The Impact of Rain fed Paddy Rice Production on Employment, Food Security and Poverty in Nigeria: A Case Study of Kebbi State

[1*]**Abubakar Muhammad Bagudo**, [2]**Lawal Muhammad Dankimba**, [3]**Aminu Adamu Argungu**

[1,2,3]Division of General Studies, Kebbi State University of Science and Technology, Aliero, Nigeria.

Abstract: - *This study was conducted in 2019 and it evaluates the impact of rice production on employment, food security and poverty in Kebbi State. A multistage (three stage) sampling technique was employed to select the farm households. Data were collected using structured questionnaires administered to 302 farmers to achieve the objectives of the study. The analytical tools used were descriptive statistics and Logistic regression. The results revealed that 53.25 percent of the rice farmers were non poor as against 46.75 percent of the farmers that were poor. The logistic regression analysis for the determinants of poverty status shows that ten explanatory variables were estimated and all but one were significantly related to poverty status of the farmers in the study area. The determinants of food security status was obtained from Tobit regression and the analysis of the survey data revealed that 7 out of 9 explanatory variables included in the model were significant in explaining the variation in food security status of household in the study area. Furthermore, the results from the multiple regression model testing for the determinants of employments were also derived. The results indicates that the factors that had significant influence on the dependent variable (i.e. employment) were, Farm size (positive), Non-farm income (positive), Rice Production (positive)) Number of labour, Hours (positive) and Labour Cost (negative), Household size and Land Ownership. The insignificant factors were Age, Gender, and Non-farm income. Finally, based on the results obtained from the study, recommendations were given to both farmers and the government accordingly.*

Keywords: - *Rice production, employment, food security, poverty*.

I.0 Introduction

Rice as a cereal crop serve as the main source of calorie intake for about half of the world's population especially the poor as it makes up one in five calories consumed worldwide (FAO, 2006). FOA in 2000 classified the crop as the most important food crop dependent on by 50% of the world population for about 80% of their food need, especially in Asia and in West and central Africa. Based on the expected population growth, income growth, and rice acreage decline, global demand for rice will continue to increase from 479 million tons milled in 2014 to 536.551 million tons in 2030, with little scope for easy expansion of agricultural land except for some areas in Africa and South America (IRRI, 2016). In Sub Sahara Africa where the problem of hunger and poverty has been a global concern, rice has become very important to food security especially among the rural household (Akpokdje et al, 2001). The root

Cause of food insecurity in developing countries is the inability of people to gain access to food due to poverty. While the world has made significant progress towards poverty alleviation, Africa, in particular, Sub Saharan Africa continues to lags behind.

Nigeria is the largest rice producer in West Africa and second largest behind Egypt in Africa with relatively higher comparative advantage than other countries of the region (Nwanze et al, 2006). Nigeria has favorable ecologies that are suitable for different rice varieties which can be harnessed to boost production to meet domestic demand and for export (Usman, 2011). The Executive Secretary National Agricultural Research council of Nigeria, Prof. Baba Abu-Bakr says of the 97mha in Nigeria, 74mha representing 75% was good for farming but lamented that less than half is put to use. Rice is cultivated in virtually all Nigeria's agro ecological zones, from the

mangrove and swampy ecologies of the Niger delta in the coastal areas to the dry zones of the Sahel in the north. The demand for rice in Nigeria is everyday growing, the estimated rate of growth is about 10% annually; the fastest growing amongst all domestically cultivated staple food in Nigeria (WARDA, 2008), thus, the rice demand is expected to increase given the country's population growth rate of 2.1% (NPC, 2006), changing consumer preferences, rapid urbanization, changes in family occupational structures and increased income levels (Akpokodje et al, 2001). Rice consumption constitutes the largest proportion (about 24%) of total household food expenditure in the country. Nigerian rice consumption has been massively increasing because it is consume across all income groups. In Nigeria, rice is one of the few food crop whose consumption has no cultural, religious or ethnic affiliation, neither has a geographical boundary. It is available in five star hotels in the big city and towns as well as the 'most local' of the eating places in the remotest villages throughout the country (Ogbeh, 2017). Nigerian rice consumption is expected to jump to 35million metric tons by 2050.

Rice production in Nigeria is generally rain fed dependent, only about 293.000 ha of irrigable land has been equipped for irrigation and only about 218, 800 ha is being actually irrigated with about 173, 000 ha under private small scale while, 29,000 ha is under public irrigation scheme (FAO-Aquastat 2005). Nigeria is still characterized by low domestic production, remarkably expanding demand/consumption and a high reliance on food imports. Thus, there is therefore an urgent need to overhaul and transform agricultural sector in Nigeria, to take advantage of these trends in food demand. To this end, the need to re-focus the Country's agricultural financing policy to develop its agricultural food baskets and its commodity value-chains to meet the food market product demands, and solves its developmental problems has become imperative. Based on the aforementioned problem statement, the broad objective of the study is to investigate the impact of rain-fed Rice Production on Poverty, Employment and Food Security in Kebbi State, Nigeria.

1.2 Justification of the Study

The connections among dwindling food production capacity, rising food prices, unemployment and dependency on food importation, and consequently poverty and food insecurity are nowhere more clearly demonstrated in recent times than in the Sahel food crisis where extreme poverty, climate change and armed conflicts, continue to threaten the lives of millions already living on the brink. This affected many of the 11 northern states of Nigeria situated in the Savannah belt. Food security is national security, and any nation unable to feed its populace cannot be said to be a responsible one. Nigeria was self-sufficient in food production and was indeed a net exporter of food to other regions of the continent in the 1950s and 1960s Ojeleye (2015). Things changed dramatically from bad to worse simply because of the outright neglect of agriculture.

Reliable information on household poverty level, food security and other socioeconomic characteristics is a pre-requisite for accurate and effective design, monitoring and development of development projects. In other words, to successfully plan, there must be data to guide policy formulation and direct plan implementation. It is apt to point out that there can be no plan without correct facts and or reliable information and hence many development agencies considered household information as a guiding principle for designing interventions in rural areas. Akpokodje et al (2011) maintained that, a comprehensive and up to date picture of rice sector in Nigeria is lacking.

Therefore, measurement of food security, poverty and employment at the Farm family level will provide the basis for monitoring future progress and assessing the impacts of various projects, programmes and policies on the beneficiary's farmers.

