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# Analysis of Rice Farmers' Perception of Climate Change in the Ketu North District, Volta Region of Ghana

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**Abstract** The research focused on the socio-economic characteristics of rice farmers and their perception of climate change towards tackling the challenges climate change poses to the rice farmers in Ketu North District, Volta Region of Ghana. The multistage sampling technique was used to obtain a sample size of 340 rice farmers from six farming sections and a primary questionnaire was used to produce data from the respondents. The data collected from the rice farmers were analyzed using descriptive statistics. Results from the socio-economic characteristics revealed that younger people are involved in the rice enterprise than the aged in the study area: 91.2% of the rice farmers had household size of ten and below. It also means that there is a high number of people for the labor force in cultivating rice in the area. With respect to education levels, 75% of the rice farmers had some formal levels of education. 69.4% of the farmers had farming experience less than 28 years. The average years of farming experience revealed that virtually all farmers have wealth of experience in rice production. With regards to access to financial support, result revealed that credit sources used by the respondents to finance their farming activities are mainly from external sources. Out of the 340 respondents, 77.3% rely mainly on taking loans from moneylenders for their farming purposes. Furthermore, 69.7% of the respondents had access to extension services in the area. The farmers therefore perceived an increased in temperature and decreased in precipitation.

**Keywords** Rice Farmers, Climate change, Perception

## 1. Introduction

According to Food and Agriculture Policy Decision Analysis (FAPDA) report (2016), in Ghana, like many Sub-Saharan African countries, agriculture sector is the backbone of its economy employing 53.6% of the total labor force and contributing 20.3% of Gross Domestic Product (GDP). Climate change is a serious problem as it affects agriculture. This challenge is composed of the likely impacts on ecosystem services, agricultural production, and livelihoods. Generally, losses in the agriculture sector due to climate change has economy wide consequences, like loss in gross domestic output, a decline in the income/consumption of the most vulnerable population; hence, a general deterioration in households' welfare Food and Agricultural Organization [FAO], (2007). Climate change and weather patterns changes are already being experienced as it is evident in severe impacts on food production, food security and natural resources all over the globe. Without the appropriate responses, climate change is likely to constrain economic development and poverty reduction efforts and exacerbate already pressing difficulties especially in countries whose economies are rooted in climate sensitive sectors such as agriculture. For instance, Taderera (2010) reported that South African awareness of climate change was literally interpreted as "changing weather" and this may influence the extent of adaptation. Adaptation is widely recognized as a vital component of any policy response to climate change.

Perceptions are influenced not only by actual conditions and changes, but are also influenced by other factors. Gbetibouo (2009) found in his study that having fertile soil and access to water for irrigation decrease the likelihood that farmers will perceive climate change; however, education, experience, access to extension services increase the likelihood that farmers perceived climate change. According to Dai and Trenberth (2007) many developing countries have already experienced weather events in terms of floods, droughts, heat waves and tropical cyclones that are more frequent or intense than previous experiences and the resulting impacts point to the consequences on the environment, production system and livelihoods from future climate variability and change, hence to minimize the impacts of climate change requires a knowledge of the

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perception and adaptation of climate change strategies to deal with the phenomenon.

Rice is very sensitive to climatic, environmental and soil conditions Abdulai & Huffman (2000). Changes in these climatic factors are expected to affect rice yield adversely. Rice is the second most important cereal after maize in Ghana and is fast becoming a cash crop for many farmers (Millennium Development Authority [MiDA], 2010; Osei-Asare, 2010). Hence, the need to meet the demand for local rice has become a major concern with the current increase in rice consumption in the country. Though there has been an increases in the production of local rice, this has not met domestic demand (Ministry of Food and Agriculture [MoFA], 2009). The importations of rice continue to increases considerably year after year. The local rice has contributed much to Ghana's capability in achieving food security even though most urban dwellers consume imported rice. For the past three decades, rice production in Ghana has increased but this has not correlated with rice yields. Since the yields have declined by close to 12% from 2.72 metric tonnes per hectare in 2008 to 2.40 metric tonnes per hectare in 2009 (ISSER, 2010).

**Statement of the Problem**

Ghana's economy can be best described as agrarian, with the agricultural sector contributing 20.3% of GDP and employing 53.6 percent of the work force, as mainly smallholder farmers ((FAPDA, 2016). Although this high percentage of the national workforce is engaged in farming, they do not produce sufficient food to feed the ever increasing populace. This is because agriculture is predominantly rain fed, and exposes agricultural production to the effects of present climate variability and the risks of future climate change.

