DETERMINATION OF HEALTH AND POVERTY STATUS OF USERS OF CLIMATE SMART AGRICULTURAL TECHNIQUES IN NORTH-WEST NIGERIA

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ABSTRACT

This research established a link existing between climate smart agricultural practices and poverty in North-West geopolitical zone of Nigeria; and was motivated by the increasing consequence of climate change and its impact on poverty status among farmers in the study area. It was based on this that the study examined the impact of climate smart agricultural practices on poverty status among farmers in the zone. The specific objective was to decompose poverty status for high-users and low-users of climate smart agricultural techniques in the study area. While Foster Greer and Thorberk model was used to decomposed poverty into headcount, severity and poverty gap, Watt's index, Sen, Shorrocks and Thon index were used to analysed the income dimensions’ of poverty. Multi-stage, purposive and random sampling techniques were used to select two hundred and ninety four (294) farming households in the study area. The analysis of poverty reveals that the absolute poverty is 42.38% and relative poverty 27.64. Based on this, the study recommends that Government, Non-Governmental Organizations and farmer associations should create a conducive learning enviroment to encourage the low-users of climate smart agriculture to improve on their performance by adopting more climate smart agricultural activities.

Keywords: Climate, Smart, Agriculture, Poverty North-West Nigeria.

INTRODUCTION

An estimated over half of the world’s population as well as most of the productive lands and urban areas are situated in coastal and delta regions where the climate related disasters are prominent (IFRC, 2000); and according to (UNDP, 2011), Climate change equally leaves many more people vulnerable to poverty. These zones are predominantly found where the under-privileged households live, especially in Sub-Saharan Africa. Therefore consequences of climate change such as submerging of droughts and landslides amongst others, will not only reduce farm yields for many, but will also leave them vulnerable to poverty in the short, medium or long term. It is therefore imperative to design policies as well as enforce practices that adapt to the current observed changing climate. This has led to a growing concern about the likely consequences of climate change on poverty, economic growth, ecosystem services, livelihood prospects, as well as overall human development (Mavhura et al., 2013). Smith et al., (2007), anticipated that the poorest populations in developing countries are expected to bear the brunt of the impacts of climate change, with costs on individuals (e.g. livelihood, agriculture or water) estimated to exceed billions of dollars in some countries. Direct and indirect effects of climate change on poverty are enormous. According to Ahmed et al., (2009), climate change affects poverty in two ways which are: - changes in incomes and changes in the actual cost of living at the poverty line. Agriculture must therefore incorporate climate change effects to ensure sustainability. The use of high resilient varieties is another method that could increase income and reduce poverty because it can enhance households’ production efficiency (Kijima et al., 2011).

Climate-Smart Agriculture (CSA) is defined as agricultural practices that sustainably increases productivity, income and build resilience to climate change, and as a result eliminates greenhouse gases emission (mitigation), which heightens the
accomplishment of national food security and developmental goals which reduced poverty (FAO, 2010). Climate smart agriculture promotes the transformation of agricultural systems and agricultural policies to increase food production to ensure that food is affordable, hence reducing poverty while preserving the environment and ensuring resilience to a changing climate (Mnkeni and Mutengwa, 2014). Existing confirmations shows that Nigeria is already overwhelmed with various ecological problems which have been directly connected to the on-going climate change (Adefolalu, 2007; Ikhile, 2007). The Southern ecological zone of Nigeria mostly known for high rainwater is currently confronted by abnormality in the rainfall pattern. Also, the Guinea Savannah is under going slowly increasing temperature, while the Northern zone faces the menace of desert encroachment at a very wonton rate per year induced by fast reduction in the volume of surface water, vegetation (flora) and wildlife (fauna) resources (Obioha, 2008).

Farming in northern Nigeria is mainly rural, with about 80 percent of the farmers involved in rain-fed agriculture and subsistence in nature. The North West zone, being a key region in northern Nigeria, remains an agricultural hub for the country with a huge proportion of its population in the agricultural sector (Olapojo, 2012). Nevertheless, it is the poorest zone in Nigeria (National Bureau of Statistics 2013), with the prevalence of high-income inequality (Action Aid Nigeria, 2009). Farming is the major sources of income for many household in North-West Nigeria Obayelu, (2010). Climate plays a significant role in ensuring sustainable agricultural production in many parts of Northern Nigeria. In addition low level of improved agricultural technology compels wide use of traditional farming system. The climate smart agricultural practices introduced include use of organic manure, agro-forestry and conservation agriculture, use of improved varieties and breeds, integrated crop/livestock management as well as irrigation for small-holder farmers. This was in response to the consequences of the poor production associated with low agricultural output and high incidence of poverty among farmers in the zone.

