



Awareness and Adaptation to Climate Change Impact in Agricultural Systems Management by Rural Farmers in Akamkpa East, Cross River State, Nigeria

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ABSTRACT

The study devoted attention to the investigation of the extent of rural farmer's awareness and adaption to climate change events in the farming systems development in Akamkpa East area of Akamkpa, Cross River State, Nigeria. The problem statement derives from the clear recognition of the current global climate change scenario and its possible impact on livelihood generally and on the agricultural sector in particular. The objectives are considered along similar lines such as examination of the extent of the peasant farmer's awareness of the extent of the climate change/Global warming scenario, their level of adaption, mitigation, their level of vulnerability and/or other alternative innovations in their livelihood modes. The literature was explored based on the basic tenet of the objectives and as a conceptualization of climate change/global warming. Analysis of the impact nature of climate change and the possible measures of mitigation and adaptation by farmers as to climate change. The methodology considered area of study, population for data collection, method of data collection and the expected output or the result of the study. From the data analysis based on the one way analysis of data, it was agreed that the null hypothesis was not accepted signifying that there is no significant variation as farmers awareness and adaptation to climate change in the area.

INTRODUCTION

Awareness is a state of consciousness or knowledge about a situation or phenomena in the environment. Environmental awareness is consciously or instinctively learnt by man or other organisms. Environmental awareness systems have been innate in a man since creation and currently there is a fast growing concern about indigenous knowledge system of the local people in their perception of environmental changes and especially changes in weather regimes or climate change in general.

The local people are capable of a cursory prediction or extrapolation of certain trends regarding seasonal cycles such early or late cessation rainfall, drought cycle and many other regimes of weather in the consideration of their agricultural system.

Orthodox study and explanation of climatic cycles have led to scientific interpretation of climate cycles resulting in the detection of the phenomenon of climate change which has been provided official definitions in many scientific cycles.

The UN Intergovernmental Panel on Climate Change (IPCC) Working Group 4 (2017) in its elaborate and indepth assessment has provided a report that substantiated beyond doubt the prevalence of the incidence of climate change.

A glaring evidence of climate change scenario is exercabal by global warming which relates to consistently rising temperature of the Earth. Following the fourth assessment report of the IPCC (2007) it is indisputable that these changes have serious impact on the Earth and that it is likely that the increase in Greenhouse gases by anthropogenic activities has caused global warming since the mid-20th century (Howden et al 2003).

Following the report it was stated that global warming not only causes a change in average temperature and precipitation but also increases the frequency of floods, droughts, heat waves and intensity of typhoons and hurricanes following the change in temperature and precipitation patterns (KIM 2006). Another weather phenomenon that is associated with climate change/global warming is the phenomenon of EL-NINO Southern oscillation (Montgomery, 2000).

The Elnino phenomenon is linked to the issue of rising ocean temperatures causing exchange of energy between the ocean and atmosphere weather systems with quite devastating and wide spread environmental consequences. Evidences/impacts of climate are equally shown in other forms all over the world, such as sea level rise, decrease in ice sheets and glaciers, latitudinal shifts in ecological habitats, increased temperature of the ocean, shortened winter and early arrival of springs.

The unpredictable weather/climatic regime which characterize the climate change scenario affects all aspects of life including the agricultural subsector. Following the third assessment report of the IPCC (2001) the impact could be positive or negative depending on the scenario. And grossly speaking, counter measures for addressing climatic change impact on agriculture could follow the strategy by mitigation or adaptation. Mitigation involves reduction or minimizing the impact based on certain techniques while adaptation requires some form of adjustment or remodeling of the system.

Statement of the Problem

Agriculture generally is faced with the vagaries of weather and environmental systems change. The capacity or ability to cope with these uncertainties derives from a number of factors such as education economic well-being technological capacity and available institutional supports. Farmers in the developing world region such as the population or universe of this study are sufficiently handicapped in the above respects.

Educationally, majority are yet far-fetched and therefore are not in a proper standing to access and utilize available knowledge and innovation needed for adjustment or mitigation. Economically and technically they are quite bereft of the essence and institutionally they lack encouragement or proper genuine empowerment from without. These web of combined controversies provided the instigating essence of the problem identification of this research.

There is therefore dire necessity of adequate examination of those issues from the point of view of individual farmers on the basis of their level of awareness of climate change impact and the corresponding variety of ways their farming systems adjustment are being undertaken.

Justification for the Study

The significance/justification of this study predicates on the following among others.

