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**EARLY VIEW**

RESEARCH PAPER

# Climate Change Awareness and Coping Strategies Among Poultry Farmers in Ondo State, Nigeria

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## Abstract

The significant effect of high environmental temperatures and humidity, can lead to panting, lethargy, and potentially death of fowls. Farmers' awareness of climate change is a prerequisite to combating heat-stress impacts on poultry productions in most of Africa's countries. This study assessed climate change awareness and coping strategies among poultry farmers in the Akoko region of Ondo State, Nigeria. The study has adopted purposive random sampling selection of forty (40) active poultry farms in each of the local government area of the study region. Each poultry farm managers were administered with a copy of questionnaire that elicited information on farming activities as it relates to climate change impact. Simple percentages and Likert scales perception model were used for rating and ranking the opinions of the respondents. Findings revealed that: the daily earning income of most farmers (57.5) is 46 US dollars, which indicates poultry farming as major source of their income. It was equally observed that farmers are into battery housing systems; also, major information on climate change are usually available to farmers through personal observation of cold, warm, and hot weather. Low production and death of fowls have been attributed to heat stress, especially, during the dry season. As a measure for copping strategy, farmers adopted indigenous-weather related cooling devices during the excessive heat. In order to strengthen these strategies, this study recommends promotion of climate service education by extension officers and involvement in more climate risk reduction activities to enhance farmers' adaptive capacity.

## Introduction

Nigeria is the second largest chicken population in Africa after South Africa (SAHEL, 2015). The Nigerian poultry industry comprises about 180 million birds, producing 650 000tonnes of eggs and 300 000 tons of poultry meat in 2013 (FAOSTAT, 2018). Livestock industry is one of the major sources of animal protein in Nigeria. The Nigerian poultry sector is playing a significant role in livestock production, which contributes 10% to agricultural Nation's GDP (Rekwot *et al.*,2015). As noted by FAOSTAT (2022), the poultry bird population in Nigeria reached a total of 249 million heads, slightly higher than the count in the preceding year. FAO (2024) has indicated that climate change poses a significant threat to poultry production in Nigeria, with increasing temperatures and altered rainfall patterns impacting production and posing challenges for small-scale farmers. Also, Bhadauria *et al.,* (2014), Gous, (2010) and Gregory, (2010) have shown that increased temperature and heat stress have been linked to poultry death losses, loss of quality and quantity of egg production, and reduced growth rates in intensive production systems. In recent years, however, the poultry industry has made tremendous adjustments to meet the increasing challenge of climate change impacts on demand and supply of meat and eggs for industrial use and human consumption; while local

production only addresses 30% of the demand for chicken eggs and meat; thus, there is huge scope for the industry to expand. Yet, the challenge of climate change impacts could retrain the efforts of poultry farmers, which has created concern among researchers in recent times. Climate change is one of the biggest challenges facing our planet today.

Climate change, a deviation in patterns of climate over a long period of time (Ngaira, 2007) is one of the most serious environmental and human threats undermining the achievement of the Millennium Development Goals (MDG) and the international community's efforts to reduce poverty. It was further observed that low-latitude and less developed areas, such as Nigeria, where the study area falls, are probably at the greatest risk from climate change due to the diversity of their climatic systems. Creating climate change awareness among the poultry farmers would serve as an initial effort to combat its effect on poultry production in the study area. It will be advantageous to farmers to increasingly adapt if they are to survive and flourish in the face of the emerging challenges resulting from the current climate scenario.

With the current trends in climate change, the trend could lead to increase or decrease in production on the basis of varying climatic situation in one location to another. Urgent alert should be placed on the threat of global warming to the survival of poultry as influenced by temperature and rainfall changes.

Better still, in order to achieve the aim of this study, which is focused on examining the level of awareness of poultry farmers about climate and how it affects the effectiveness of poultry farming in a view to developing sustainable poultry management strategies. However, the general objectives of the study examine, the socio-economic characteristics of the poultry farmers, farmers indigenous knowledge on climate change, and identifies farmers' coping strategies towards sustainable poultry production in the study area.