Drought has affected several parts of Northern Nigeria with agricultural yields varying extensively from year to year and from one locality to another Abayomi et al., (2001). The restraints posed by climate change on agriculture in this region range from prominent seasonality of precipitation which may be shorter periods of rainfall or irregular rains (which limits crop production to short periods of three to five months), to severe and repeated droughts (which dislocate the usual pattern of seasonal water availability). Furthermore, the droughts likewise unveil such characteristics as fictional onset of rains, late onset of rains, prominent breaks through rainy seasons, and early termination of rains; leading to severe alterations in the pattern of seasonal rainfall dissemination (Anyanwale, 2007). High rate of poverty makes majority of the population susceptible to climate change and compromises their adaptation capacity (UNDP, 2011).

Etim and Udofia (2013) revealed that seventy percent (70%) of Africa’s deprived households (poor) live in rural areas and depend on agriculture. Englama and Bamidele (1997), have revealed that the majority of the rural dwellers are engaged in farming activities. The implication of this is that, a greater percentage of the rural poor are farmers. Hence, most of the poverty deliberations and considerations in Nigeria are linked with agriculture (Canagarajah et al., 1995; World Bank, 1996). This is due to the fact that agriculture is still the mainstay of the Nigerian economy. It has continued to employ 72% of the people (Ogbalubi and Wokocha 2013), despite its decreased role in providing foreign exchange income to the government. But these farmers, due to their low productivity coupled with inadequate access to capital, transportation, storage and processing facilities are usually exposed to negative impact of climate change and poverty. Studies have been done on the subject at National, Regional and State levels such as Ogwumike (1991), Obayelu, (2010) and Anyanwu (1997) but analysing the impact of climate smart agriculture practices and poverty status among small holder farming households in North West Nigeria is another area for further studies. Ekpoh (2010) assessed the effect of climate change and adaptation on agriculture by rural farmers in North-Western
Nigeria. The broad objective of this research is to study the linkages between climate smart agricultural practices and poverty status of small holder farming households in North-West Nigeria.

The specific objective is to decompose health poverty status for high-users and low-users of climate smart agricultural techniques in the study area.

**MATERIALS AND METHOD**

The study area is North-Western (NW) Nigeria. This comprises of seven (7) States, namely: Katsina, Kano, Kaduna, Kebbi, Jigawa, Sokoto and Zamfara States. The region is located between latitude 9°10’N and 13°50’N and longitude 3°35’E and 9°00’E and covers about 168,719 km² of the country’s total land mass. The zone is blessed with population of 35,786,944 million (NPC, 2006). It is by far the most densely human inhabited zone of Northern Nigeria. The agricultural sector forms the basis of the overall development thrust of the zone. The flora of Northern Nigeria is principally marginal or short grass savannah. This region is described by a relatively hot climate with seasonal rainfall and a marked dry season (Draper and Maureen 2009). The soils in the northern region of Nigeria are characterized as reddish brown or brown soils of the semi-arid and arid areas and are known as tropical ferruginous soils which are made up of about 85% sand with pH values that varied between 6.0 and 7.0 (Harris, 1999). It is therefore evident that changing climates (increasing droughts or floods) will influence agricultural productivity and imperative to examine the impact of climate smart agriculture practices on poverty status among farmers in North-West Nigeria. The climate makes the farmers to cultivate a wide range of crops such as cereals, legumes and vegetables. Livestock such as cattle, goats, sheep, poultry, turkey, pigeon and ostriches etc are reared in an extensive system. For the purpose of this study, if a respondent practiced three and above types of climate smart agricultural practices, the researcher classified the farmers as high-users of climate smart agricultural practices, but if the respondent practiced two or less types of climate smart agricultural practices, the researcher classified the farmer as low-users of climate smart agricultural practices.