This study hopes to contribute to the literatures on the relationship between rice production on one hand, and poverty, employment and food security on the other hand with regards to helping policy makers in designing policies and programs implemented to improve community food security and poverty status and as well address diverse range of issues,

including participation in and access to Federal food/agricultural assistance programmes (e.g. ABP), economic opportunity and job security, community development and social cohesion, environmentally sustainable agricultural production, farmland preservation, economic viability of rural communities, direct food marketing, and diet related health problems. Specifically, the study will be useful to ministries of Agriculture and Rural Development, Trade and Investment, Budget and National Planning. It can also be of help to Central Bank of Nigeria, Researched Institutes, Extension Agencies, Funding Agencies, Input Suppliers and rice farmers among others for increasing local rice production.

The study is structured into six Chapters. Following this Chapter, the remaining chapters are structured as follows. Chapter 2, provides an elaborate discussion on the Background information on all the variables of the study both at national and state level. Chapter 3, focuses on Literature review, where Conceptual, Theoretical and Empirical Literatures are intensively discussed. Chapter 4, dwells on Methodology, it provide a brief but concise notes on the; theoretical framework, Study area, Data collection and Techniques of data analysis. Chapter 5, presents a succinct analysis and discussion on the research findings. Finally, Chapter 6, concludes the study. This chapter summarizes the findings from the previous chapters and provides policy recommendations.

2.0 Literature Review

2.1 Conceptual Clarifications

The Concept of Food Security

Food security in its most basic form is defined as the access to all people to the food needed for a healthy life at all times (FAO, 1992). According to Uma (2014), food insecurity is "the limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in a socially acceptable way. In the 1996 Rome declaration on world food security, food security is defined as: food that is available at all times, to which all persons have means of access that is nutritionally

adequate in terms of quantity, quality and variety, and is acceptable within the given culture (Uduma, 2015). Availability, access and affordability are all elements of food sufficiency. Food security has been promoted by the United Nations as the most basic human need and as a central indicator of absolute poverty and physical wellbeing. It is vital to add that Amartya Sen has been credited with initiating the paradigm shift in the early 1980s that brought focus to the issue of access and entitlement to food. He said; as a basic physiology need, threat to sufficient food production is threat to human survival. Furthermore, the 1996 World Food Summit Plan of Action notes four instances that render a nation food-insecure: (1) when the source of food is highly diminished and the likelihood of making up the difference is non-existent; (2) high occurrence of malnutrition not attributed to health or care factor for most part of the year;(3) when sources of food are unsustainable, and (4) when people endanger their lives in in a bid to sustain their livelihood.

Definition of Poverty

Definition of poverty vary widely. Poverty is defined as "state of being in which we are unable to meet our needs" (Watt, 2000). However, the concept of "needs" itself is defined very differently across cultures and generations, as development of technology and changing values alter perceptions of the pre-requisites of an acceptable standard of living. This shows that the concept of "needs" connotes the notions of what is conventionally regarded as necessary to lead one's life as an integrated member of a particular society. Thus, in the Wealth of Nations the eighteenth century Scottish economist, Adam Smith, recognized the importance of this point when he defined the ability to appear in public "Without shame" as a major criterion of individual human welfare" (Smith, 1986).

Baratz and Grisably (1972) defined poverty as a "condition involving some deprivations and adverse occurrences that are closely (but not necessarily exclusively) associated with inadequate economic resources". Some see poverty as "inadequacy of income to support a minimum standard of living" (Edozuin, 1975). Closely related to this is the use of

"Basic Needs" indicators such as food, clothing and shelter to define the concept.

Furthermore, not infrequently, distinction is made between "absolute" and "relative" poverty. Absolute poverty, according to Webster (1993) describes situation in which people are barely existing, where the next meal may literally be a matter of life or death as cumulative effects of malnutrition and starvation enfeeble all, particularly children, whose weakness gives them the tragic distinction of having the highest mortality rate for any group anywhere in the world. Thus in these tragic circumstances poverty takes on an "absolute" status since there is nothing beyond it except death.

On the other hand, relative poverty is much more difficult to define and establish as an objective concept. Better Put, definition of poverty along this line varies dramatically among academics and/or official government agencies. For instance, National Welfare Right Organization in the United States estimated that a family of four needed $7200 per year to satisfy their basic requirements.

Conceptualizing Employment and Unemployment

Employment is an economic drift through which human resources are put into productive use Gbosi (2005). Thus, in the Keynesian economic analysis, employment is envisaged as a pathway to enhance the growth rate of an economy. This is because when there is employment, there is productivity (Keynes, 1936). Hence the achievement of attainment of full-employment has often been seen as one of the germane macroeconomic goal or objectives facing any civilization.

The opposite of employment is unemployment, which signifies wastage of human resources because goods and services that could have been produced are forgone. There are several definitions of unemployment by different scholars. Dantwala (1971) defines unemployment as a state in which people who can work are without jobs and are seeking work for pay or profit. This definition gives rise to the problem of measurement, especially when we are interested in knowing the average rate of

unemployment in the economy over a period of time (Feremiah, 2010). Falae (1971) considers such a definition too broad because some categories of people who are without work should not really be regarded as unemployed in any meaningful sense. He therefore, pointed to the labour code prescription of lower and upper limits for the labour force in Nigeria and submitted that anyone who is unable to work is not accounted as unemployed, though he/she would like to work. People who are mentally retarded; who suffer from severe emotional or psychological problems, or who are physically handicapped are generally excluded from the labour force.

For instance, in less developed countries, a very high percentage of labour supply is self – employed or unpaid family labour in household enterprises. Such self-employed persons would rarely be openly unemployed. His/her earnings could be low and sometime even nil. Yet, such a person cannot be considered unemployed. Also, because of the preponderance and dominant nature of agriculture in developing countries, there are marked seasonal fluctuations in unemployment. These classic features result in the classification of people without work during the reference period as employed. Thus, the choice of the reference period can significantly affect the magnitude of unemployment as measured in labour force surveys.

No matter the measurement or yardstick used in defining the unemployment situations, one thing is clear, that is employment in Nigeria is low. In other words, unemployment rate in Nigeria is very high and has different dimensions. There are under employed cases in which people receive incomes that are inadequate to support their basic needs, in terms of food, clothing and shelter.

