

A multi-stage sampling technique was used for this study. Five local government areas (LGAs), namely Akure South, Owo, Akure North, Akoko North-East, and Okitipupa, out of the state's 18 LGAs, were purposefully chosen for the first stage as a result of their significant contributions to catfish production as attested to by a list provided by Ondo State Catfish Farmers' Association (2019). In the second stage, a random sampling technique was used to select 80% of the catfish farmers from each selected LGA, which resulted in a total of 171 farmers as shown in Table 1.

**Table 1: Sampling frame and sample size of catfish farmers**

| Local Government Areas | Sampling Frame | Sample Size (80% of sampling frame) |
|---|---|---|
| Akure North | 47 | 38 |
| Akure South | 89 | 71 |
| Owo | 43 | 34 |
| Akoko North-East | 21 | 17 |
| Okitipupa | 14 | 11 |
| Total | 214 | 171 |

**Source: Ondo State Catfish Farmers' Association (2019) and author's computation**

The study covered the 2019–2021 production cycles. For this study, well-structured questionnaires and interview schedules were employed to collect cross-sectional data from primary sources. The data obtained from the study were analyzed using descriptive statistics and multinomial logit regression. The effect of socio-economic variables on catfish producers' risk attitudes was measured using the multinomial logit model. The risk attitude of catfish farmers is the dependent variable, while the farmers' socioeconomic factors are the independent variables. The farmers were categorized as risk takers, risk-averse and risk-neutral based on their responses to how they were able to manage risks in their respective farms. According to Greene (2003), the study's multinomial logit would be stated as:

$$Pr(Y_i = j) = \frac{e^{\beta_j X_i}}{1 + \sum_{t=0}^{6} e^{\beta_t X_i}} \quad , \quad j = 0, 1, 2, 3, \dots, \quad 6 \qquad \dots\dots\dots\dots\dots\dots(1)$$

Where βj is a vector parameter that relates $X_i$ (socio-economic factors) to the probability that $Y_i = j$. Because the probabilities of the six (6) socio-economic factors must add up to one, it is expedient through normalization to set one of the parameter vectors, for instance, $\beta_0$, equal to zero. In agreement with Greene (2003), the probabilities for the six socio-economic factors can be expressed thus:

$$P_{ij} = Pr(Y_i = j) = \frac{e^{\beta_j X_i}}{1 + \sum_{t=0}^{6} e^{\beta_t X_i}} \quad , \quad j = \ 1, 2, 3, \dots, \quad 6 \qquad \dots\dots\dots\dots\dots\dots(2)$$

$$P_{i0} = \ Pr(Y_i = 0) = \frac{1}{1 + \sum_{t=1}^{6} e^{\beta_t X_i}} \qquad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

The probability of being in groups 1 and 2 is represented by $P_{ij}$, while the likelihood of being in the reference group or group 0 is $P_{i0}$. In practice, the coefficients of the reference group are normalized to zero while estimating the model (Greene, 1993; Kimhi, 1994). According to Greene (1993), referenced by Ojo et al. (2013), the probability for all the selections must add up to unity. As a result, only three (3-1) separate sets of parameters can be identified and calculated for the three (3) choices. The effect of the independent variables on catfish farmers' risk attitudes can be explained by looking at the derivatives of the probabilities for the element of the vector of the independent variables, according to Greene (2000), as shown below:

$$\frac{\partial P_j}{\partial X_i} = P_j\left[\beta_j - \sum_{t=0}^{j} P_t \beta_t\right] = P_j\left[\beta_j - \beta\right] \qquad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4)$$

The explicit form of the multinomial logit model is specified as follows:

$P_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + U_i$ ……………(5)

Where,

$P_{ij}$ = Probability of farmers' risk attitude;
$X_1$ = Age of farmers (years);
$X_2$ = Sex (dummy: male = 1, female = 0).
$X_3$ = Household size (number of persons);
$X_4$ = Educational level (schooling years);
$X_5$ = Years of experience in catfish farming (years);
$X_6$ = Extension contact (number of contacts)

# RESULTS AND DISCUSSION

## Socio-economic Characteristics of Catfish Farmers

Table 2 shows the age of catfish farmers in the research area. The average age of the catfish farmers was 43, indicating that they were adults who were still active. According to Baruwa et al. (2019), farmers around this age are still seen as productive and are young and vigorous enough to handle the demands of farming. This demonstrates that these farmers are still capable of overcoming difficulties that can be associated with catfish production and that they are easily inspired to adopt new technologies that can aid in planning and expanding catfish output. According to the findings of the study, 70 percent of the catfish farmers were between the ages of 20 and 49. This age group can handle any stress brought on by catfish production because they are still active. Oke et al., 2021; Gbigbi, 2020; Ikpoza et al., 2021, among others, also suggested that farmers in this age range are considerably more enthusiastic and economically engaged, which is beneficial for the future of catfish production.