Agriculture is affected by climate change, especially by decreasing precipitation and increasing temperature and these reduce agricultural production. Rice farmers in the Ketu North District are not immured against the effects of climate change. Since most of the population of the district derive their livelihood from agricultural activities, hence changes in the climate is of great concern to their agricultural production activities in the district.

The production of rice accounts for 15% of agricultural output and 45% of the total land area used in cereal grain production in Ghana (Stanturf *et al.,* 2011). In the production of rice, farmers mostly make use of irrigation, rain-fed lowland and rain-fed upland systems and so years of extensive drought, has decreased the production of rice in the country. With expected rise in temperature and decline in rainfall in the years 2020, 2050 and 2080 it is believed that rice production in these years will steeply decline.

Although the issue of climate change and agriculture is not a recent development, there has been little or no efforts aimed at scientifically documenting the existing climate change situation among rice farmers in the Ketu North District in the Volta Region of Ghana, with regards to the various indigenous innovative technologies and adaptation measures to combat the negative effects of climate change.

Despite the importance of perceptions and adaptation strategies to climate change, very few studies have examined farmers' perceptions and adaptation strategies to climate change and its effects on other crops grown in the district. Virtually, no study has been conducted in the study area to investigate the effect of climate change on rice production and adaptation strategies.

**Objectives of the study**

The general objective of the study is to analyze the socio-economic characteristic of rice farmers and their perception of climate change in the Ketu North District in the Volta Region of Ghana.

The study is to specifically sought to:

1. Determine the socio-economic characteristics of the rice farmers in the area
2. Analyze rice farmers' perception of precipitation and temperature patterns in the study area.

# 2. Materials and Methods

**Description of the study area**

Ketu North District is one of the 25 districts in the Volta Region of Ghana. It is located between latitudes 6o 03' N and 6o 20' N and longitudes 0o 49'E and 1o 05'E. It shares boundaries with the Akatsi North District to the North and the Republic of Togo to the East. To the South, it is bounded by Ketu South district and Keta Municipality and to the west by the Akatsi South District. The district has an estimated population of 100,000 and agriculture is the mainstay of the economy. The target population for the study includes all rice farmers farming at the Weta irrigation scheme within the Ketu North District of the Volta Region of Ghana. The estimated population of rice farmers within the Ketu North District is 1024.

**Sample and Sampling Procedure**

A multistage sampling technique was used to select the respondents from the study. The sampling technique was chosen because it allows larger clusters to be subdivided into smaller, more target groupings for the purposes of surveying (Agresti & Finley, 2008). At the first stage, a simple random sampling technique was used to select six of the eleven rice farming sections farming at the Weta rice irrigation scheme in the district. At the second stage, a list of registered farmers was obtained from the District Agricultural Assembly. Based on the population of these six farming sections, a random sampling technique was used to randomly select (340) rice farmers using the sample size table constructed by Krejcie & Morgan (1970). This was done based on time and resources available. Table 1 provides the summary of farmers selected from the Weta irrigation scheme, Ketu North District, Volta Region of Ghana.

**Table 1.** Sample size used for the Study

| Rice farming section | Total number of rice farmers | Selected sample size |
|---|---|---|
| Section 2 | 74 | 47 |
| Section 3 | 94 | 59 |
| Section 5 | 107 | 67 |
| Section 6 | 82 | 51 |
| Section 7 | 95 | 59 |
| Section 9 | 91 | 57 |
| **Total** | **543** | **340** |

### Data Collection

The primary data were collected through the use of self-administered questionnaires and interview. The variables were broadly categorized into socio-demographic characteristics, production activities and climate change information. Primary data was collected using open and close ended interview schedules. The questionnaire for the rice farmers was grouped into 8 items with three sections. Section I was made up of 6 items that is used to generate information on the socio-economic characteristics of sampled population. Section II was on the production activities and Section III on climate change information. The questionnaire for the primary data collection was pre-tested in South Tongu District. The purpose of the pre-test was to identify errors associated with the questionnaire and interview content and omit double barreled questions and ambiguous statements. Furthermore, pre-testing was conducted to detect issues that were not anticipated and to assess I) clarity of questions regarding rice farming, II) whether the questions are understandable and III) whether the order and wording of the questions elicited the desired responses for each question. The total number of questions administered was 15. Based on the responses provided, modifications were made in the research instruments before administration.