Youth employment is a crucial issue in Nigeria because, the youth are the dominant component or a major part of the labour force, and they possess innovative ideas, which among other factors are vital ingredient in the development process of the country. However, a large proportion of them, are unemployed. The negative consequence of the youth unemployment includes psychological problems of frustration, depression, hostility and gradual drift of

some visible unemployed youth into all manner of criminal behavior Dreze and Sen (2001).

2.2 Theoretical Literature

There are several theories that directly and or indirectly relate to the variables of this study. In other words, there are several theories and models that are much suitable to provide a theoretical framework for this research work. However, the review here, is for some of the prominent and appropriate theories that are highly related with the objectives of this study.

Agricultural Household Model

The Russian agronomists Alexander Chayanou (1925) was among the first scholars who believed that behavior of farm household would be best understood in a household farm framework, where potentially important interactions existed between farm operations, external labour markets (nonfarm labour market)and household consumption.

This model provides a framework for analyzing household behaviors that integrates three decisions. Consumption, production and work (labor) allocation. Agricultural household models are a staple of micro research on less-developed country (LDC) rural economics. It was first envisioned as an instrument for price policy analysis to provide an explanation on the counterintuitive empirical finding that an increase in the price of a staple did not significantly increase the marketed surplus in the sector of Japan. The various attempt to search for an empirically supported explanation led to a model in which both production and consumption decisions are linked, since the deciding entity is both a producer, choosing the labor allocation and other inputs for the crop production, and a consumer, deciding on the income allocation from farm profits and labour sales for the consumption of commodities and services.

In fact, a suitable model was needed to explain the economic behavior of:

1. The subsistence agricultural practice typical of small scale low productivity farmer, frequently operating under marginal conditions and incomplete market;

2. The net surplus producing family, farm, typical of small-owner operated of medium productivity;

3. The small scale renter and sharecropper farms.

4. The owner-operated commercial farms producing food for both domestic consumption and agro-industry and export markets. These cases describe farming system in which most of the rural population in the developing world is engaged.

In its double role as producer/supplier and consumer, the household makes choices among production, labour allocation and consumption that may be interrelated upon one another. In its most general conceivable form, an individual's objective is to maximize utility from consumption of goods including home produced goods, goods purchased as well as leisure, which will be subject to a large set of constraints.

Estimated household farm models can be used to analyze a multitude of research and policy issues relating to agricultural development. The early works and or uses were concerned primarily with farm price policy. Geographically diverse econometrics studies (Kuroda and Fotopoulos (1978) in Japan, Choon Yong Ahn, Singh and Squire (1981) in Korea, Peter Hazell and Alisa Roell (1983) in Malaysia and Nigeria) etc., demonstrate that, as expected from neoclassical models, an increase in the price of a crop increases the production of that crop. In economic terms, it means that the own-price supply elasticity is positive. However, they also revealed positive consumption effects through farm profit. Despite an early emphasis and application of the model on price policy, the application of Agricultural Household Models was extended to such diverse topics as Off-farm labour supply, Nutrition policy, downstream growth, Labour supply, Migration, Income distribution, Savings and Family planning among others.

2.3 Empirical Literature

There are several empirical literatures on rice production and its related activities carried out by several authors and scholars. Some of these empirical work were highlighted below.

Ojeleye, A. (2015) carried out an Analysis of Farm Household and Community Food Security in Kaduna State, Nigeria. From the study, Food Security Index (FSI) of households obtained showed that 66% of respondents were able to meet the daily calorie intake of 2260 kcal per capita. Similarly, the study found among other things that rice production (in grain equivalent), access to credit, expenditure on health, and dependency ratio were among the significant determinants of food security status of the households. Okpe et al (2014) examined The Impact of Rice Milling on Poverty Reduction in the Three Geo-Political Zones of Benue State, Nigeria. The study found that rice milling activity has reduced the probability of its operators being poor in Benue State, which means that rice milling activity is a poverty alleviating enterprise. The empirical findings from this research also shows that milling of rice in the study area is beset with many obstacles which include among others poor pricing of locally milled rice, problem of electricity, water supply, increasing cost of paddy rice, high cost of milling as a result of increase in cost of equipment and the problem of capital. The study recommended among other things the provision of necessary incentives such as funds to encourage unemployed youths; ensure all year round production of rice through irrigation; form cooperative societies among rice millers so that they will have easy access to loans.

In addition, Folorunso, T. (2015) in her dissertation investigated the effects of Fadama 111 on Food Security and Poverty Status of Farmers in some Central States of Nigeria. The results shows that Age, Family size, Farmers' level of education, Farm size and farmers' Farming experience were the socioeconomic factors identified in the study area that have significant impact on the participants' productivity. The results also revealed that the problems encountered by the farmers in the study area high cost of input, limited finances, bad roads, low produce prices, inadequate fixed inputs, poor marketing practices, high cost of labour, poor storage facilities, non-availability of water and shortage of fertilizer. The study recommends among other things that farmers should be advised through the Agricultural Development Programme of Benue,

Kogi and Plateau States on how to allocate, and use their resources efficiently in other to enhance their net farm income, productivity, food security and poverty status.

In their study conducted by Terwase et al (2014) on the Impact of Rice Production, Consumption and Importation in Nigeria: the Political Economy Perspectives, found amongst others that: while the level of production of rice is low, the consumption is high and its importation is highly inelastic. Also, Ganiyu B. (2015) carried out an Economic Analysis of Small Rain-Fed Lowland Rice Production in selected Local Government Areas of Niger State, Nigeria. The result shows among other things that the average economic efficiency of the rice farmers was 39 percent. This indicates that rice farmers were economically inefficient. Findings, further revealed that household size, educational status, farming experience and cooperative membership were the socio-economic variables responsible for the variation in technical efficiency of the rice producers.

Similarly, Kadiri et al (2015) examined the effect of paddy rice production on the welfare of farmers in Nigeria Delta Region of Nigeria. The findings shows some of the benefits the sampled respondents got in producing paddy rice e.g. source of regular income, easy feeding and clothing, ability to train children in school, among others which are all important factors in alleviating poverty and sustainable development in the rural areas. The result further indicates that household size, income per adult equivalent credit as well as yield have positive relationship with the welfare of farmers, meaning that increasing each one of them can raise the welfare and or standard of living of the sampled farmers. It was concluded that paddy rice production has positive effect on the welfare of farmers in the study area.