## Materials and Methods

### Study area

Ondo State, the study area in the southwestern part of Nigeria, is located between longitudes 40 30 and 60 60 East of the Greenwich Meridian and latitudes 5045' and 8015' North of the Equator (Figures 1 and 2) (Ondo State Ministry of Lands and Housing, Akure, 2022). The State is classified into the rainy and dry seasons of April to October and November to March, respectively. It has a temperature range of 21°C to 29°C and a relatively high humidity. The annual rainfall varies from 2,000mm to 1,150mm. The major preoccupation of the people in the state is agriculture, which provides employment to over 75% of the population. The environmental conditions in the state are favorable for certain agro-economic activities and animal rearing, such as poultry, piggery, dairy, and fishing.

### Methods

The primary data used for this study were collected through personal observation and a structured questionnaire. These instruments obtained information on the socioeconomic characteristics of the farmers, examined the farmers indigenous knowledge of climate change, and identified farmers' coping strategies in the study area.

The research population comprised all identified poultry farmers in the studied area. However, the sample frame involved only farmers who practice intensive poultry systems, believing them to be more accessible than other subsistence practicing poultry farmers. Multistage sampling was adopted to first select 10 poultry farms across the four Local Government Area that comprises Akoko North-West, Akoko South-West, Akoko Northeast, and Akoko South-East; while 10 poultry farmers from each of the selected farms were further selected using simple random sampling method. In it all, a total of 40 respondents were administered with questionnaire (Appendix I). The selected farmers were asked to choose from a fixed set of answers indicative of climate change and poultry production in the study area. Responses were measured with a 5-point Likert scale rating, such as strongly agree = 4, agree = 3, disagree = 2, and strongly disagree = 1. that with the assumption that they would feel the impact of climate change more. Descriptive methods such as simple percentages and Likert scales as perception models were used in the processing of data.

## Results and Discussion

### Socioeconomic characteristics of poultry farmers in the study area

The socioeconomic characteristics of respondents include gender, age, marital status, educational status, poultry farming experience by farmers, income, and the housing system employed by poultry farmers were presented in Tables 1 to 8.

It was revealed that 65% of the respondents were male poultry farmers, while 35% were female poultry farmers (Table 1). This implies that male poultry farmers dominated the poultry activities in the study area. This result reflected most of the finding that the majority of the poultry farmers in this part of the world are male. The reason for male dominance in poultry farming could be connected to the fact that only male farmers can withstand the rigors of work. The study shows that 7.5% of the respondents were 15–25 years of age, 45% fell between the ages of 26–35, and 30.0% and 10.0% were for ages 36–45 and 46–55, respectively. However, 7.5% was for the age group above 56–65 years (Table 2). This result indicates that majority of the poultry farmers were still in their active and productive years, with the expected capacity to adopt adaptation strategies to climate change.

It was further revealed that 62.5% of the respondents were married, 32.5% were single, and 5% were divorced (Table 3). The result of the highest percentage of the married farmers is an indication of high level of dependency on poultry farms, which could be referred to as a major source of income to the family. Study revealed in Table 4 where farmers with 45% were of tertiary education, 22.5% has secondary education, 17.5% were holding primary education, and 15% has informal education. This level of education among the farmers is a reflection of the quality of this research based on their level of understanding in their responses to survey questions. Also, this level of education will help in the adoption of strategies of climate adaptation based on the study outcomes. Many studies in the literature have reported age and experience to be significant factors in addressing adaptation strategies and their utilization. This study revealed 65% of respondents with 10 years of farming experience, 25% and 5% had farming experience 7, 5 and, 1 and above years respectively (Table 5). This result signifies a good number of respondents with a long period of farming experience, which is adequate for their responses to questions on poultry farms. They are also with timely knowledge on weather variation and climate change effects in the study area. In the context of this study, "income" refers to the total amount of money realized by farmers at the end of the last production season. The respondent gave the estimated value of the income in Nigerian currency. It has been revealed that 57.5% of the farmers realized over 46US dollars from poultry production on daily basis (Table 6).