- The need for a clear appreciation of the full view perspectives of climate change/global warming.
- Provision of adequate knowledge of climate change/counter measures by way of mitigation and adaption by farmers.
- Adoption of the knowledge of low carbon system of agriculture.
- Development of alternative strategies by farmers on other ways of coping with climate change vagaries.

Objectives of the Study

The study is backed by the following specific objectives.

- i. Investigating farmer's awareness of climate change scenarios in their farming systems undertaking.
- ii. Examining farmers alternative coping strategies in their farming system undertakings in response to climate change impact awareness.

RESEARCH HYPOTHESIS

HO: There is no significant variation in farmer's awareness of the scenario of climate change in their farming system.

H1: There is a significant variation in the farmers' awareness of climate change scenario in their farming systems.

Literature Review

Climate change and its impact has become an incidence of global concern in the world environment. Precisely, it was in 1972 that the first world convention on Human Environment (UNCHE 1972) was held in Stokockholin, Norway to discuss issues of global environmental change caused by activities of man in industries, urbanization, agriculture, transportation and so on. It was in this forum that the UN Declaration on human environment containing twenty three principles were formulated covering all spheres of the environment including agriculture. In response to this, several environmental charters or regimes were formed such as the international union for the conservation of nature (IUCN 1982), World Conservation Strategy (WCS 1986), World Charter for Nature (WCN) and a host of others, (Utang and Upla 2004).

Following this the United Nations Environmental Programme (UNEP) was established as an agency for monitoring and coordinating environmental issues. UNEPS headquarters is at Nairobi, Kenya to encourage the participation of Africa (Bernic & Boyle 1991).

Accordingly, the IPCC (2007) presented considerable scientific evidences in its fourth assessment report on climate and it has become clearly recognized worldwide concerning prevalence of the change phenomenon. Additionally, global warming/climate change is glaring to every adult citizen of the earth due to the temperature rise associated with it which is caused by increased Greenhouse gases in the earth's atmosphere.

Going by the fact that accelerated global warming has impact on human and ecological systems, it has become an important issue both nationally and internationally (Kim 2009).

Following the rate of global impact assessment four scenarios have been put forward as conceptual models for evaluating the rate of development. The scenarios have been designed A₁ A₂, B₁ and B₂ respectively. Kim, Chang Cil, et al (2009) A₁, represents the world of very rapid economic growth in the direction of globalization, A₂, represents a heterogeneous world tending towards localization but with emphasis on economic growth. B₁ will represent a world of continuous development while B₂ will be a time of regional co-existence. Following the authors of this framework we are the stage of A₁ with emphasis on rapid economic growth and globalization. This stage according to the authors will peak in 2050. The essence of these model framework is for a clear appreciation of measures of mitigation and adaptation to the impact of the scenario by groups and individuals.

In another report by Global Environmental Facility (GEF, 2014) climate change has a wide range of impacts on the rural economy including agricultural productivity, revenues of the farm household and asset values.

Kim, Chang Cil et al (2009) classified climate change impact into positive and negative ones. Positive impacts include (i) increased productivity due to increased concentration, (ii) increased productivity at low level temperature rise (iii) opportunity for new crop cultivars (iv) extended growth period (v) reduction of heat cost for protected cultivation etc.

On the other hand negative impacts were said to include (i) reduction in productivity due to temperature rise (ii) band quality degradation due to temperature rise, (iii) increase weeds, blights and pests, (iv) increase of agriculture disasters such as moisture stress and drought, and (v) increase of soil erosion. Following such scenario, it has been recognized that the optimal conditions for crop productivity may swing as result of a northward shift in ecological boundaries for crop productivity. It therefore follows that adaption approaches have to be arranged for maximization of opportunities and minimization of cost (GEM 2004).

Climate change mitigation and adaptation strategies

Climate change is function of disruption of energy balance of the global climate system due to increase of Greenhouse gases and aerosols in the atmolsphere (NOAA 1995) and changes in land cover and solar radiation. The prescribed counter measures for agricultural systems sustainability are divided into mitigation method that reduces the rate and scale of climate change by mitigation and absorbing the greenhouse gas emissions and the adaptation method that admits the inevitability of global warming, understanding the impact of climate change and minimizing the damages it causes (IPCC 2004).

Mitigation measures for the agricultural sector, include the improvement of cultivation methods through improved irrigation and fertilization control for the sector to suppress major greenhouse gases such as methane, (CH₄) and nitrous oxide (N₂O), improvement of animal excretion in the form of product change through policies of greenhouse taxes or carbon tax. There is a scheme that set emission trading market for a profit.