Furthermore, Amos O. (2014) conducted study on: Exploring options for improving rice production to reduce hunger and poverty in Kenya. The study aims at finding possible ways of boosting rice production in Kenya. This research work emphasized that investment in research and development in agriculture, Stabilization in prices and adoption of

New Rice for Africa (NERICA), Kenya can be sufficient in food production.

Abdul – Gafar et al (2017) carried out a Comparative study on Factors Influencing Rice Yield in Niger State of Nigeria and Hainan of China. The findings identify factors influencing rice yield in Niger states in Nigeria, and Hainan of China, a province sharing relatively similar crops and climate conditions, with the intent of finding yield influence and as well determine to what extent any management system could be inserted into the Nigeria rice system. The findings further shows that yield can be improved in the two regimes, when appropriate investment on essential inputs is provided to the farmers.

Furthermore, in their study, Umeh and Ataborh E, investigated the Efficiency of Rice Farmers in Nigeria with particular emphasis on food security and poverty reduction. The result indicates among other things that technical efficiency in rice production in Nigeria could be increased by 46 percent through better management and use of available resources. The study indicated that this could be achieved through farmer specific factors including age, farming experience, household size, education, and improved rice variety. In another study, Udama et al (2015) carried out a Review of Irrigation Potentials and Rice self-sufficiency in Nigeria. The review shows that an intensive and consistent irrigated rice production scheme will set Nigeria on a pathway to rice self-sufficiency thereby bringing an end to the gross loss in foreign exchange due to importation and smuggling of the commodity. The study concluded that for Nigeria irrigation potentials to be harnessed towards rice self-sufficiency there is need to amend policies on irrigation and water resources, create conducive market for local producers and provide subsidized and appropriate farm implements.

Uma, K. et al (2014) wrote a paper on "Stimulating Food Production in Nigeria for Sustainable Development: Lessons from China. The paper concentrated on resuscitating agriculture in Nigeria by adopting reforms similar to that of the Chinese government. The work exposed the excessive importation of food in Nigeria in spite of available fertile land, over dependent on oil sector and adverse effects it has on the economy. Again, Maji, A. et al (2012) looked at Emergency Rice Initiative: Socio economic Analysis of Rice Farmer in Nigeria. The result shows among other things, that 84% of the households were below the poverty line. Majority (94%) has no access to credit facilities and incidence of poverty was 58%. In his dissertation, Thath, R. (2015) investigated the productivity and efficiency of Rice Production: The implication for poverty alleviation in Cambodia. The study find out that due to many factors, the productivity of Cambodian rice is very low compared to other rice producing countries, and farmers are cultivating inefficiently. The result also shows that although having gradually improved, the performance of the Cambodian Rice Industry is far from satisfaction and far from its full potential. The study therefore concludes that, as majority of the rural Cambodian is poor and by and large engage in growing rice, improving rice productivity and raising farmers efficiency will undoubtedly increase their income and eventually their poverty. In other words, improving the performance of the rice industries will have positive effect on farming households' welfare. Furthermore, Omu, D. et al (2015), empirically assess the trend rice production and imports in Nigeria, spanning from 1980 to 2013. The study find out among other things that the growth rate of rice imports in Nigeria between 1980 and 2013 is relatively higher than the growth rate in rice production in Nigeria within the same period. The study advocated a restrictions on rice imports through the use of import taxes, increased government support to domestic rice farmers through provision of credit and subsidizes for rice farmers. Tunji, et al (2007) wrote a paper on: Streamlining Policies for Enhancing Rice production in Africa: Past Experiences, Lesson learn and the Way Forward. The paper identified that Africa today still depends on rice imports at a scale never imagined and the domestic rice production programmers have been largely unsuccessful. Drawing on the benefits of past experiences, the paper makes proposals for improved policy environment to support the new initiatives to increase rice output in the continent. Similarly,

Binugo G. et al carried out an investigation to determine the technical efficiency on rain fed lowland rice producers and factors influencing technical efficiency of rain-fed lowland rice producers in Niger State. The finding revealed among other things, that farming experience and corporative membership were the socio economic variables responsible for the variation in technical efficiency of the rain-fed low land rice producers. The study therefore, recommended that timely and adequate supply of fertilizer and labour should be made available to farmers at affordable price in order to enhance the production of rice in Niger State.

Finally, Chamhuri, S. et al (2013) investigated issues and challenges facing rice production and food security in the Garanary Areas in the East Coast Economic Region (ECER), Malaysia. The study is an effort to explore and investigate issues and challenges in rice production and food security in Malaysia. The study identified clearly the role of the area under study and its importance in enhancing the self-sufficiency level of rice in Malaysia. It also identified the importance of efforts and government intervention and several approaches to improve the productivity and stability of food production in the country.

Arouna, A., Lokossou, J., Wopereis, S. and Roy-Macauley, H. (2017) investigate Contribution of improved rice varieties to poverty reduction and food security in sub-Saharan Africa. Using the metadata and primary data collected from sixteen countries, they assess the number of households and individuals lifted out of poverty and food insecurity. Their findings reveals that a positive impact of improved varieties on food security and poverty reduction was observed over the period 2000–2014. In addition, the rate of adoption of these varieties increased over these years and this increase was more significant after the 2008 food crisis. Similarly, Maertens M. and Vande Velde (2017) carried out a study on contract- farming in staple foods chains in Benin. By using data from cross-sectional farm-household survey and different propensity score matching estimations, the study reveal how participation in contract- farming scheme affects smallholder rice

production in terms of contributions to rice output growth and increased income. This simply implies that contract-farming can facilitates the upgrading of rice supply chain and the development of the rice sector in Benin.

3.0 Research Methodology

3.1 Data Collection

Primary data were used for this study and. Firsthand information on agricultural operations of the farmer was collected from the field using structured questionnaires. Data on socio-economic characteristics of the farmer; quantity of rice produced and its market value (in naira) as well as quantity of all inputs used and their cost, were collected. Also, collected, were data on type and cost of labour, information related to poverty and food security, as well as constraints associated with paddy rice production were also sought from the respondents. Other relevant data such as the population of farm families (rice farmers) in each ten (10) selected LGAs and villages in Kebbi State were sourced from Kebbi Agricultural and Rural Development Authority (KARDA).