According to Table 2's results on the years of experience of farmers in catfish production, 50.3% of the farmers had 1 to 5 years of experience, indicating that they were relatively inexperienced in the industry. According to Esiobu et al. (2022), experience in any type of business or agricultural activity tends to make employees more productive and informed about that enterprise. Other findings from Table 2 showed that 34.5% of the farmers had experience producing catfish for 6 to 10 years, 5.8% had experience for 11 to 15 years, 5.3% had experience for 16 to 20 years, and only 4.1% had experience for 21 years or more.

The study area's catfish farmers were highly educated, as shown in Table 2, where 67.25% of them had tertiary education. This indicates that they will be open to workable innovations that will help them improve their agricultural businesses, lower costs, and, if possible, increase profits. This outcome is consistent with research by Baruwa et al. (2019), which also came to similar conclusions. Small-scale fish farmers in Kaduna State have a high level of tertiary education, according to Sambo et al. (2021). The high level of postsecondary education found in the research area may be a result of the state government's emphasis on education. In addition, Table 2's findings revealed that 23.4% of catfish farmers had secondary education, whereas 4.09% had only primary education.

When it comes to agricultural productivity or any other activity that needs energy, gender is a key factor. According to Table 2, 92.98% of the catfish farmers that were sampled were men, and 7.02% were women. This finding supports research by Olagunju (2020) that shows the aquaculture industry is a male-dominated agricultural sector. In support of this finding, Onyekuru et al. (2019) study on the socioeconomic and profitability analysis of catfish production in Nsukka Local Government Area of Enugu State, Nigeria, revealed a higher proportion (83%) of male catfish producers. Catfish farming is a male-dominated agricultural activity in Nigeria, according to research findings from various studies by several authors (Ikpoza et al., 2021; Ochiaka and Obasi, 2019; Olaoye et al., 2013; Okoror et al., 2017; Emaziye, 2020; Obianefo et al., 2020). According to the findings of this study, 81.29% of catfish farmers were married. This implies that family labour is accessible for catfish production tasks. This outcome is consistent with Ikpoza et al. (2021), which noted that 70% of catfish farmers in their survey were married. In their investigations, Onyekuru et al. (2019), Aasa et al. (2020), and Oke et al. (2021) similarly found a significant proportion of married catfish farmers. Only 16.96% of catfish farmers were single, as evidenced in Table 2.

Table 2: Distribution of catfish farmers according to their socioeconomic features

| **Variables** | **Frequency** | **Percentage (%)** | **Mean** |
|---|---|---|---|
| Age | | | |
| 20-29 | 16 | 9.36 | 43 |
| 30-39 | 49 | 28.65 | |
| 40-49 | 54 | 31.58 | |
| 50-59 | 35 | 20.47 | |
| 60-69 | 13 | 7.6 | |
| 70-79 | 4 | 2.34 | |
| Total | 171 | 100 | |
| Years of experience | | | |
| 1-5 | 86 | 50.3 | 7 |
| 6-10 | 59 | 34.5 | |
| 11-15 | 10 | 5.8 | |
| 16-20 | 9 | 5.3 | |
| 21-25 | 6 | 3.5 | |
| 26-30 | 1 | 0.6 | |
| Total | 171 | 100 | |
| Educational status | | | |
| No formal education | 9 | 5.26 | |
| Primary school | 7 | 4.09 | |
| Secondary school | 40 | 23.4 | |
| Tertiary education | 115 | 67.25 | |
| Total | 171 | 100 | |
| Gender | | | |
| Male | 159 | 92.98 | |
| Female | 12 | 7.02 | |
| Total | 171 | 100 | |
| Marital status | | | |
| Single | 29 | 16.96 | |
| Married | 139 | 81.29 | |
| Divorced | 1 | 0.58 | |
| Widow | 2 | 1.17 | |
| Total | 171 | 100 | |
| Household size | | | |
| 1-5 | 125 | 73.10 | 4 |
| 6-10 | 44 | 25.73 | |
| 11-15 | 2 | 1.17 | |
| Total | 171 | 100 | |
| Access to credit | | | |
| No | 128 | 74.85 | |
| Yes | 43 | 25.15 | |
| Total | 171 | 100 | |
| Extension contact | | | |
| No | 62 | 36.26 | |
| Yes | 109 | 63.74 | |
| Total | 171 | 100 | |

Source: Field survey, 2022.