This income is derived by the majority of poultry farmers and could serve as a major part of their daily income for family upkeep and to take care of other financial responsibilities. Types of housing systems are critical to poultry farming. This study has revealed two categories, deep litter and battery cage, as housing systems employed by poultry farmers in the study area. It was further revealed that the majority of farmers are into battery housing systems, with the highest percentage of 42.5%. However, the study presented both deep litter and batteries with 32.5% usage level by farmers (Table 7).

**Climate change awareness among the poultry farmers in Akoko region**

Knowledge of climate change awareness among poultry farmers is important to understand the level of climatic impacts on poultry activities. This study acquired information on climate awareness from the farmers in two ways. The main sources of information on climate change and the perception of poultry farmers helped to understand issues around climate change in the study area.

a. Sources of information on climate change among poultry farmers

It was observed in Table 8, where five main sources of information on climate change were presented.

Also, the items explain farmers' level of climate awareness. It was revealed that farmers relied on information from friends and relatives, agricultural extension agents, personal experience, newspapers, magazines, pamphlets, radio, television, and internet sources for climate change. However, friends, relatives, neighbors, and personal experience were the leading sources of information on climate change, with 25%, respectively. The closest source to these was a radio (22.5%) announcement on climate change. The agricultural extension agents gave 12.5% of the information to farmers. These results indicate that farmers are knowledgeable about climate change, especially through personal experience and interactions with friends and family members.

b. Perception of poultry farmers on climate change

In order to effectively assess climate change impacts in the study area, this study has provided varying climatic conditions based on farmers' perceptions. The study area was characterized as cold, warm, and hot; however, the study revealed a hot climate (20%) as the dominant one (Table 9). The warm and cold have similar trends in the study. The result shows the general perception of a hot climate as regularly observed by farmers in recent times. The observed increase in heat is an indicator of climatic change. The changing climate has noticeable effects on poultry production.

**Effects of climate change on poultry production in Akoko region**

The result in Figure 3 shows that majority (25%) of the respondents agreed that climate change induces the emergence of new diseases in the study area.

In another instance, 22.5% were recorded for reduced quality of eggs, reduced meat production, and sudden deaths of birds as a result of heat conditions. The impact of the observed increase in temperature has caused farmers to switch to more costly foreign feed for the birds. This is because there is a scarcity of local grains, usually grown for the purpose of feeding the birds. The scarcity could be the result of low moisture that supports the growth of grains. It was also noted that birds are in need of water more than before, mainly because of the rate of dehydration. As a result, farmers have been experiencing sudden mass deaths of birds in most cases.

In the studies of Tankson *et al*. (2001), heat stress on poultry reduces feed intake, weight gain, carcass weight, and protein and muscle calorie content. Furthermore, heat stress on hens reduces reproductive efficiency and, consequently, egg production because of reduced feed intake and interrupted ovulation (Nardone *et al.,* 2010; Novero *et al.,* 1991). Egg weight and shell thickness may also be negatively affected by increasing temperatures (Mashaly *et al*., 2004).

**Remedial actions by farmers to reduce impacts of climate change on poultry farms**

Having noticed climate change events with rainfall anomalies, heat waves, and variations in climatic elements, the poultry farmers in the study area adopted coping strategies to ameliorate the impacts of climate change, which is an essential step towards sustainable poultry management. These farmers have used indigenous knowledge to adapt to these changes, especially high environmental temperatures (Abioja and Abiona, 2020).

This study observed eleven control measures that were put in place by the farmers to check climate change activities. It was, however, noted that seven parameters were accepted as effective and commonly adopted measures in regulating climate change activities. It was further revealed that building pens close to water sources, reducing the number of fowls in storage, using indoor fowl production facilities, being conscious and proactive about climate change events, stocking climate-friendly fowls, flood prevention, and planting trees as heat sinks are common practices as climate change control systems in the study location. These parameters were accepted because their mean weight values (MWVs) are higher than the calculated ground mean weight value (GMWV=2.6) (Table 10).

