

Original Research Article

Determinants of the Use of Indigenous Coping Strategies against Climate Change among Smallholder Farmers in Katsina State, Nigeria.

ABSTRACT

Aims: This study assessed the indigenous coping strategies employed by irrigation farmers in response to adverse effects of climate change in Katsina State and the factors that determine the use of such strategies.

Place and Duration of Study: The research was carried out in two out of the three zones of Katsina State Agricultural and Rural Development Authority. The data were collected in 2013.

Methodology: A sample of 200 farmers was randomly selected from a sample frame of 1332 irrigation farmers. Structured interview and focus group discussion were employed for data collection. The data obtained were analyzed using descriptive statistics, coping strategy index and regression analyses.

Results: Age of respondents, total land size, total annual income and years of membership of farmers' cooperatives were found to be positively related to the use of indigenous coping strategies against climate change and significant at 1% probability. The constraints to effective use indigenous coping strategies against climate change were identified to be: poverty (identified by 87.5% of the respondents), poor record keeping and documentation (84%), poor access to information on climate change (72%), low level of education (59.5%), uncertainty in the agricultural enterprises due to reliance on natural conditions (46.5%), land tenure system (39%) and inadequate physical and social infrastructure in the rural areas (29.5%).

Conclusion: Despite the constraints hindering effective use of indigenous coping strategies among smallholder farmers in the study area, they were able to, over time, develop and fine-tune such strategies.

Keywords: climate change, coping strategy index, smalholder, indigenous coping strategies

1. INTRODUCTION

It has been confirmed that global climate is indeed getting warmer and the effect of climate change and ozone layer depletion on the society is enormous [1]. Global warming lead to erratic weather conditions in most places worldwide [2]. The Intergovernmental Panel on Climate Change (IPCC), defines climate change as statistically significant variations in climate condition that persists for an extended period, typically for decades or longer. It is any change in climate, rainfall or productivity caused by natural variability and direct or indirect human activities that alter the composition of the atmosphere [1]; [3]; [4]. A research sponsored by the International Food Policy Research Institute also shows that agriculture and human development will continue to be adversely affected by climate change [5]. It further shows that populations in the developing nations, which are already vulnerable and

28 food insecure are likely to be the worst hit and that further climatic changes pose huge
29 challenges to food security.

30 It was also established that, climate change is not a completely new idea to Africa and
31 Africans [6]. Local populations through their indigenous knowledge systems (IKS) have
32 developed and implemented extensive coping strategies that have enabled them reduce
33 their vulnerability to past climate variability and change, which exceed those predicted by
34 models of future climate change. The fact that local communities have survived till today with
35 fast population growth rates testifies that they have developed indigenous mechanisms and
36 strategies to cope with changes in environmental conditions such as climate. It has been
37 recommended that community-based coping strategies to climate change should be
38 supported as farming and climate change are location specific [5].

39 Unfortunately, despite their relevance in the design and implementation of sustainable
40 development projects, farmers' indigenous knowledge and practices are rarely taken into the
41 requisite consideration in the design and implementation of modern mitigation and
42 adaptation strategies. Such incorporation can promote local participation in the development
43 of sustainable, cost-effective climate change mitigation and adaptation strategies rich in local
44 content which will improve the food security situation of the people [7].

45 Furthermore, although research is gradually recognizing the importance of IKS in
46 developmental studies, the value of IKS in climate change has received little attention. This
47 is despite the fact that, through continuous adjustments, rural communities have over time
48 exhibited their competence in sustaining livelihoods in both urban and rural sectors as well
49 as contribute to the development of the national economy [8]; [7]. Literature has shown that
50 one of the enormous challenges facing rural development today is how to recognize,
51 integrate and strengthen the indigenous resource management system of rural people in
52 Nigeria's development policy [9]. This brings to the fore the need for climate change
53 mitigation and adaptation efforts, especially those aimed at combating hunger, to learn from
54 the experiences of other developmental projects by recognizing the role of the IKS. This
55 study aims to investigate factors that determine the use of indigenous coping strategies
56 employed by farmers in Katsina State in response to changing climate. Specifically, the
57 objectives of this study are to:

- 58 i. identify the socio-economic and institutional characteristics of the respondents;
 - 59 ii. evaluate factors that influence the use of indigenous coping strategies; and
 - 60 iii. identify the constraints to the use of coping strategies against climate change.
- 61 The following null hypothesis was tested in this study: Socioeconomic and institutional
62 factors do not influence the use of indigenous coping strategies.

