ESTIMATION OF IMPACT OF EXTREME CLIMATE EVENTS (FLOOD) ON COST OF LIVELIHOOD CAPITALS IN THE FLOOD BELT OF NIGERIA: THE NEED FOR COMMUNITY-BASED MITIGATION MODEL

BY

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INTRODUCTION

Background Information

- *The African scenario of impact of extreme climate change events on livelihood can be seen from the frequent doughts reported in **Ethiopia** (Collier et al. 2008 & Deressa et al. 2008). The study of Deressa et al. (2008) shows evidence of decline in precipitation and increase in temperature which are both damaging to Ethiopian agriculture.*
- *The survey conducted by International Resources Group (2008), sponsored by USAID in **Madagascar**, shows that the impact of climate related changes on livelihoods*

- *and socio-economic impacts was attributed to floods in southwest and drought in the north of Madagascar.*
- *Both studies in Ethiopia and Madagascar gave an anticipated worse situation regarding shifts in local livelihoods (agricultural production activities), food security and water security.*
- *In 2012, **Nigeria** rain fed agriculture was hit by its worst flood disaster resulting in food losses and poverty trap.*
- *Over 90% of the food supply comes from rain fed subsistent agriculture in **Nigeria** and rainfall failure means loss of major livelihood sources. Therefore, extreme climate events will translate to food price volatility in Nigeria.*

Problem Statement

- *With the majority of the Nigerian workforce depending on the extremely climate sensitive agricultural sector, adaptation measures which reduce the vulnerability of the poor and allow farmers and agricultural workers to sustain their livelihoods are of utmost importance.*
- *At present, there is lack of evidence – based studies on extreme climate change attributions that can estimate cost implications of climate change hazards and efficacy of community based mitigation model in Nigeria.*

Research Question

- *Does extreme climate event have impact on the cost of livelihood of community people in the flood belt of Nigeria?*
- *Do community people in the flood belt of Nigeria possess effective and sustainable mitigation approach to extreme climate events?*
- *Do community people in the flood belt of Nigeria possess effective and sustainable capacity to manage extreme climate events?*

Purpose

- *To estimate the impact of flood hazards on cost of livelihood capital in the flood belt of Nigeria;*
- *To evaluate the effectiveness of community-based climate mitigation model.*
- *To examine the economic implications of the impact of extreme climate change event (flood) on the economy of Nigeria*

Gaps in Knowledge

- *Close link between extreme climate event (flood hazards) and cost of livelihood capital.*
- *Community- based response/management lacks relevant model.*
- *Community-based adaptive use of seasonal climate forecast.*
- *Sustainable strategies for adapting to the effect of extreme climate events.*
- *Sustainable capacity for mitigating and adapting to extreme climate events.*

MATERIALS AND METHODS

Selection of Study Locations

- *The study locations comprise of the flood belt (coastal area) along the bank of river Niger and its tributaries. The flood belt of Nigeria is recognized as distinct in terms of geographical landscape and livelihood and was chosen as an attempt to provide a representative understanding of climate change impacts in Nigeria. This area was chosen for the study due to its vulnerability to flood.*

A flooded neighbourhood in Nigeria (2012).

- *A randomly selected sample of 420 farming households participated in the survey. Structured questionnaire and focused group interview were used to collect primary data from respondents. Descriptive and inferential statistics were used to analyse collected data.*

Framework for Analysis

- *Operational Variables*
- *The operational variables of the study include:* ***(i) Impact (ii) Vulnerability (iii)Mitigation***
- ***i) Impact***
- *Climate impact refers to the extent of damage or stress inflicted by extreme climate event on livelihood and social systems.*
- ***Flood Impact = f(Flood Frequency + Flood Severity)***
- *(Desanker & Justice 2001 and Deressa et al. 2008)*
- ***ii) Vulnerability***
- *Vulnerability in this study is, thus, defined as the likelihood of households and communities in the area, to suffer from climatic adverse impacts on their livelihood and their inability to respond to stresses resulting from the impacts (adopted from Thornton etal. 2006; Pulhin et al. 2006). Ellis (2000) used indicators such as assets (i) market, (ii) land holding, (iii) water availability,(iv) biological resources, (v) social interconnectedness, (vi) labour or human capital, (vi) saving and credit availability (vii) social relations, and (viii) institutions.*

- ***Vulnerability = f(Degree of Exposure minus Available resources to withstand effect).***
- ***iii) Mitigation***

This has to do with the action(s), and ordinances aimed at the reduction or lessening of the severity of impact of extreme climate events.