3.2 Analytical Techniques

The analytical tools that were used to achieve the research objectives include the following: Descriptive statistics; food security index (FSI), Tobit Regression models logistic regression and multiple regression model.

The Logit Model

Logit model also known as logistic regression model was developed by statistician David Cox in 1958, and is used to model dichotomous outcome variable or simply adopted where the dependent variable (DV) is categorical. The model like all other regression analysis, is a predictive analysis. Put differently, logit analysis is used to interpret and analyzed relationship between one dependent binary variable and one or more independent variable

In logit models, the probability of an event occurring is a nonlinear function of the explanatory variable(s) as we have as follows:

$$P_i = \frac{1}{1+e^{-z_i}} = \frac{e^{z_i}}{1+e^{z_i}} \qquad \text{Eq.4.11}$$

Where

$$z_i = \beta_1 + \beta_2 X_i \ \dots\dots\dots\dots \qquad \text{Eq. 4.12}$$

Thus, eq. (4.1) is called the **(cumulative) logistic distribution function**. As z_i ranges from $-\infty$ to $+\infty$, P_i ranges between 0 and 1, and P_i is nonlinearly related to z_i (that is, X_i).

Conversely, the probability of an event not occurring is given as $1-P_i$, that is,

$$1 - P_i = \frac{1}{1+e^{z_i}} \qquad \dots\dots\dots \qquad \text{Eq. 4.13}$$

The ratio of eq. (4.1) to eq. (4.3) gives the odds ratio as follows:

$$\frac{P_i}{1-P_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \qquad \dots\dots\dots \qquad \text{Eq.4.14}$$

Taking the natural log of eq. (4.4) gives

$$L_i = In\left(\frac{P_i}{1-P_i}\right) = z_i = \beta_1 + \beta_2 X_i$$
$$\dots\dots\dots\dots\dots\dots\dots \qquad \text{Eq.4.15}$$

Where L_i is called **logit**; hence eq. (4.5) is the **logit model** (Gujarati and Porter, 2009).

For empirical purposes, a typical logit model can be written as

$$L_i = In\left(\frac{P_i}{1-P_i}\right) = z_i = \beta_1 + \beta_2 X_i \qquad + \qquad u_i$$
$$\dots\dots\dots\dots\dots\dots \qquad \text{Eq.4.16}$$

To this end, this study adopts and modifies the model of Ajewole et al (2016) to investigate the impact of rice production on poverty as follows

$$Z_i = In\left(\frac{P_i}{1-P_i}\right) = \alpha + \sum_{i=1}^{n}\sum_{j=1}^{K}\beta_j X_{ij} \qquad + \qquad u_i$$
$$\dots\dots\dots\dots\dots\dots\text{Eq.4.17}$$

Where Z_i = logit in favor of a rice farmer being poor. The response variable is such that a farmer that earns below this poverty line is regarded as poor, while the one that earns above the poverty line is classified as non-poor, that is, $Y_i = 1$ for poor and 0 for non-poor.

P_i = the probability of that the rice farmer is poor and

$1-P_i$ = the probability that the rice farmer is non-poor

X_{ij} = a set K explanatory variables over the n-rice farming household;

α, β_j = intercept and partial slope coefficients, respectively;

u_i = stochastic error term.

The model is explicitly stated to include all the dependent variables as:

$$PS = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + u_i..4.18$$

Where, PS = Poverty Status and is mathematically expressed as:

$$PS = \frac{Average\ Annual\ Income\ of\ Household\ from\ Rice\ Production}{Total\ number\ of\ days\ in\ a\ year(365)}$$

The classification of rice farmer into poor and non-poor is based on the standard poverty line of \$2/day adopted by the World Bank. Thus, if the calculated PS is less than 2 dollar, it means the household is poor in which case we assign (1). However, if it is 2dollar and above, it means the household is non-poor, in which case we assign (0).

The explanatory variables include X_1 = Gender of the Household Head of individual i; X_2 = Education Level of Household Head (1 if have access to formal education, 0 if otherwise) of individual i; X_3 = Total Farm Size (Ha) of individual i ; X_4 = Adjusted Household Size of individual i; X_5 = Access to medical services (1 if there are visits to specialize and/or general hospitals, 0 if otherwise) of individual i; X_6 = Occupation (1, if farmer engaged in other economic activity and 0, if rice farming is primary occupation) of individual i; X_7 = Access to Credit (1 if farmer has access, 0, otherwise) by individual i; X_8 = Number of dependents of individual i; X_9 = Quantity of food consumed (1 if 3 times a day, 0 if otherwise) by individual i; X_{10} = Rice Production in bags of individual i.

The logit as used in this study is applied to determine the impact of rice production activity on the poverty status of the farming household and is served to achieve objective v.

Classical Multiple Linear Regression Model

The regression analysis is a statistical tool for examining the nature and form of the relationship between one or more independent variables X_1, X_2,

$X_3, \ldots, X_N$ to a single continuous dependent variable Y. It is most often used when independent variables are not controllable as when collected in a sample survey or other observational study (Gollrger, 1964).

A typical multiple regression model where the dependent variable is quantitative in nature irrespective of whether the regressors are quantitative or not is given as follows

$$Y_i = \alpha + \sum_{i=1}^{n} \sum_{j=1}^{K} \beta_j X_{ij} + u_i \ldots\ldots\ldots\ldots\ldots\ldots 4.19$$

The main assumptions underlying eq. (4.19) include, linearity in parameters (α, β's), normality of the error term (u_i), no serial correlation in errors, constant error variance, and less or no linear dependence among the explanatory variables (X's).

For the purpose of this study, the variables and parameters in eq. 4.19 are defined below.

Y_i = dependent variable which is employment (measured by the amount of hired and/or family labour employed on the farm);

α, β_j = intercept and partial slope coefficients respectively;

X_{ij} = a set of K explanatory variables spread over n-number of rice farming household;

u_i = stochastic error term.