### Data Analysis

The study utilizes descriptive statistics analysis. Descriptive statistics such as frequencies, mean, standard deviation and percentages were used to present rice farmers' perception on climate change, rice farmers' decision to adapt to climate change and the barriers to adaptation. Statistical Package for Social Sciences (SPSS version 21.0) and STATA version 13.0 software were used for all analysis.

## 3. Results and Discussion

### Socio-economic characteristics of the Respondents

This section of the report presents information on the socio-economic characteristics of the respondents with respect to sex, age, marital status, household size, educational level, farming experience, farm size, financial support and access to extension services.

### Age distribution of the respondents

Table 2 presents the age distribution of the respondents. The study revealed that younger people are involved in the rice enterprise than the aged in the study area. The result implies that the older the rice farmer, the more experienced he/she is in farming and the more exposure he/she has had to past and present climatic conditions over longer periods. Furthermore, mature rice farmers are better able to access the characteristics of modern technology than younger rice farmers, who might be more concerned about profit than the long-term sustainability of their operations. As shown in Table 2, ages of the farmers ranged from 20 to 80 years. The mean age of all the respondents is 47 years with a standard deviation of 10.22 and modal age of 50 years.

**Table 2.** Frequency Distribution of Age of Respondents

| Age of respondents | Frequency | Percent |
|---|---|---|
| 20-29 | 12 | 3.5 |
| 30-39 | 61 | 17.9 |
| 40-49 | 121 | 35.6 |
| 50-59 | 92 | 27.0 |
| 60-69 | 49 | 14.4 |
| 70-79 | 4 | 1.2 |
| 80-89 | 1 | 0.3 |
| **Total** | **340** | **100** |

Mean = 47.3 SD = 10.22 Youngest = 20 Oldest = 80

### Household Composition in the Study Area

The size and composition of the households are important aspects that impact on household welfare. Table 3 shows information collected in the study area on household composition. The 340 respondents interviewed had a total household membership of 2,186. The mean household size is about 6, a little bit higher than the size of the country's average of 4.4 as reported by Ghana Statistical Service (GSS, 2010). The household size range from a minimum of one 25 with a standard deviation of three. 91.2% of the rice farmers had household size of 10 and below. It also means that there is a high number of people for the labor force.

**Table 3.** Frequency Distribution of Household size of the Respondents

| Household size | Frequency | Percent |
|---|---|---|
| 1-5 | 156 | 45.9 |
| 6-10 | 154 | 45.3 |
| 11-15 | 25 | 7.4 |
| Above 16 | 5 | 1.4 |
| **Total** | **340** | **100** |

Mean = 6.4 SD = 3.21 Min = 1 Max = 25

### Educational Levels of the Respondents

Education is extremely important in that it facilitates individuals to make informed decisions that influence their health and wellbeing. Education also provides people with the knowledge and skills that can lead to a better quality of

life. Literacy is widely acknowledge as benefiting both the individual and society and, in particular among women, is associated with a number of positive outcomes, including intergenerational health and nutrition benefits. Ghana Statistical Service (GSS, 2010), Noguchi Memorial Institute for Medical Research (NMIMR), & ORC Macro (2004). Table 4 presents the distribution of male and female rice farmers according to their educational background characteristics.

**Table 4.** Frequency Distribution of Educational status of Rice Farmers

| | Male | | Female | | N | Total |
|---|---|---|---|---|---|---|
| Education levels | F | % | F | % | F | % |
| No formal edu. | 50 | 24.3 | 35 | 26.1 | 85 | 25.0 |
| Primary school | 49 | 23.8 | 57 | 42.5 | 106 | 31.2 |
| Middle School/JSS | 78 | 37.9 | 41 | 30.6 | 119 | 35.0 |
| O'level/SSS | 25 | 12.1 | 1 | 0.7 | 26 | 7.6 |
| Tertiary level | 4 | 1.9 | 0 | 0.0 | 4 | 1.2 |
| **Total** | **206** | **100** | **134** | **100** | **340** | **100** |

75% of the rice farmers (see Table 4) had some formal levels of education, whilst 11.3% did not have any form of formal education. With respect to formal education, 61.2% of the male respondents acquired formal education; whilst 38.8% of the female respondents also had some levels of formal education. Table 4 revealed that men have more formal education than women in the study area. This finding is supported by GSS et al. (2004) that females continue to lag behind males in education. Conforming to the outcomes of GSS 2000, the study underlined the relatively high literacy rates of men and women in the study area. Also Duncan and Brants (2004), reported that education levels of male respondents were higher than those of the female respondents in the Region.