Table 2 displays the distribution of catfish farmers by household size. A large portion of catfish farmers have numerous family members. 73.1% of the catfish farmers in the study had households with 1 to 5 people. A greater availability of people who can be used as a source of labour to produce catfish is indicated by larger households. According to Baruwa et al. (2019), large households offer a reliable source of inexpensive labour that may be tapped at any moment. Additionally, according to Gbigbi (2020), more households imply more family members who will be accessible for catfish production. There were 26.9% of catfish farmers whose homes included more than five people.

Without sufficient funding, no agricultural enterprise can thrive or survive; hence, farmers must have timely access to finance that is both sufficient and regular. Table 2 displays the frequency distribution of catfish farmers, with 74.8 percent of them without access to credit. This outcome is consistent with research by Esiobu et al. (2022), who claimed that a significant portion of catfish farmers in Imo State lack access to finance that would enable them to make timely purchases of crucial farm supplies. Just 25.15 percent of the farmers in the study area had access to finance.

In the production of catfish, the extension agent's role cannot be disregarded. The findings in Table 2 show that 63.74% of the farmers had contact with extension agents, indicating that they were familiar with relevant knowledge or the most recent scientific discoveries that could aid them in their catfish production. According to Chukwu (2014), consistent extension contacts support farmers' efforts to boost output, income, and overall catfish production. Table 2 shows that the proportion of catfish producers without any extension contacts was relatively low (36.26%).

**Ponds used for Catfish Production**

Catfish farmers in the study area used different ponds for producing food-size catfish. Some of these ponds include earthen ponds, concrete ponds, and collapsible ponds. A larger percentage (77.19%) of the farmers used earthen ponds to culture their fish, as indicated in Table 3. This result agrees with the findings of a study carried out by Ele et al. (2013) in Calabar, where they reported that most farmers made use of earthen ponds. Adebayo and Daramola (2013) also indicated extensive usage of earthen ponds by catfish farmers in the Ibadan metropolis. This might be because earthen ponds support the growth of phytoplankton and zooplankton that fish feed on, and they are also easy to manage as compared to concrete and collapsible ponds that require constant changes of water, which also attract extra costs in terms of fuel for generators for pumping water into ponds. Gbigbi (2020) also reported that catfish farmers prefer the use of earthen ponds as compared to other types of ponds. A small percentage (17.54%) of the catfish farmers used concrete ponds to carry out their catfish production. Only a fraction of the farmers made use of both earthen and concrete ponds (3.51%) in producing food-size catfish, as shown in Table 3.

**Table 3: Distribution of catfish farmers based on their ponds**

| Pond | Frequency | Percentage (%) |
|---|---|---|
| Earthen pond | 132 | 77.19 |
| Concrete pond | 30 | 17.54 |
| Collapsible pond | 1 | 0.59 |
| Earthen and concrete ponds | 6 | 3.51 |
| Earthen, concrete and collapsible ponds | 1 | 0.59 |
| Concrete and collapsible ponds | 1 | 0.59 |
| Total | 171 | 100 |

Source: Field survey, 2022.

**Sources of Water used in Producing Catfish**

Fish generally cannot survive without water, and that makes water a significant input in terms of fish production. Adequate and regular sources of water cannot be overemphasized when it comes to fish rearing, either for fingerlings or food-size fish production, if optimum results are to be achieved. A lot of the catfish farmers (49.12%) made use of underground water, which is readily available in the soil, in raising their fish, as shown in Table 4. This does not require the use of a generator and the accompanying fuel expenses for pumping water into the pond. Also, a sizeable percentage of the sampled catfish farmers used stream water (28.07%) in culturing their catfish, which is in line with the findings of Olaoye et al. (2013) and Joshua et al. (2012).

**Table 4: Distribution of catfish farmers according to sources of water**

| Sources of water | Frequency | Percentage (%) |
|---|---|---|
| Borehole | 23 | 13.45 |
| Well | 8 | 4.68 |
| Stream | 48 | 28.07 |
| Public water supply | 1 | 0.59 |
| Underground water | 84 | 49.12 |
| Borehole and stream | 1 | 0.58 |
| Borehole and underground water | 5 | 2.92 |
| Borehole, stream and underground water | 1 | 0.59 |
| Total | 171 | 100 |

**Risk Factors in Catfish Production**

Diseases and parasites were the most prominent risk factors. This result is similar to the findings of Ogunmefun and Achike (2017), who found that diseases and pests posed one of Nigeria's biggest threats to fish production. Diseases and parasites affect catfish health, reduce their appetite, and eventually kill them if not managed properly and timely. Low farm-gate prices at harvest were ranked second with 49.71% among the risk factors confronting catfish farmers. Baruwa et al. (2019) mentioned in their study that price variability was one of the notable risks in catfish production. The price at which food-size catfish is sold is an important variable in catfish production because if the selling price per kilogramme is ridiculously low, farmers will not be able to break even, let alone make a profit. This can cause some farmers to stop production if they keep incurring losses.