Building pens close to water is an essential factor for effective poultry farming. This effort ensures regular water supply to keep the fowls alive, especially when water supply from every other source fails and increased temperatures cause more demand for scarce water resources (Ayanlade *et al.,* 2017; Debela *et al*., 2015; Ou and Mendelsohn, 2017; Thornton *et al.,* 2009). In another effort, poultry farmers adopted the fowl spacing method in an attempt to reduce the fowl population in stock. This generally permits appreciable ventilation for birds during heat periods. The practice of indoor fowl production facilities enables farmers to take stock of fowls for proper monitoring. This also helps in keeping birds away from eternal factors that are capable of influencing them negatively. Consciousness and pro-activeness to climate change events are another effort that is put in place by the farmers. This helps in understanding climatic risks and putting up measures to prevent them. In order to prevent climate change's impact on poultry farms, farmers in the study area have introduced the stocking of climate-friendly fowl. This result is an indication that a good percentage of the farmers had knowledge of poultry farming and observed some variations in the behavior of climate change in general. Flood prevention and the planting of trees as heat sinks around a fowl's pen are more major measures for keeping fowls safe during climatic events. However, it should be noted that some farming practices have not been regularly used to prevent climate change impacts on poultry farming. Such practices include covering the pen's roof with leaves, using weather monitoring kits, cooling devices for fowls, vaccinating fowls against disease, and monitoring fowl behavior on a regular basis.

**Conclusion and Recommendations**

This study has assessed the level of farmers awareness about climate change and its impact on poultry production system in Akoko Region of Ondo State, Nigeria. The study also ascertained the socio-economic characteristic of the poultry farmers, examined farmers indigenous knowledge on climate, and identify farmers' coping strategies on climate change in the study area. Building pen close to water sources, reducing number of fowls in storage, the use of indoor fowl production facilities, being conscious and proactive to climate change event, stocking climate friendly fowls, flood prevention, and planting of trees as heat sink formed the common practice as climate change control system in the study location. In order to improve on the adopted coping strategies by farmers, this study recommends promotion of climate service education by extension officers, and involvement in more climate risk reduction activities that would enhance farmer's adaptive capacity towards sustainable poultry farming in Akoko Region and other related environments.

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**APPENDIX I: QUESTIONNAIRE**

Department of Geography and Planning Sciences
Adekunle Ajasin University, Akungba Akoko, Ondo State

**Dear Sir/Ma,**

This questionnaire is designed to gather information on the climate change awareness and coping strategies among poultry farmers in Ondo State, Nigeria. You are assured that your identity will be kept confidential and the responses will be used for this study only. Please, indicate the correct option by placing a **tick {√}** appropriately. You are kindly requested to respond to all items. Thank you.

**Section A: Demographic Information**

1. What is the name of your current location? ……
2. Which of the age groups does your age fall? 15-25 ( ) 26-35 ( ) 36-45 ( ) 46-55 ( ) 56-65 ( )
3. Indicate your gender (a) Male..... { } (b) Female..... { }
4. What is your educational background? Primary { } Secondary { } Tertiary { } informal education { }.
5. Please, indicate your years of experience as farmer { } 6-10 { } 11-15 { } 16-20{ } Over 20 years{ }.
6. Indicate the number of farmer assistant currently enrolled in your farm. Below 0-5 { } 6-10{ } 11-15 { } 16-20{ } 21- above.
7. What type of poultry housing system do you use? Deep littre ( ), Battery ( ), Both ( )

**B. Sources of information on climate change**

| S/N | Items | Yes | No |
|---|---|---|---|
| 1 | Friends/relatives/neighbour | | |
| 2 | Agric extension agents | | |
| 3 | Personal experience | | |
| 4 | Newspaper/magazine/pamphlets | | |
| 5 | Radio | | |
| 6 | Television | | |
| 7 | Internet/social networks | | |

**C. Please, indicate your perception on climate of your location**

| S/N | Climate | Yes | No |
|---|---|---|---|
| 1 | Cold | | |
| 2 | Warm | | |
| 3 | Hot | | |

**D. Climate change impacts on poultry farms**

1. What is the major source of your poultry feeds? a.foreign ( ) b. local ( )
2. Do you observe a reduction in your poultry egg and meet production?
3. Do your birds react to heat in the need of excessive water to survive?
4. How do you perceive disease outbreak in poultry farms in the recent times?
5. Is there any record of sudden death of birds in your poultry farm?
6. Do you recently observe a record of mass death of birds?
7. Do you have a record of emergence of any new poultry disease?