Equation 4.19 can be explicitly stated as:

$$Y = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + u_i \ldots\ldots 4.20$$

The explanatory variables includes: X_{1i} = age (years) of individual i; X_2 = gender (1 if male, 0 if female) of individual i; X_3 = total farm size (ha) of individual i; X_4 = adjusted household size of individual i; X_5 = land ownership (1 if self-own, 0, otherwise) of individual i; X_6 = non-farm income (naira) of individual i; X_7 = rice production in bags of individual i; X_8 = number of labour hours of individual i; X_9 = cost of labour (naira) of individual i.

The Tobit Model

Tobit regression analysis was used to achieve objective v. To identify the determinants of food security status of farming household, two stages of analyses were employed; one, a Food Security Index (FSI) was constructed and secondly, the Tobit regression model, was used as a lead model, to estimate the food security of household as a function of a set of independent determinants.

The Tobit model is a statistical model proposed by James Tobin (1958) to describe the relationship between a non-negative dependent variable Y_i and an independent variable (or vector) $\mathcal{X}_i$ (Wikipeida). The Model supposes there is a latent (i.e. unobservable) variable y_i, which linearly depends on $\mathcal{X}_i$ (an independent variable) through a parameter (Vector) β which measures the relationship between the independent variable, $\mathcal{X}_i$ and the latent variable y_i (just as in a linear model). In addition, there is a normally distributed error term μ_i to include random influence on this relationship. The observed variable Y_i is determined by the following measurement equations:

$$Y_I = \begin{cases} y_i^* & if \ y_i^* > 0 \\ o & if \ y_i^* \leq 0 \end{cases}$$

Where y_i^* is a latent variable: Eq.4.23?

$$y_i^* = \beta x_i + \mu_i, \quad \mu_i \sim N(0, \delta^2) \ldots\ldots\ldots\ldots\ldots 4.24$$

The model in this study simply measures the parameter of the conditional probability of being food secure as well as the effects of the marginal changes in the explanatory variables on the food security status of the farming household. This study adopts with modifications the model of Ojefeleye O.A (2015). The model can be expressed as modifying the equating 2 above, we can expressed our model as:

$$K_i^* = x_i \beta + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.25$$

Where K_i^* is a latent variable that is observed for values greater than α and censored otherwise? The model generally considered censuring, both from

below and/ or from above respectively. The observed K_i is defined below.

$$K_i = \begin{cases} k^* \ if \ k^* > 0 \\ \alpha_k \ if \ k^* \leq \alpha \end{cases} \ldots\ldots\ldots\ldots 4.26$$

Generally it is assumed that in a typical Tobit model $\alpha = 0$. Meaning to say, the data are censored at 0. Hence, we have

$$K_i = \begin{cases} k^* \ if \ k^* > 0 \\ 0 \ if \ k^* \leq 0 \end{cases} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 4.27$$

The other components of equation 4.25 are defined as follows:

X_i = Vector of explanatory variables

ε_i = the error term, $\varepsilon_i \sim N (0, \sigma2)$, normally distributed

β = Vector of the parameter estimates,

Where equation 4.25 can be explicitly stated as follows

$$K_i^* = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + u_i \ldots 4.27$$

The explanatory variables are define as follows:

X_1 = Age of the Household Head in years of individual i, X_2 = Gender of the Household Head (1 is for Male and 0 is for female) of individual i, X_3 = Marital status of Household Head (1, if married and 0 otherwise) of individual i, X_4 = Farming experiences in years of individual i; X_5 = Total farm size (Ha) of individual i; X_6 = Adjusted Household Size of individual i; X_7 = Number of dependents of individual i, X_8 = Food Expenditure (In naira) of individual i; X_9 = Rice production in bags of individual i.

4.0 Results and Discussions

4.1 Demographic and Socio-Economic Characteristics of Respondents

Household heads' level of education

According to Imonikhe (2004), education in agricultural production would assist the farmer to test and accept innovations available to him and thus would enhance his ability to make informed and accurate decisions on the management of the farm. The level of literacy among respondents in the study area as measured by ability to read or write in Arabic or Hausa languages was high, however few of the respondents were observed to have little knowledge of English language acquired through some formal or informal means. From the survey conducted it was found that 10.95% of farmers had fine formal education. About 24% had Quran (Arabic) education while 25.87, 28.36% and 9.95% had primary, secondary and post-secondary education level respectively. Oluwatayo et al. (2008) in their studies on resource use efficiency of maize farmers in rural Nigeria observed that the more educated an agricultural worker is, the more the chances that he will adopt innovations than the uneducated ones. Meaning to say, education has influence on the rate of adoption of new technology and the efficient resource management in agricultural production.
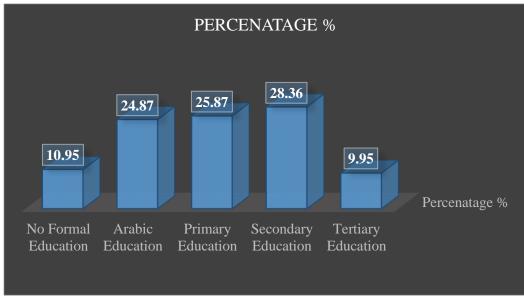
Figure 1: Household heads' level of education

Access to Extension Service

From the figure below it shows that a meager number, 37 representing just 18% of the sampled respondents indicated that they have extension visits while a relatively large number, 164 translating to about 82% have no access to any extension service. This implies that there is a near total absence of agricultural extension in the state in general. Therefore, absence or inadequate extension contacts means that the farmers had reduced access to information on modern agricultural technology Umar et al. (2007) observed that higher extensions contact would increase adoption of improved farm production technologies.
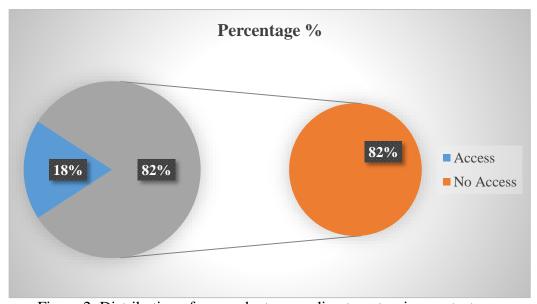