**Data and sampling procedure**

A multi-stage sampling procedure was employed for the collection of data from the rural farming households. The first stage involved a purposive selection of Katsina and Sokoto States due to the high prevalence of poverty in the two states (NBS, 2016). The second stages involved a random selection of three (3) Local Government Areas from each of the three agricultural zones in Katsina State; and selection of three (3) Local Government Areas from three (3) out of the four agricultural zones in Sokoto State — making a total of six (6) Local Government Areas in all. The third stages involved random selection of 10 communities from each Local Government Areas to bring the total to sixty (60) Communities. Lastly, five (5) farming households were randomly selected from each of the communities to give a total of three hundred (300) respondents.

**Analytical method**

The objective of the study was analysed using Foster Greer and Thorbecke Index model, watts index, Sen, Shorrocks and Thon index, decomposition methods for income (monetary) dimensions of poverty. While FGT index was used to determine poverty levels among the respondents, Watts’ index was used to analyse individual in the population in ascending order of income or expenditure; and Sen, Shorrocks and Thorn index was used to analyse the headcount and poverty gap ratios for the whole population. These models have varying computations and were therefore used to see if the results will be consistent across all the methods. The most popular of them is however the Foster, Greer and Thorbecke (1984) model which is widely known as the FGT poverty measurement technique that examines the proportion of poor people amongst farmers who are high-users and low-users of climate smart agriculture, as well as the poverty gap and the severity of poverty. The study employs indices as monetary dimensions of health expenditure dimension, (total household expenditure divided by household size). The FGT Index model, Equally Distributed Equivalent (EDE) FGT, watts index, Sen, Shorrocks and Thon index are employed to decompose the monetary
dimensions of poverty. Poverty decompositions methods necessitate the use of poverty lines. A poverty line has been defined as the least or the cut-off standard beneath which an individual or family is labelled as poor (Anyanwu, 1997). According to (FOS, 1999) and (Canagarajah and Thomas, 2002), there is no certified poverty line in Nigeria and as such numerous earlier studies have used poverty lines which are proportions of the average per capita expenditure. This study employed per capita expenditure which is considered more suitable as in past studies, because of its consistency (reliability) and does not change over a period of time when compared to income. Therefore, the poverty line here is defined as the two-thirds (2/3) of the mean value for the health dimensions. This is in line with Durojaiye, (1995) and World Bank, (1996) who characterized farm households into poor and non-poor groups using the two-third mean per capita expenditure as the bench mark. This arbitrary poverty line is not too bias considering the fact that the focus of this study is on comparing the poverty rates between high-user and low-users of climate smart agriculture. For the dimensions, they are grouped into two categories poor and non-poor on the bases of the poverty line and thereafter the decomposition was done.

The most popular decomposition method - Foster, Greer and Thorbecke (FGT) poverty index was used to determine poverty levels among the respondents. The FGT index is given as

$$FGT_\alpha = \frac{1}{N} \sum_{i=1}^{N} \left( \frac{z - y_i}{z} \right)^\alpha$$

(1)

Where:
N = Total number of respondents i.e. household sampled
H = Number of respondents below the poverty line i.e. poor people
z = the poverty line or threshold
y_i = Per Capita Household Expenditure of the i\textsuperscript{th} respondent
\alpha = Non-negative poverty aversion parameter (0, 1 or 2)

That is, y_i = (y_1, y_2, ..., y_n) which represents the income vector of the farmers both high-users and low-users of climate smart agriculture with incomes sorted in collective order of magnitude. Z is the poverty line which can be used to decide the level of poverty status of the high-users and low-users of climate smart agriculture, H is the number of poor individuals, N is the total number of individuals in the population under study, \alpha is a weighing parameter that can be regarded as a measure of poverty aversion and is the most important because it is the index that makes this formula vary in measuring headcount, poverty gap and the severity of poverty. The FGT index takes on the values 0, 1 and 2 for headcount, poverty gap and severity respectively. The headcount index is advantageous in that it is simple to construct and easy to understand.

Mean while, EDE FGT is estimated as:

$$EDE = \left[ \frac{1}{N} \sum_{i=1}^{N} \left( \frac{z - y_i}{z} \right)^\alpha \right] = \left( \frac{1}{N} \right)$$

for \alpha > 0

(2)

EDE FGT is the Equally Distributed Equivalent form of FGT. EDE FGT applies only when \alpha = 1 and \alpha = 2. This means that it does not measure headcount as in the case of the FGT index.