Flooding was ranked third with 33.92%, and this is another factor that can wipe out an entire farm. Baruwa et al. (2019) also indicated flooding as a risk factor in catfish production. This particular factor can cause catfish farmers to lose all of their fish if it happens, especially at night with no one in sight to rescue the situation. Poaching was ranked fourth with 33.33%, and this is one of the reasons why some catfish farmers employ the services of security guards in order to prevent the theft of fish and save their investment from being hampered by criminally minded individuals. Inadequate water during the dry season was ranked fifth with 30.99%, as water is the medium that supports fish's existence. Fish need water to survive, but in a situation where it is inadequate, their growth, movement, metabolic activity, and so on will be seriously hampered.

**Table 5: Risk factors in catfish production**

| Risk factor | Frequency* | Percentage (%) | Remark |
|---|---|---|---|
| Diseases and parasites | 89 | 52.05 | 1st |
| Low farm-gate price/selling price of food size fish | 85 | 49.71 | 2nd |
| Flooding | 58 | 33.92 | 3rd |
| Poaching | 57 | 33.33 | 4th |
| Inadequate water during dry season | 53 | 30.99 | 5th |
| Bird predation | 28 | 16.37 | 6th |
| Sub-standard feed | 21 | 12.28 | 7th |
| Unstable government policy | 20 | 11.7 | 8th |
| Water pump failure | 8 | 4.68 | 9th |

Source: Field survey, 2022. *Multiple responses

**Risk Attitudes of Catfish Farmers**

Risk is the probability that something negative will occur. The production, financial, human, and institutional risks that catfish farmers must manage are just a few of the many concerns they must contend with. A lot of the catfish farmers were risk takers (76.02%), as shown in Table 6, and this indicates that they can manage risks. This result is per Oladimeji et al. (2019), who stated that there was a relatively high level of risk-taking among catfish farmers using concrete ponds. This result is also contrary to the findings of Nmadu et al. (2012), who reported a relatively high percentage of risk-averse farmers in their study on the risk status of small-scale farmers in Niger State, Nigeria. Only 15.21% of the farmers were risk-averse, while 8.77% were risk-neutral.

**Table 6: Distribution of catfish farmers according to their risk attitudes**

| Risk attitude | Frequency | Percentage (%) |
|---|---|---|
| Risk taking | 130 | 76.02 |
| Risk averse | 26 | 15.21 |
| Risk neutral | 15 | 8.77 |
| Total | 171 | 100 |

Source: Field survey, 2022.

**Determinants of Risk Attitudes of Catfish Farmers**

Socioeconomic variables were examined in order to see how they influence catfish farmers' risk attitudes. Risk-neutral farmers were the reference group. The log-likelihood ratio ($\chi^2$) value of -98.51 was significant at the 1% probability level which indicates that all the slope coefficients were significantly different from zero.

**Risk-taking relative to risk-neutral in relation to age**

Age was positive and significant, as indicated in Table 7. At a 5% significant level and a relative risk ratio (RRR) of 1.18, as displayed in Table 7, farmers are more likely to take risks relative to the reference group if they are sure that the management practices, they adopt will produce good results in terms of getting big food-size catfish at the right time. So, given a unit increase in age, the relative risk of being in the risk-taking group of farmers would be 1.18 times more likely when the other variables in the model are kept constant.

**Risk aversion relative to risk-neutral with age**

Age was positive and significant at the 5% probability level, as indicated in Table 7. The result indicates that a unit increase in age increases the likelihood of catfish farmers' risk aversion relative to the reference group, and this is justified by the findings of Ojo et al. (2019). Given a unit increase in age and an RRR of 1.20, the relative risk of being risk-averse would be 1.20 times more likely when the other variables in the model are held constant. This indicates that as catfish farmers advance in age, they tend to be risk-averse in order not to lose all their investment in catfish production. In other words, farmers are more likely to be risk-averse than risk-neutral.

**Risk-taking relative to risk-neutral with extension contact**

Extension contact was positively significant at 1% to the probability of taking risks relative to the reference group. This implies that a unit increase in the number of extension contacts, the greater the probability of catfish farmers taking risks. With the latest research findings, farmers are more guided and can weather any risks involved in catfish production. With a unit increase in the number of extension contacts and an RRR of 2.89, as indicated in Table 7, the relative risk of being a risk-taking catfish farmer would be 2.89 times more likely when the other variables in the model are held constant. This indicates that farmers are more likely to take risks than to be risk-neutral.