Figure 2: Distribution of respondents according to extension contact

Availability of Credit

From the survey results in figure 5.5, only 72 respondents admitted that they have no access to capital credit while a larger proportion of the respondents (129) attested to accessing capital credit for rice farming activity. This is not unconnected with the focus and the commitment of the present federal and state government on agriculture. Availability of credit increases farmers' financial capability and liquidity and thus enhances their ability to buy inputs and pay for hired labour. According to Oyewole (2012), accessibility of farmers to capital credit would increase their access to inputs which in turn would increase food production.
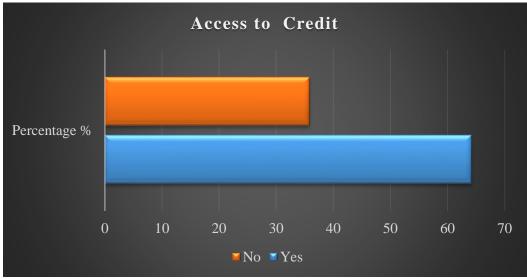
Figure 3: Poverty Status of the Household Heads

The poverty status of the respondents were derived and presented in Figure 5.6. It revealed that 105 of the rice farmers in the study area were non poor and closely 96 were poor. Figure 5.6 is used to highlights the point. The study by Iheke and Arikaibe (2012) on .

the Impact of agricultural intensification on poverty alleviation among rural farm household in Imo State Nigeria, supported this result. They reported that 53.25% of the intensified farmers were non poor
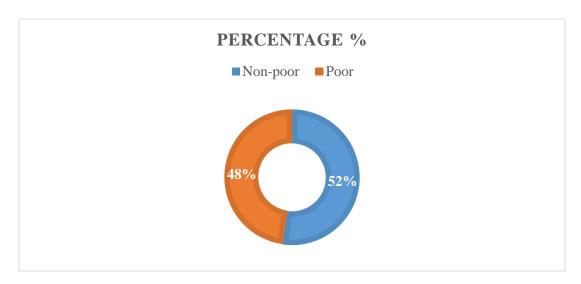

Figure 4: Poverty Status of the respondents

4.2 Household Food Security Status

As stated earlier in order to measure household food security, a Food Security Index (FSI) was constructed. The quantity of crops produced and purchased for consumption was converted to kilogram me and further to calorie and then divided by household size adjusted for adult equivalence using the equivalent male adult scale weight. The nutrient composition of commonly eaten foods in Nigeria was adopted to estimate the calorie intake of sampled respondents. The households whose daily

per capita calorie intake was up to required 2260kcal and 65g were regarded as food secure while those below 2260kcal were regarded as food insecure. The distribution of the respondents based on their food security status is presented in figure 5.7. Based on the recommended daily calorie intake of 2260kcal, 39.79% of the farming households were food secured, while 60.21% were found to be food insecure. The average Food Security Indices for the food secure was 1.35 while that of food insecure households was 0.79 respectively, and the average Food security index for the 201 sampled farmers was

1.19. This conforms to the findings of Ibrahim and Bello (2009), and Iheke and Onyendi (2017) on their studies on the Economic Efficiency and Food Security Status of Rural Farm Household in Abia State of Nigeria. Thus more than half of the households were consuming less than the daily per capita calories content. In other words, a higher proportion of the households in the study were still food insecure. This may be partly attributed to; adoption of inappropriate land use practices which have resulted to soil degradation and loss of fertility, instability in food production, food price increases and/or income shortfalls.
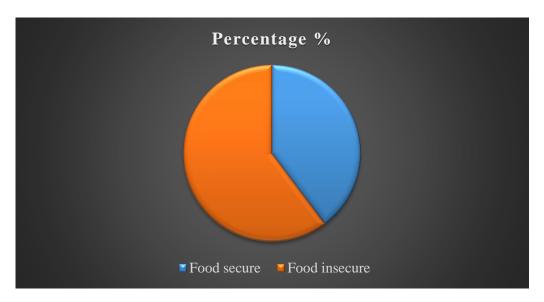

Figure 5: Food Security Status of the Respondents

4.3 Determinants of Poverty Status of Respondent

Table 5.11 presents the result of logistic regression on the determinants of farm family's poverty status among paddy rice farmers in Kebbi state. The method was adopted in line with other studies by Anyanwu (2010), Mosood and Nasir Igbal (2010), and Okpe et al (2014) among others. The estimated coefficients for the likelihood ratio chi-square was significant (p<0.01) for the State with chi-square value of 71.29. The model accounted R2 (0.8843) for 88% of the variation in poverty status of paddy rice farming households in Kebbi state, Nigeria. This suggests that the overall model is statistically significant and has performed very well. Put differently, the model predicts with a high degree of accuracy, the likelihood of a sampled respondent being poor or non-poor in the study area. Ten explanatory variables were estimated and all but one were significantly related with poverty status of the farmers in the study area. The variables were significant at 1%, 5% and 10% level.

Table 1: Result of the Logistic Regression Model for the Determinants of Poverty Status

Variables	Coefficients
Gender	-3.182** (1.480)
Education	-2.851 (3.160)
Farm Size	-2.461*** (0.929)
Household Size	1. (0.894)
HealthCare	2.479** (0.978)
Occupation	-4.574*** (1.374)
Credit Access	-2.666** (1.311)
No._of Dependents	2.715*** (0.988)
No. of Meals per day	-1.596* (0.905)
Rice Production	-0.122** (0.058)
Constant	12.517*** (3.742)

Pseudo R2	0.884
Obs.	201

Note: *** denote 1% level of significance, ** denote 5% level of significance and * denotes 10% level of significance. Figures in the parentheses are standard error

Table 2: Result of the Multiple Regression Analysis for the Determinants of Employment

Variables	Coefficients
Age	0.0136 (0.163)
Gender	1.783 (1.171)
Farm size	3.092*** (0.590)
Land ownership	1.056** (0.901)
Household size	0.041** (0.579)
Non-Farm income	0.004 (0.007)
Rice Production	0.114*** (0.016)
No. of Labour Hours	0.163*** (0.032)
Labour Cost	-0.003*** (0.007)
Constant	-1.513 (3.387)
R-squared	0.8969
Adj. R-squared	0.8775
Number of observation	201

Note: *** denote1%levelofsignificance, **denote5%levelofsignificanceand*denotes10% level of significance. Figures in the parenthesesare standard errors.