The Watts index is the first distribution-sensitive poverty measure proposed in 1968 by Watts (World Bank Institute, 2005). Watts’ discrete version takes the form:

$$W = \frac{1}{N} \sum_{i=1}^{N} \left[ \ln(z) - \ln(y_i) \right]$$

(3)

Where the N individuals in the population are indexed in ascending order of income (or expenditure), and the sum is taken over the q individuals whose income (or expenditure) y_i falls below the poverty line z.

While the Sen Index has been modified by others, and perhaps the most compelling version is the Sen Shorrocks-Thon (SST) index, defined as:

$$P_{SST} = P_0 P_1 (1 + \bar{G}^p)$$

(4)

Which is the product of the headcount index, the poverty gap index (applied to the poor only), and a term with the Gini coefficient of the poverty gap ratios (i.e. of the Gn’s) for the whole population. This Gini coefficient typically is close to 1,
indicating great inequality in the incidence of poverty gaps.

RESULTS AND DISCUSSION

For the result on poverty rates for high-users and low-users of climate smart agriculture, health expenditure shall be used to ascertain the income dimension of poverty in the area. The results for all the six measurements of poverty showed that poverty head count is higher for low-users of climate smart agriculture than high-users. Poverty head count according to the FGT index for the total population was 42.38% for absolute poverty and 27.64% for relative poverty. It implies that 42% of the average climate smart agricultural farmers were deprived of health and 28% by average standard of living occasioned by climatic variations. This corroborates the work of Oyakhiloman et al., (2016) that the outcome of health poverty in farm households setting is health degradation which was occasioned by the quality of the food intake of the farming household. Further analysis into low and high-users shows absolute poverty for low-users to be 57.57% and relative poverty value as 37.44%. This means that about 58% of climate smart agricultural farmers were deprived of health; and 37.44% of climate smart agricultural farmers were deprived of average standard of living. On the other hand, the relative poverty values for the high and low-users of 0.3814 and 0.2371 means that average high-users climate smart agriculture farmers were deprived of average standard of living for about 38% and 24% respectively. This is in accord with Anselm and Taofeek (2010), that challenges of agricultural adaptation to climate change are overcome when the the farmers are able to produce enough food to ameliorate and fights resistance of the body. This trend is similar with the watts index that records 50.21% poverty head count for low-users as against 25.89% poverty headcount for high-users. Similarly, Sen, Shorrocks and Thon index show 47.34% poverty headcount for low-users and 27.96% poverty headcount for high-users. Yet again, poverty headcount, poverty gap and severity is higher for low-users of climate smart agriculture than high-users of climate smart agriculture. This shows that beyond the general expenditure, low-users have lower welfare status for not only per capita expenditure as a whole, but also for health dimensions of poverty. Hence our point of increasing awareness and capacity of farmers to encourage climate smart agricultural practice cannot be overemphasized as shown in Table 1.

<table>
<thead>
<tr>
<th>Measurement Technique</th>
<th>Population</th>
<th>P(0)</th>
<th>P(1)</th>
<th>P(2)</th>
<th>Poverty line</th>
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<tr>
<td>FGT absolute Index</td>
<td>Low-user CSA</td>
<td>0.575194</td>
<td>0.300446</td>
<td>0.190549</td>
<td>963.25</td>
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<td>EDE-FGT absolute Index</td>
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<td>Watts Index</td>
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<td>High-user CSA</td>
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<td>Total Population</td>
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<td>Sen, Shorrocks and Thon index</td>
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<td>Total Population</td>
<td>0.332447</td>
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Source: Authors Computation
CONCLUSION AND RECOMMENDATION

The study was motivated by the increasing consequence of climate change and its impact on poverty status of farmers in the study area. The already existing poverty in Nigeria was alarming and climate change threatens food security and increase poverty directly and indirectly. It was based on this that the specific objective is therefore to decompose health poverty status for high-users and low-users of climate smart agricultural techniques in the study area. The study shows that high-users of climate smart agriculture reduces the odds of being food poor; and from the findings of the study, the following recommendations are necessary:

1. There should be massive campaigns by government, civil societies and the media
   i. for the creation of awareness about climate smart agriculture;
   ii. and proffer indigenous solutions that address the significant constraints being faced by the farmers occasioned by the climatic change.

2. There is equally need to boost the role of financial institutions in terms of the volume and frequency of credit given out to the affected farmers; and

3. Reduce or eliminate interest rates associated with such credit, especially for those practicing climate smart agriculture.

REFERENCES


An unpublished M.Sc Dissertation of the Department of Agricultural Economics. University of Ibadan, Nigeria.