Subsidy is another mitigation approach where government allows emitter to emit up to a certain level and compensate those who emit less than the allowable level (Smith and Skinner 2002). Direct regulation involves a scheme where government regulates emission using various policies and measures under law to ensure that the emitter complies and meets the required emission level (Freidman 2008).

Emission standard is a policy measure that specifies total Greenhouse Emission caps for each source and ensures complete compliance of the emitters.

There is also voluntary agreement which is a non-regulatory policy measure by which firms and the government voluntarily agree on greenhouse gases reduction targets. In the agricultural sector it involves good forming practices (GFP) and voluntary development of resources recycling villages (KIM 2009).

Adaptation: various definitions have been provided to explain the concept of adaptation. IPCC (2001) defined adaptation as “adjustment in natural and human system in response to actual or expected climate stimuli and their effects. United Nations framework convention on climate change UNFCCC 2010) defined adaptation as a “regulatory process of ecological and socio economic systems to reduce possible damages from actual and expected climate change. This means actions taken to help communities and ecosystem cope with changing climate conditions. Adaptation can also be explained as the ability of a system to withstand changes and stress while maintaining its structure and functions (Iglesias, et al 2007).

Types of adaptation are classified according to such factors as the characteristics, intention and point-of-time in the system (FAO 2009) it is either classified into autonomous or planned adaptation depending on intention, pre-adaptation or post adaptation accordingly7 (FAO 2010).

The low carbon Green growth strategy for agro-based adaptation to climate change.

The concept of green growth was created in order to increase the possibility of policy of sustainable development. It is a qualitative growth that enhances the standard of living through the attainment of ecological and economic soundness. It is growth achieved by saving and using energy efficiently. It is growth aimed at drastic reduction in greenhouse gas emission.

Some of the stipulated measures include:

- i. Development of new breeds of livestock and cultivars that are in great demand and resistant to heat.
- ii. Popularization of new cultivation, technologies for fertilization and sowing, popularizes technologies to reduce carbon emission etc.

Low carbon farming system is in line with the policy of clean development mechanism (CDM) put forward by the Kyoto Protocol (1997).

Conclusion

Farmers' awareness and adaptation is essential for sustainable agriculture systems in all environmental scenarios including climate change/global warming. Adaptation/mitigation are necessary for development of new strategies and innovation that will bring about success in all farming endeavours. In the current world of global competence, there is need to key-into the art practices that will yield the most favourable results in all endeavours.

Study Methodology

1. Research Area

The study area is Akamkpa Eastern flank stretching from Anengeje, through Osomba, Akim, Oban to Nyaje in the eastern border of Cameroun republic. There area is a region of heterogeneous landscape/geological features being an extension of the Adamawa Massifs that belong to the same relief formation of the Eastern border or the Cameroun relief formation of the crystalline basement complex formations. The region enjoys per humid, equatorial ecological biome with adequate supply of rainfall and a lush community of equatorial forest biome.

Study Population

The overall universe for this study comprises peasant farmers with a homogenous blend of literary characteristics, economic status and cultural attributes. From this universe, the sampling techniques was applied.

Sampling Method

1. The first leg in the sampling approach is to delineate the area into three namely – (i) Akamkpa East North, (ii) Akamkpa East Central and (iii) Akamkpa East South.

The Northern clusters relate to those areas at the Cameroun border e.g. Akim, Ekang etc. Central clusters refer to the zones in between e.g. Oban Central, Osomba etc. Southern cluster refer to Anengeje and other contiguous zones.

2. Finally, from each cluster 40 farmers were selected on the basis of farm acreage.

Thus, the total sampled population was one hundred and twenty in all 300.

Instruments for Data Collections

Instruments employed in field data collection include questionnaire and checklists.

Method of Data Collection

Questionnaires was administered directly on farmers and withdrawn for statistical analysis.

Data Analysis

Questionnaire information was tested hypothetically using the technique by one way analysis of variance (ANOVA).

Data Presentation

Table 1

Awareness and Adaptation to Climate change Impact in Agricultural systems Management by Rural Farmers in Akamkpa East, Cross River State, Nigeria.