In Ghana, it is generally believed that education standard up to JSS or Middle School level is enough to make one literate (GSS, 2004). The impact of the level of education on agriculture stems from the fact that farmers who are literate, generally tend to adapt innovations quickly which increase total factor productivity of rice and for the matter, agricultural development in general (Adesina & Djato, 1996).

## Farming Experience of the Respondents

Farming experience plays extremely important role in decision making of what to produce, when to produce, how to produce and how much to produce in order to satisfy the demands of the prevailing markets. The rice farming experience of the respondents is shown in Table 5. Out of the 340 respondents interviewed, 35.9% of them had been producing rice between ten to eighteen years and 33.5% had farming experience between twenty to twenty eight years.

The farmers had rice farming experience ranging from 1 to 45 years with a mean experience of 20 years and a mode of 20. 69.4% of the farmers had farming experience less than 28 years. The average years of farming experience revealed that virtually all farmers have wealth of experience in rice production. These results confirm Gbetibouo (2009) that experienced farmers have diverse skills in farming techniques and management, and are able to spread risk when faced with climate variability. Highly experienced farmers tend to have more knowledge of changes in climatic conditions and the relevant response measures to be applied.

**Table 5.** Frequency Distribution of Farming experience of the Respondents

| Years of farming | Frequency | Percent |
|---|---|---|
| Less than 9 | 31 | 9.1 |
| 10-19 | 122 | 35.9 |
| 20-29 | 114 | 33.5 |
| 30-39 | 57 | 16.8 |
| Above 40 | 16 | 4.7 |
| **Total** | **340** | **100** |

Mean = 20.46 SD = 9.41 Mode = 20 Min. = 1 Max. = 45

## Financial resources available for Rice Production

Finance plays a very important role in rice farming since it determines farmers' ability to secure farm inputs for the establishment and maintenance of farms. Access to credit for productive purpose can effectively reduce the vulnerability and improve their household welfare. This therefore necessitates investigating access to finance and financial credits. From the findings of the study, money lenders form a major source of financial capital for establishing rice farms in the study area.

It is shown in Table 6 that credit sources used by the respondents to finance their farming activities are mainly from external sources. Out of the 340 respondents interviewed, 77.3% rely mainly on taking loans from money lenders for their farming purposes. Observations from the study revealed that only few rice farmers 15.2% rely on their own savings for production. The most worrying revelation from Table 6 is the funding from the banks (less than 5%) to the rice farmers. Duncan and Brants (2004) revealed similar results in the region where they reported that only 4% of their respondents access credits from formal institutions such as banks and financial NGOs.

**Table 6.** Source of Finance for Rice Production (n = 340)

| Source of finance | Frequency | Percent |
|---|---|---|
| Money lenders | 263 | 77.3 |
| Own savings | 52 | 15.2 |
| Friends and Relatives | 19 | 5.59 |
| Farmers' Organization | 4 | 1.18 |
| From Banks | 2 | 0.58 |
| **Total** | **340** | **100** |

## Farmers access to Extension Services

The results of the analysis in Table 7 showed that majority 69.7% of the respondents had access to extension services;

30.3% of the rice farmers did not have access to extension services shown in Table 7. The main source of technical knowledge for the rice farmers is the District Agricultural Extension within the District Assembly. Finding of the study is consistent with Gbetibouo (2009), who argued that farmers with access to extension services are likely to perceive changes in the climate because extension services provide information about climate and weather. Consequently, awareness and perceptions of changes in climatic conditions shape action or inaction on the problem of climate change. Furthermore, access to extension services increases the likelihood of perceiving changes in climate, as well as the likelihood of adapting to such changes through the creation of opportunities for the farmer to adapt suitable strategies that better suit the changed climatic conditions. This suggests that extension services assist farmers to take climate changes and weather patterns into consideration, through advice on how to deal with climatic variability and change.