**E. Farmers' responses to methods of poultry management in the study area**

Please note that the response options are as follow SA-Strongly Agreed, A-Agreed, D-Disagreed, SD-Strongly Disagreed. Please tick {√} in the appropriate column.

| **Statement Items** | **Responses** | | | | |
|---|---|---|---|---|---|
| | **SA** | **A** | **D** | **SD** | **T** |
| Covering the pen's roof | | | | | |
| Building pen close to water sources | | | | | |
| Reduce fowls in the storage | | | | | |
| Use indoor fowl production facilities | | | | | |
| Using weather monitoring kits | | | | | |
| Be alive to climate change event | | | | | |
| Stocking climate friendly fowls | | | | | |
| Providing cooling devices for fowls | | | | | |
| Building a barrier as Flood prevention method | | | | | |
| Plant trees around the poultry as heat sink | | | | | |
| Vaccinating fowls against disease | | | | | |
| Monitor fowls behaviour regularly | | | | | |

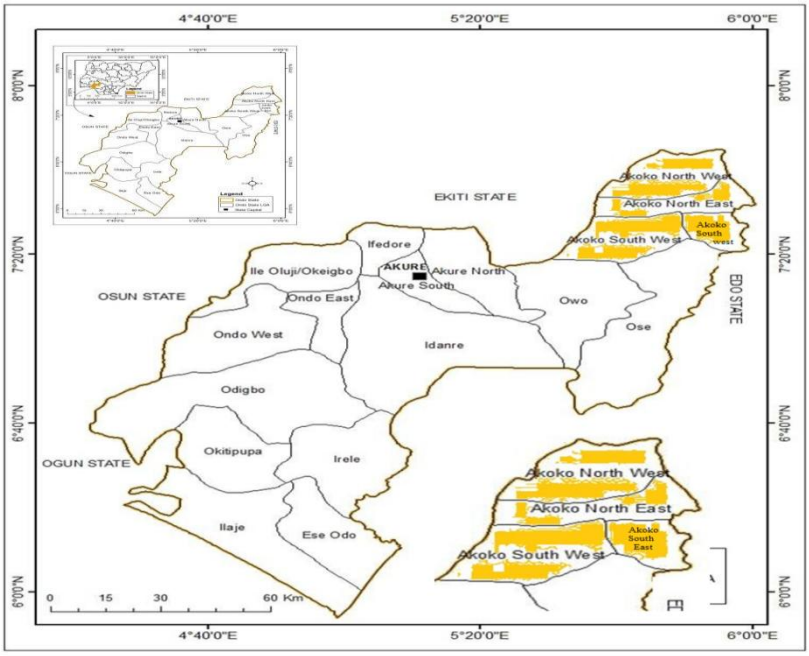


**Figure 1**. Ondo State showing Akoko Region (inset: Nigeria showing Ondo State)

Source: Ondo State Ministry of Lands and Housing, Akure, 2022

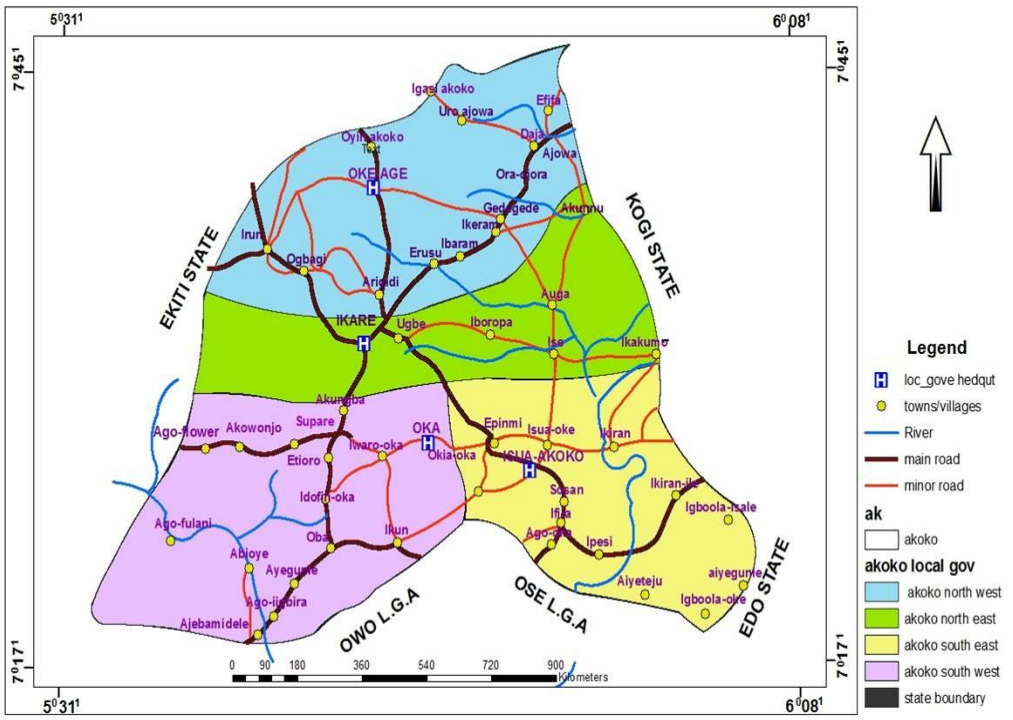


**Figure 2.** Study Area Source: Ondo State Ministry of Lands and Housing, Akure, 2022

**Table 1.** Sex of farmers

| Items | Frequency | Percentage (%) |
|---|---|---|
| Male | 26 | 65 |
| Female | 14 | 35 |
| Total | 40 | 100 |

**Table 2**. Age of farmers (year)

| Age group | Frequency | Percentage (%) |
|---|---|---|
| 15 – 25 | 3 | 7.5 |