63 2. METHODOLOGY

64 This study was conducted in Katsina State, North-Western Nigeria. Katsina State has a total
65 land area of 23,938 square kilometres located between longitudes 110 and 130 East; and
66 latitudes 60 and 90 North. The projected population of the state was put at 7,452,629 in
67 2014 from the 2006 figure of 5,792,578 at a growth rate of 3.2 percent per annum [10].
68 Majority of the population are Hausa/Fulani Muslims. The climate is semi-arid with average
69 annual rainfall of about 689mm falling between May and September. The major crops grown
70 are maize, cotton, groundnut, millet, sorghum, cowpea and vegetables among others. The
71 State lies within three agro-ecological zones: Sahel Savanna, Sudan Savanna and
72 Northern Guinea Savannah. Likewise, Katsina State Agricultural and Rural Development
73 Authority, the state apparatus responsible for agricultural and rural development and
74 extension, stratified the state into three agricultural zones. These are: Zone I (Ajiwa), Zone II
75 (Funtua) and Zone III (Dutsinma).
76
77

Multi-stage sampling procedure was applied for the purpose of this research. Zones I and III (Ajiwa and Dutsinma) were randomly selected out of the three agricultural zones of KTARDA. This study targeted household heads who happen to be registered irrigation farmers in the study area as its respondents. After rigorous consultations with the relevant agencies lists of farmers that fit the demand of this study were compiled. Fifteen percent of the sample frame was selected via simple random sampling method giving rise to two hundred (200) respondents.

Primary data was used in this study. The data was obtained using complementary methodological approach combining the conventional approach in form of structured questionnaire and the participatory methodologies of inquiry as used by [9]. Descriptive statistics were used to achieve objectives i and iii, while multiple regression analysis was used to achieve objective ii of the study and test the hypothesis.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic and Institutional Characteristics of the Respondents

The respondents in this study are middle-aged to elderly irrigation farmers aged 42 to 79 years old with a mean age of 55.335 years and a standard deviation of 7.9 as shown in Table 1. The respondents in this group were expected to have acquired substantial knowledge and understanding of the subject matters of this research: indigenous coping strategies, irrigation farming and climate change in their environment. Furthermore, all the respondents are household heads who are major stakeholders in the decision making processes of the household-farm socio-economic unit and are believed to have the required information for this study. This is compounded by the farming experience of the respondents accumulated between 21 to 63 years of active involvement in agricultural activities.

The mean years of formal education are 4.66 which imply that the average respondent does not have up to complete primary education. The range of 0 to 23 years indicates that though some farmers have not acquired any formal education there others that have obtained up to tertiary education among the respondents. Further investigation showed that all the farmers have acquired various levels of Qur'anic education.

The study area is characterized by relatively large households ranging from 3 to 31 members with a mean of 14 and standard deviation of 5.93. Large households have more hands to partake in the rigors of irrigation agriculture even though smaller households have fewer mouths to feed which could their food security.

Even though agricultural lands in the study area have been subjected to fragmentation, the average total farm (irrigated and rainfed) size of a household is 3.35 hectares with a hectrage range of 1 to 12 and standard deviation of 1.064503. Land is a vital resource in agriculture; hence, larger farm sizes are expected to enable farmers to experiment with different coping strategies and technologies and to enhance their food security. The household cumulative annual income has an average of ₦242,085.00, a range of ₦76,000.00 to ₦ 760,300.00 and a standard deviation of 106361. Meanwhile, the average credit obtained by a household in the last production cycle from all sources – formal and informal – and for all purposes was ₦ 22,620.00 with a range of ₦ 0.00 to ₦ 300,000.00 and standard deviation of 57142.03.

The average respondent received less than 1 extension visit in the production cycle. The number of visits ranges from 0 to 5 with a standard deviation of 0.99. This implies that none of the farmers acquired the recommended 24 visits per year. The mean duration of

membership of cooperative group was 5.625 years with a range of 3 to 16 years and a standard deviation of 7.151229.

Table 1: Statistical distribution of socio-economic characteristics of respondents

Variable	Mean	Standard Deviation	Min	Max
Age of the respondents	55.335	7.895853	42	79
Educational attainment	4.66	5.2538	0	23
Farming experience	39.425	9.093284	21	63
Household size	14.165	5.928195	3	31
Land size	3.35	1.064503	1	12
Income	242085	106361	76000	760300
Extension visit	0.53	0.9919779	0	5
Credit obtained	22620	57142.03	0	300000
Membership of cooperative	5.625	7.151229	2	16

3.2 Factors Influencing the Use of Indigenous Coping Strategies against Climate Change in the Study Area

Furthermore, the study found that some of the socioeconomic and institutional factors above determine the use of indigenous coping strategies in the study area. This was achieved using a linear regression analysis. The analysis depicted that the parameters regressed are responsible for 59.1% of variation in the coping strategy indices (CSIs). Therefore, the null hypothesis is hereby rejected as the analysis indicates that certain socioeconomic and institutional factors influence the use of indigenous coping strategies.