**Table 7.** Farmers access to Extension Services (n = 340)

| Access to extension services | Frequency | Percent |
|---|---|---|
| Yes | 237 | 69.7 |
| No | 103 | 30.3 |
| **Total** | **340** | **100** |

### Rice farmers' Perception of Changes in Precipitation

With respect to changes in precipitation in Figure 1, the study revealed 3.2% perceived an increase in rainfall; 54.1% perceived a decrease in rainfall; 15.3% of the farmers did not see any change in rainfall pattern and 27.4% perceived an irregular rainfall pattern.

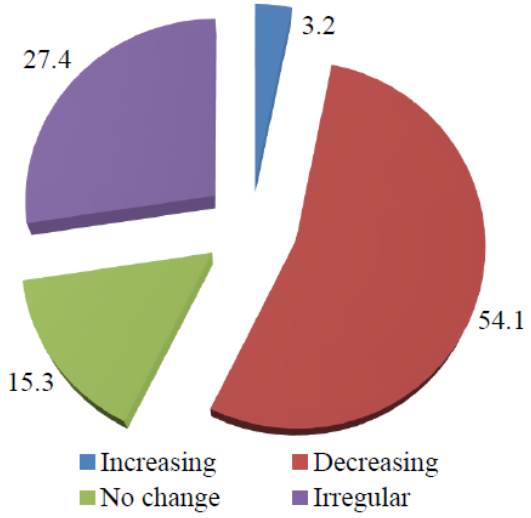


**Figure 1.** Rice Farmers' Perception of changes in Precipitation (%) in the Ketu North District, Volta Region of Ghana

### Rice farmer's Perception of Changes in Temperature

According to the same study in Figure 2, majority of the rice farmers 59.7% of the farmer's perceived increasing temperature, and 3.5% of the rice farmer's perceived decreasing temperature, 16.5% of the farmers perceived no change in temperature, whilst 20.3% of the farmers perceived irregular pattern of temperature.

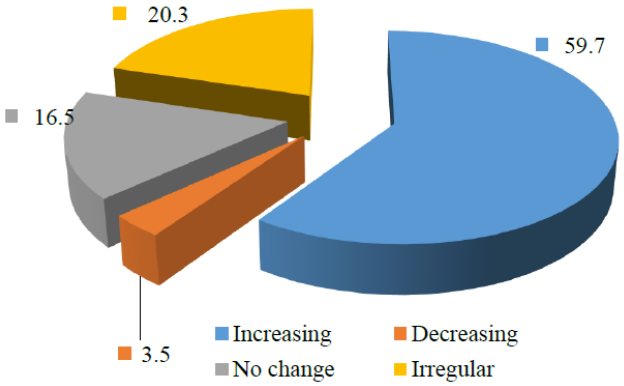


**Figure 2.** Rice farmers' Perception of changes in Temperature (%) in the Ketu North District, Volta Region of Ghana

These findings of the study are consistent with Acquah and Onumah (2011), who assessed farmers' perception and adaptation to climate change in the Western part of Ghana, found that majority of the farmers' perceived increase in temperature and decrease in rainfall pattern.

In a study to analyze farmers' perception and adaptation strategies to climate change in India, Dhaka, Chayal and Poonia (2010), also found that significant numbers of farmers believed temperatures have already increased and the precipitation has declined along with late onset and early withdrawal of monsoon with long dry spells.

## 4. Conclusions

From the findings of the study, the following conclusions are drawn: the socio-economic characteristics revealed that younger people are involved in the rice enterprise than the aged in the study area, 91.2% of the rice farmers having household size of ten and below. With respect to education levels, 75% of the rice farmers had some formal levels of education; 69.4% of the farmers had farming experience less than 28 years. With regards to access to financial support; 77.3% rely mainly on taking loans from moneylenders for their farming purposes. Furthermore, 69.7% of the respondents had access to extension services in the area. Majority of the rice farmers perceived decrease in precipitation and increasing temperature respectfully.

## 5. Recommendations

Based on the findings of study, the following recommendations are made for policy making.

1. The Ministry of Food and Agriculture (MOFA) in collaborations with plant breeders should produce rice variety that will be tolerant to the climate change situation in the district.

2. Banks and Microfinance institutions should provide credits and capital to rice farmers to facilitate their access to credits which will help to improve their productivity.
3. Ghana meteorological agency should provide information on climate related issues through the department of agriculture in the district to enhance adequate information on climate change.
4. The Ministry of Food and Agriculture should introduce climate smart agriculture to the rice farmers in the district.

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