| 26 – 35 | 18 | 45 |
| 36 – 45 | 12 | 30 |
| 46 – 55 | 4 | 10 |
| 56 – 65 | 3 | 7.5 |
| Total | 40 | 100 |

**Table 3**. Marital Status

| Status | Frequency | Percentage (%) |
|---|---|---|
| Single | 13 | 32.5 |
| Married | 25 | 62.5 |
| Divorced | 2 | 5 |
| Total | 40 | 100 |

**Table 4.** Educational Background of farmers

| Education | Frequency | Percentage (%) |
|---|---|---|
| Primary | 7 | 17.5 |
| Secondary | 9 | 22.5 |
| Tertiary | 18 | 45 |
| Informal education | 6 | 15 |
| Total | 40 | 100 |

**Table 5**. Length of experience by farmers (years)

| Year | Frequency | Percentage (%) |
|---|---|---|
| 10 and above | 26 | 65 |
| 7 | 10 | 25 |
| 5 | 2 | 5 |
| 1 and below | 2 | 5 |
| Total | 40 | 100 |

**Table 6**. Daily income of farmers (US Dollars)

| Amount | Frequency | Percentage (%) |
|---|---|---|
| ≤ 20.00 | 7 | 17.5 |
| 21.00 – 35.00 | 7 | 17.5 |
| 36.00 – 45.00 | 3 | 7.5 |
| 46.00 and above | 23 | 57.5 |
| Total | 40 | 100 |

**Table 7**. Poultry Housing System

| Housing type | Frequency | Percentage (%) |
|---|---|---|
| Deep litter | 10 | 25 |
| Battery | 17 | 42.5 |
| Both | 13 | 32.5 |
| Total | 40 | 100 |

**Table 8**. Sources of information on climate change to poultry farmers

| Items | Frequency | Percentage (%) |
|---|---|---|
| Friends/relatives/neighbour | 10 | 25 |
| Agric extension agents | 5 | 12.5 |
| Personal experience | 10 | 25 |
| Newspaper/magazine/pamphlets | 2 | 5 |
| Radio | 9 | 22.5 |
| Television | 2 | 5 |
| Internet/social networks | 2 | 5 |
| Total | 40 | 100 |