Individually, as shown in Table 2, each of age of respondents, total land size, total annual income and years of membership of farmers' cooperatives were found to be positive and significant at 1% probability. Age was found to be positively related to CSI and significant at 1%. The coefficient of 20.407 means that a farmer who is a year older would have a CSI that is higher by 20.407. This implies that older farmers tend to have higher CSIs than younger ones. This is because elderly people are the custodians of indigenous knowledge and practices. Also, the CSI is a factor of duration of usage of indigenous coping strategies which is related to age. This supports the findings of [11] that age, educational level, and amount of farm credit received were found to be significant in managing effects of climate change among farmers.

Table 2: Factors influencing the use of indigenous coping strategies in the study area

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1248.278*	176.017		7.092	.000

Age	20.407*	3.350	.357	6.092	.000
Educational attainment	27.256	33.977	.037	.802	.423
Farming experience	-1.020	2.470	-.021	-.413	.680
Household size	1.501	3.541	.020	.424	.672
Land size	68.528*	20.637	.162	3.321	.001
Income	.001*	.000	.144	2.817	.005
Extension visit	-27.945	21.161	-.061	-1.321	.188
Credit	.000	.000	-.017	-.365	.715
Cooperative membership	23.533*	3.689	.373	6.380	.000

a. Dependent Variable: Coping Strategy Index. * = significant at 1% level of probability.

However, contrary to [11], this study found that farm size is highly significant and positively related to CSI. This implies that an increase in one hectare of farm size results in a higher CSI by 68.582. Likewise, level of income is positively related to CSI and significant at 1%. This implies that more well to do households have a higher tendencies of using indigenous coping strategies against climate change. This is in line with findings of [11] and [12] in separate studies in Nigeria (Nasarawa State) and Tanzania respectively.

Years of membership of cooperatives also are positively related to CSI and significant at 1%. This implies that more years a farmer spends in cooperative group, the more (s)he would learn and get exposed to in terms of beneficial knowledge and practices abound in the society.

3.3 Constraints to the Use of Indigenous Coping Strategies against Climate Change in the Study Area

The respondents identified what they believed are constraints militating against efficient utilization of indigenous coping strategies against climate change. As shown on Table 3, the first was poverty which was identified by a total of 175 respondents (87.5%). Dearth of resources constrains any venture, inhibits diversification and minimizes options for survival.

Table 3: Constraints to the use of indigenous coping strategies in the study area

Constraint	Ajiwa Zone (n=105)		Dutsinma Zone (n=95)		Pooled data (n=200)		Rank
	Frequency	%	Frequency	%	Frequency	%	
Poverty	93	88.57	82	86.32	175	87.5	1
Poor record keeping and documentation	90	85.71	78	82.11	168	84	2

of IK

Poor access
to information
on climate
change

91	86.67	53	55.79	144	72	3
----	-------	----	-------	-----	----	---

Low level of
education

70	66.67	49	51.58	119	59.5	4
----	-------	----	-------	-----	------	---

High level of
uncertainty in
agricultural
enterprises

56	53.33	37	38.95	93	46.5	5
----	-------	----	-------	----	------	---

Land tenure
system

35	33.33	23	24.21	78	39	6
----	-------	----	-------	----	----	---

Poor physical
and social
infrastructure

26	24.76	23	24.21	49	29.5	7
----	-------	----	-------	----	------	---

171

172 This supports the findings of [11]. Following poverty was poor record keeping and
173 documentation. Farmers commit happenings, activities and experiences to memory and oral
174 transmission. This makes information to become faded out, distorted and, in some cases,
175 lost completely. Proper documentation is required for effective reference to environmental
176 challenges encountered and best possible remedies tested, thereby enabling transmission to
177 subsequent generations and improvement.

178 Poor access to information on climate and climate change was identified by a total of 144
179 respondents (72%). This was followed by low level of education (59.5%), uncertainty in the
180 agricultural enterprises due to reliance on natural conditions (46.5%), land tenure system
181 (39%) and inadequate physical and social infrastructure in the rural areas (29.5%) in that
182 order.

183

184

185

186 4. CONCLUSION

187

188 It is evident that rural farmers in the study area are among the victims of the global danger of
189 climate change. Fortunately, they are aware and have even identified indicators of the
190 environmental phenomenon. It is also clear that despite the constraints hindering effective
191 use of indigenous coping strategies among smallholder farmers in the study area, they were
192 able to, over time, develop and fine-tune such strategies. Socioeconomic and institutional
193 factors affect the use of such strategies significantly in the study area.