**Risk aversion relative to risk-neutral with educational level**

The level of education was positively significant at 10% to the probability of catfish farmers preferring risk aversion. Well-informed farmers are armed with useful information that can help them avert any untoward situation that can affect their catfish production negatively. So, with a unit increase in the level of education acquired or knowledge gained and an RRR of 1.17 as shown in Table 7, the relative risk of being risk-averse would be 1.17 times more likely when the other variables in the model are held constant. In other words, given their level of education, farmers are more likely to be risk-averse than risk-neutral (the reference group).

**Table 7: Parameter estimates of the determinants of catfish farmers' risk attitudes**

| Risk attitude | Variables | RRR | Standard error | Z – value | P > \|z\| |
|---|---|---|---|---|---|
| Risk neutral ( Base Outcome) | | | | | |
| Risk taking | | | | | |
| | Constant | 0.00 | 3.11 | -1.71 | 0.09* |
| | Age | 1.18 | 0.07 | 2.37 | 0.02** |
| | Sex | 1.96 | 1.32 | 0.51 | 0.61 |
| | Household size | 0.66 | 0.27 | -1.52 | 0.13 |
| | Educational level | 1.03 | 0.07 | 0.36 | 0.72 |
| | Years of experience | 1.09 | 0.10 | 0.83 | 0.41 |
| | Extension contact | 2.89 | 0.41 | 2.60 | 0.01*** |
| Risk averse | | | | | |
| | Constant | 0.00 | 3.34 | -2.76 | 0.01*** |
| | Age | 1.20 | 0.08 | 2.42 | 0.02** |
| | Sex | 1.41 | 1.37 | 0.25 | 0.80 |
| | Household size | 0.86 | 0.30 | -0.50 | 0.62 |
| | Educational level | 1.17 | 0.09 | 1.80 | 0.07* |
| | Years of experience | 1.01 | 0.11 | 0.08 | 0.94 |
| | Extension contact | 1.64 | 0.45 | 1.11 | 0.27 |
| Log Likelihood | | | -98.51 | | |
| LR $Chi^2(12)$ | | | 45.2*** | | |
| Prob. > $Chi^2$ | | | 0.000 | | |
| Pseudo $R^2$ | | | 0.1866 | | |
| Number of Observations | | | 171 | | |

*p < 0.1 **p < 0.05 *** p < 0.01; RRR = Relative Risk Ratio
Source: Field survey, 2022.

## Measures Against Risks in Catfish Production

Since catfish production is a biological process that faces several risks that can cut down production or lead to financial loss, measures must be devised against these risks. Among some of the measures adopted by catfish farmers, the use of pond cover net ranked highest with 76.61%, as indicated in Table 8. Nwadukwe and Arimoro (2012) reported that the use of nets helps reduce mortalities in catfish production as it is an effective means of preventing predatory animals from eating catfish. The use of drugs when necessary to treat catfish diseases and parasites ranked second (66.08%), while having regular bulk buyers of food-size catfish ranked third (46.20%) among coping strategies used by catfish farmers to guard against risks. Other measures adopted by catfish farmers against risks were the use of security men (22.81%), protective fences (19.88%), regular water changes (14.04%), and livelihood diversification (11.11%).

**Table 8: Distribution of catfish farmers according to risk coping strategies**

| Measures | Frequency | Percentage* | Remark |
|---|---|---|---|
| Cover net usage | 131 | 76.61 | 1st |
| The use of drugs when necessary | 113 | 66.08 | 2nd |
| Regular bulk buyer of food size catfish | 79 | 46.2 | 3rd |
| The use of guards/security men | 39 | 22.81 | 4th |
| Protective fence | 34 | 19.88 | 5th |
| Regular change of water | 24 | 14.04 | 6th |
| Livelihood diversification | 19 | 11.11 | 7th |

## CONCLUSION AND RECOMMENDATIONS

Risks are involved in agricultural production, and they must be properly managed to avoid losses or total agribusiness failure. A lot of the catfish farmers in the study area were risk-takers, indicating their prowess in managing risks. Diseases and parasites, the low farm gate price of food-size catfish, flooding, and poaching were the most prevalent risks confronting farmers in the study area. Since catfish production operates under physical, economic, and biological conditions, farmers are enjoined to make wise decisions and not be rigid to secure their investment in catfish production. It is also recommended that farmers take preventive action against diseases and parasites to avoid total business collapse.

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