**Table 9.** Perception of climate by poultry farmers

| Climate | Frequency | Percentage (%) |
|---|---|---|
| Cold | 10 | 25 |
| Warm | 10 | 25 |
| Hot | 20 | 50 |
| Total | 40 | 100 |

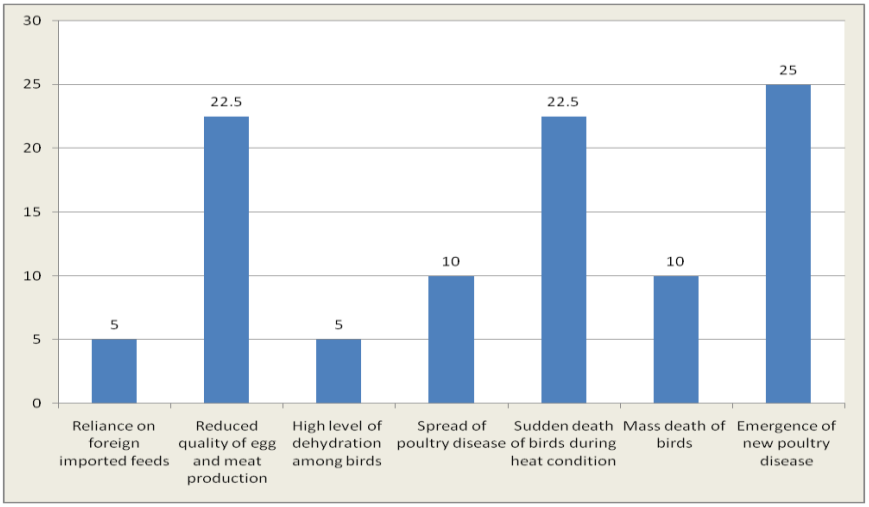


**Figure 3**. Climate change impacts on poultry farms

**Table 10**. Farmers' responses to methods of poultry management in the study area

| Statement Items | Responses | | | | Likert Conversion | | | | | TWV | MWV | Decision |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SA | A | D | SD | T | 4 | 3 | 2 | 1 | | | |
| Covering the pen's roof | 12 | 7 | 7 | 14 | 40 | 48 | 21 | 14 | 14 | 97 | 2.4 | R |
| Building pen close to water sources | 14 | 7 | 12 | 7 | 40 | 56 | 21 | 24 | 7 | 108 | 2.7 | A |
| Reduce fowls in storage | 11 | 15 | 5 | 9 | 40 | 44 | 45 | 10 | 9 | 108 | 2.7 | A |
| Use indoor fowl production facilities | 19 | 6 | 4 | 11 | 40 | 76 | 18 | 8 | 11 | 113 | 2.8 | A |
| Using weather monitoring kits | 3 | 15 | 2 | 20 | 40 | 12 | 45 | 4 | 20 | 81 | 2.0 | R |
| Be alive to climate change event | 20 | 12 | 5 | 3 | 40 | 80 | 36 | 10 | 3 | 129 | 3.2 | A |
| Stocking climate friendly fowls | 15 | 10 | 10 | 5 | 40 | 60 | 30 | 10 | 5 | 105 | 2.6 | A |
| Cooling devices for fowls | 8 | 7 | 20 | 5 | 40 | 32 | 21 | 40 | 5 | 98 | 2.4 | R |
| Flood prevention | 10 | 22 | 3 | 5 | 40 | 40 | 66 | 6 | 5 | 117 | 2.9 | A |
| Plant trees as heat sink | 12 | 10 | 13 | 5 | 40 | 48 | 30 | 26 | 5 | 109 | 2.7 | A |
| Vaccinating fowls against disease | 7 | 12 | 5 | 16 | 40 | 28 | 36 | 10 | 16 | 90 | 2.3 | R |
| Monitor fowl's behaviour regularly | 15 | 4 | 4 | 17 | 40 | 60 | 12 | 8 | 17 | 97 | 2.4 | R |

GMWV or COV = 2.6 R= Rejected A= Accepted