194 5. RECOMMENDATIONS

195

196 Based on the findings of this study it is apparent that there is need for capacity building and
197 advisory services that enhance complementing the use of indigenous and modern strategies

against climate change particularly in areas of information accessibility and weather prediction. This should target both the extension personnel and the farmers. Also, governmental, intergovernmental and non-governmental organizations involved in intervention projects and programmes should take into cognizance the documentation and prioritization of indigenous coping strategies as used by farmers for further development and utilization. This is because; it has been found that the indigenous practices are working for the communities and starting from there would enhance participation and sustainability in the projects/programmes. Likewise, it has also been found that poverty is a major constraint in using coping strategies against climate change. However, the problem of poverty can be resolved by pooling resources in form of cooperative groups. Also, farmers can access loans from government and commercial banks easier through cooperative groups. Although most farmers these days belong to one cooperative group or the other, they are not involved in cooperative activities. They joined such groups when they are expecting certain benefits from intervention projects. Therefore, farmers are enjoined to imbibe the idea of group formation with the aim of cooperation. Though majority of the farmers possess little or no formal education, they are mostly literate in Arabic and Ajami (Hausa language written in Arabic transcription). Hence, farmers should endeavor to keep records of their indigenous knowledge and practices for future use, comparisons and improvements. Also, agencies responsible for adult literacy should intensify their efforts especially in rural areas.

REFERENCES

1. Intergovernmental Panel on Climate Change (IPCC), (2001). Impact, adaptation and vulnerability. Contribution of working group II of the IPCC to the third assessment report of the IPCC. Cambridge University Press. London.
2. Fayiga, A. and Adedoyin S. F., (2011): Environmental sociology: definitions and conceptual issues. In: Adedoyin, S. F., (ed) Rural, agricultural and environmental sociology in Nigeria. A publication of the Nigerian Rural Sociological Association. Andkolad Publishers Nigeria Limited, Ile-Ife, Nigeria, p32.
3. Intergovernmental Panel on Climate Change (IPCC) (2007). Tide gauge measurements and satellite imagery suggest that sea level has risen. Recent climate change – sea level changes, climate, science. The fourth assessment report of the IPCC. Cambridge university press. London.
4. United Nations (1998). Framework convention on climate change, article 1. Retrieved May 9, 2013 from http://unfccc.int/essential_background/convention/background/items/2536.php
5. Nelson, G. C., M. W. Rosegrant, J. Koo, R. Robertson, T. Sulser, T. Zhu, C. *et al.* (2009). Climate change: Impact on agriculture and costs of adaptation. International Food Policy Research Institute. Washington, D.C.
6. Musa, M.W., and Omokore, D.F., (2011a). Reducing vulnerability and increasing resiliency to climate change: learning from rural communities. Journal of Agricultural Extension. June, 15(1):1-9
7. Nyong, A., Adesina, F., and Elasha, B.O. (2007). The value of Indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. Journal of Mitigation and Adaptation Strategies for Global Change 12:787-797. Retrieved September 02, 2012, from <http://www.springerlink.com> .

- 246 8. Musa, M.W., and Omokore, D.F., (2011b). Old pathways, new hopes: using
247 agricultural extension in expanding indigenous resource management systems for
248 rural development. In: The role of agricultural extension in rural development.
249 Proceedings of the 45th conference, South African Society for Agricultural
250 Extension, held at Kimberley, Northern Cape Province, South Africa, 30 May-2 June.
- 251 9. Musa, M.W. (2006). Indigenous resource management systems (IRMS) among rural
252 communities in north-west zone of Nigeria and their relevance for participatory
253 poverty reduction. Unpublished Ph.D. thesis, Ahmadu Bello University, Zaria,
254 Nigeria.
- 255 10. National Population Commission, (2006). Report of national population census.
256 Nigeria.
- 257 11. Salau, E. S.; Onuk, E. G. and Ibrahim, A.(2012) Knowledge, perception and
258 adaptation strategies to climate change among farmers in southern agricultural zone
259 of Nasarawa State, Nigeria. Journal of Agricultural Extension.16 (2):199-211.
- 260 12. Shemdoe, R.S. (2011). Tracking Effective Indigenous Adaptation Strategies on
261 Impacts of Climate Variability on Food Security and Health of Subsistence Farmers
262 in Tanzania. Research Paper, African Technology Policy Studies Network (ATPS).
263 Nairobi, Kenya.