S/N	AWARENESS VARIABLES	RESPONDENTS RATING				
		A	SA	D	SD	TOTAL
1.	Awareness of sporadicity of rainfall	70	82	58	38	248
2.	Awareness of increased temperature regime	85	91	38	34	248
3.	Awareness of increased solar receipt	94	97	28	18	237
4.	Increased incidence of flooding	66	72	80	32	237
5.	Increased storminess of rainfall/weather systems	94	88	60	7	249
6.	Unpredictability of weather systems	82	98	45	24	249
7.	Awareness of early cessation and late arrival of rainfall	86	94	61	7	248
8.	Awareness of increased occurrence of draught	86	94	42	16	248
	ADAPTATION STRATEGIES					
1.	Introduction of new cullarers	87	99	34	27	247
2.	Introduction of new livestock strains	40	48	90	69	247
3.	Application of herbicides/pesticides	95	88	35	22	240
4.	Shift from stabilized to arable farming	40	38	96	72	246

Note: The sample size comprised of two hundred and fifty farmers drawn through multi-stage sampling for the interview. The information is recorded on table 1 above for statistical analysis through one-way analysis of variance (ANOVA). Two major parameters were explored (investigated) in the interview procedure, namely, farmer's awareness of the climate change scenarios involving direct and surrogate indices and their corresponding adaptation to the climate change scenarios.

A null hypothesis is hereby stated for statistical testing.

The 400mt Likert scale refers: A = Agree, SA = Strongly Agree, D = Disagree, SD = Strongly Disagree.

Data Analysis

The above table is hereby transposed for statistical analysis based on the technique of one way analysis of variance as presented below.

Ho: there is no significant variation in the farmer's awareness and adaption towards climate change scenario in the study area.

Table 1

One-Way ANOVA of variance in the farmer's awareness and adaption towards climate change scenario in the study area.

Source of Variable	Df	SS	MS	F-ratio
Treatment	3	130.2187	43.406	
Error	36	27805.2501	772.368	0.0561
Total	39	27935.46875		
Source of variable				
Treatment	3	8.5	2.8333	
Error	16	11908.5	744.281	0.00380
Total	19	11917		

*Significant at .05

Reject Ho if $F_{cal} - \text{ratio } F_a$ otherwise do not reject. Comparing both value we accept.

Ho because $F_{cal} \text{ ratio} = 0.0561$, $F_{(3,36)} = 4.51$ at 0.05 level of significant and we concluded that there is no significant variation in the farmers awareness and adaption towards climate change scenario in the study area.

Similarly we accept Ho because $F_{cal} - \text{ratio} = 0.00380 < F_{(3,16)} = 5.29$ at 0.05 level of significant and we concluded that there is no significant variation in the farmers awareness and adaption towards climate change scenario in the study area.

Results/Findings

Deriving from the statistical analysis using the technique of one way analysis of variance, (ANOVA) and in line with decision rule which depicts that the F_{cal} ratio of 0.0561 is less than ($<$) the $F_{critical}$ value of 4.51 at alpha level of 0.05 degree of significance, the HO (null hypothesis) is accepted while the H_1 (alternative hypothesis) is rejected.

It is therefore concluded that there is no significant variation in farmer's awareness and adaptation to climate change scenario in the study area. This is clearly reflected by the pattern of farmers' awareness and adaptation responses as elicited based on field survey interview.

Inherently, as depicted on table 1 which is the field survey information, the farmers response direction is skewed more in favour of the positive response axis (A and SA) while the negative response axis are less favoured except for items 4 and 5 for the awareness parameters and items 2 and 4 of the adaptation parameters. This overwhelmingly homogenous awareness and adaptation pattern falls in line with the reality of Kims (2009) model of the four conceptual global impact scenario.

Basically, we are the first phase (A_1) of the scenario which is characterized by rapid economic growth in the direction of globalization. Essentially, majority of the world's citizens have been drawn into the realization of the changing world scenarios including the phenomenon of climate change. Again, the above homogenous tendencies of the rural farmer debunk IPCC (2000) characterization of farmers into daivoyant, responsive, passive and dormant farmers. The present situation favours the first flank of the farmer's characterization of being homogenous i.e. clairvoyant. On the contrary IPCC (2007) 4th assessment report corroborates the current tendency of these farmers in the sense that global warming and climate change have become glaring to every adult citizen of the earth. This statement is further bolstered by Kim's (2009) position that accelerated global warming has an important impact on human and ecological systems and therefore it has become an important issue both nationally and internationally.

Besides formal knowledge and scientific information, the local people are imbued with indigenous knowledge about their environment in terms of the entire paraphernalia of unity of nature" or ecological understanding. On the basis of this, they are well equipped with the ingenious knowledge of weather systems, seasonal cycles, regimes of weather and the relationship between vegetation, soils, rainfall and other phenomena of the environment.

The findings derived from our study clearly substantiated the point that farmers in the area investigated are significantly aware of the changing of climatic trend and have equally devised adaptation measures to cope with the change.

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