4.4 Determinants of Employment

The result of the multiple regression estimates for the factors influencing the employment rate of the rice producing farmers is presented in table 5.12 The values for both R square (0.8969) and adjusted R square (0.8775) implies that 0ver 80 percent variability in employment rate in the study area is explained by the explanatory variables that were specified in the model. The factors that had significant influence on the dependent variable were Land Ownership Farm size (positive), Household size, Rice Production (positive)) Number of Hours (positive) and Labour Cost (negative). The insignificant predictors were Age, Gender, and Non-farm income.

4.5: Determinants of food Security Status

The empirical results for the determinants of Household's Food Security Status were obtained by means of Tobit regression model using STATA Package(R). The result of the Tobit regression analysis for the sampled respondents is presented in table 5.13. The result shows that sigma (disturbance standard deviation) was 0.442398 found to be statistically significant at 1% level. Thus, the model had a high negative Log likelihood of -91.0742, altogether describing a model displaying a good fit and normal distribution of the error term.

Analysis of the survey data revealed that 7 out of 9 explanatory variables included in the model were significant in explaining the variation in food security status of household in the study area. The significant and positive variables were Age, Gender, Farming experience, Households feeding (expenditure on food) and Rice production, while Household size and Number of dependents were significant but negatively related to food security as expected. The two insignificant and positively related variables where Marital status and Farm size respectively. The coefficient of the variables were significant at 1 % (p<0.01), at 5% (P<0.05) and at 10% (P<.10).

Table 3: Socio-Economic Determinants of Food Security Status of Rice Farmers in the Study Area.

Variables	Coefficients
Age	0.054*** (0.014)

Gender	0.721*** (0.192)
Farming Experience	0.002*** (0.008)
Marital Status	0.133 (0.133)
Farm Size	0.074 (0.054)
Household Size	-0.119** (0.050)
Number of Dependents	-0.117*** (0.026)
Household Feeding	0.005** (0.002)
Rice Production	0.004*** (0.001)
Constant	-2.222*** (0.396)
/sigma	0.442*** (0.036)
Pseudo R2	0.559
Number of obs	201

Log Likelihood = -91.0742. Note: *** denote 1% level of significance, ** denote 5% level of significance and * denotes 10% level of significance. Figures in the parentheses are standard errors.

5.0 Conclusion and Recommendations

This study was conducted to evaluate the effects of rice production on poverty, employment and food security status of farm families in Kebbi State. In order to achieve this, a multistage (three stage) sampling technique was employed to select the farm households. Ten (10) LGAs were purposively selected in the state, because of their concentration of rice farmers. Likewise, two villages were randomly selected from each of the LGAs .then, samples were drawn from the total of eight villages selected; random sampling was done to give equal opportunity to every member of the strata.

Data for the study were collected using structured questionnaires administered to 301 farmers to achieve the objectives of the study.

The result of food security indices of households obtained in the study area shows that 39.79% of the farming households were food secured, while 60.21% were found to be food insecure. Also the average Food Security Indices for the food secure was 1.35 while that of food insecure households was 0.79 respectively, and the average Food security index for the 201 sampled farmers was 1.19. The determinants of food security status was obtained from Tobit regression and the analysis of the survey data revealed that 7 out of 9 explanatory variables included in the model were significant in explaining the variation in food security status of household in the study area.

In the same vein, poverty status of the respondents were derived and presented. It revealed that 53.25 percent of the rice farmers were non poor as against 46.75 percent of the farmers that were poor. The logistic regression analysis for the determinants of poverty status shows that ten explanatory variables were estimated and all but one were significantly related to poverty status of the farmers in the study area. The variables were significant at 1%, 5% and 10% level.

Furthermore, the results from the multiple regression model testing for the determinants of employments were also derived. The results indicates that the factors that had significant influence on the dependent variable (i.e. employment) were, Farm size (positive), Non-farm income (positive), Rice Production (positive)) Number of labour, Hours (positive) and Labour Cost (negative), Household size and Land Ownership. The insignificant factors were Age, Gender, and Non-farm income

Finally, about 86 % of the respondents in the study area complained of high cost of high cost of input in rice crop production. Also, about 35.82% of the respondents had limited access to capital credit. The reasons for limited access to credits may include high cost of borrowing (interest rates), absence of agricultural financial institutions in the rural areas, and lack of collateral to secure loans from commercial banks, among others. About 76% of the respondents reported that roads in the study area were bad. Other nagging constraints associated with rice production in the study area, as highlighted by

the respondents were pest and diseases, and the destruction of farmlands by Fulani herdsmen.

Recommendations

The farmers have expressed the need for government to intervene in food production matters. Production inputs such as fertilizer, agrochemicals, pesticides, pumping machines and improved seeds should be provided through institutional sources in good time, in enough quantities and within the reach of the farmers(at affordable costs).

There is also a great need to improve the rural support services that is readily accessible to the farmers through the provision of basic infrastructure like roads, extension service, and water for irrigation and consumption, agricultural credit facilities and agricultural machines for processing activities to reduce post-harvest losses and raise value addition to farm produce. This will undoubtedly aid the performance of the farmers and increase their productivity.

Land use and accessibility dominantly by inheritance, is a major obstacle to adequate food production. Indigenous Land tenure system should be reformed as soon as possible because it limits access to land by prospective farmers and or those in need to expand their farm size. Policy issues addressing environmental sustainability viz a viz agricultural production must also be given priority by the government.

Health statuses of both household heads and particularly the household members as reflected on the access to health related services came significant but positively related to household poverty status. The government intervention in community healthcare services and or facilities to provide at least basic, primary health care for farmers so as not to allow ill-health impede production activities of farmers is therefore highly recommended. Public enlightenment on birth control measures should also be pursued and targeted at farm household's level. This will reduce the risk of overpopulation and the attendant implication for more expenditure on health care services.

Generally, poverty alleviation or eradication is best approach from the perspective of sustainable human development which entails raising or improving people's capabilities, or enhancing freedom. The corollary of this to development is that empowerment i.e. helping people in poverty to acquire the tools they to meet their need is simply the long term solution to poverty. The government should educate and mobilize people on the importance of self- help projects for their villages. This will ensure that the people do not always wait and expect everything from the government, this will equally reduce government's financial burden.

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