Model Specification

- ***Model I: Livelihood Impact Model***

Livelihood impact model was formulated, following Bamire and Ola (2004) Logit model specified as:

This is presented below:

$Pd^{k}_{j} = C/(i+e^{-z_{ij}})$.....(1)

$Ln\ (P_i) = \beta_1 NATCAP + \beta_2 PHYCAP + \beta_3 FINCAP + \beta_4 SOCCAP + \beta_5 HUMNCAP + \mu$--(2)

The model is read as:Total impact equals the sum of impact on naturalcapital , physical capital, financial capital, socialcapital and human capital.

Where Pi = Probability of flood event (dummy variable of 1, for evidence of flood event and 0, for no flood event)

NATCAP = Natural capital

PHYCAP = Physical capital

FINCAP = Financial capital

SOCCAP = Social capital

HUMNCAP = Human capital

μ = Error term

Model II: Community - based Climate Mitigation Model

Flood Response Model

- *It is assumed that the variables are correlated with flood response bahviour. Community-based Flood Response Impact (FRI) Model: Following Cherdpong et al, (2013), the models is implicitly specified as:*

ECFM = f(INS, COS, FRB)

In this study,the model was modified and explicitly specified as:

$$ECFM = \beta_0 + \beta_1 INS + \beta_2 Cos + \beta_3 FRB + \mu \ldots\ldots(3)$$

The essence of this model is to predict in advance community capacity to mitigate flood hazards before it occurs. It has been recognized that subjective and social dimension of the society play key roles in shaping resilience to climate change hazards and defining which adaptive options are considered acceptable feasible (Adger et al, 2009; O'Brien 2009).

Community sources of inspiration (INS) for Flood Management

The respondents were asked to express their perceptions on sources of inspiration for flood response actions with respect to the following and their responses were ranked on likert scale:

X_1 = *Impression from flooding*

X_2 = *Impression of the environment*

X_3 = *Impression created by radio*

X_4 = *Impression from television*

X_5 = *Impression from newspaper*

X_6 = *Impression from internet*

Ii. Community strength for flood management

The respondents were asked to express their perceptions on sources of strength for flood response actions with respect to the following and their responses were ranked on likert scale:

Y_1 = *Community leadership)*

Y_2 = *Community willingness to participate*

Y_3 = *Community social capital*

Z_4 = *Self dependable*

Y_5 = *Environmental Education*

Y_6 = *Support from government and donor agencies*

iii. Community-based Flood Response Behaviour (FRB)

The respondents were asked to express their perceptions on the possible and effective flood response actions/ behaviours with respect to the following and their responses were ranked on likert scale:

Z_1 = *Community flood surveillance*

Z_2 = *Community flood warning system*

Z_3 = *Contingency planning for flood response*

Z_4 = *Administration of relief services during flood hazards*

Z_5 = *Review of Community participation performance after flood hazard*

Logit regression model was fitted to establish the relationship between endogenous and groups of exogenous variables X, Y ,Z, (i.e. INS, Cos and FRB) variables.

The logit regression model was specified as:

$$ECFM = \beta_0 + \beta_1 Ins + \beta_2 COs + \beta_3 FRB + \mu \ldots\ldots\ldots\ldots\ldots (4)$$

ECFM = Effectiveness of Community-Based Flood Management

Present Value Analysis (PVA) was used to to obtain the mean cost of livelihood capital lost to flood hazards for 2012.

Results and Discussion

The result of cost impact of of extreme climate event (flood) on livelihood capital among households in the flood belt of Nigeria is presented in table...

Table 1.0 Cost Implications of Extreme Climate Change Event (Flood)

Livelihood Capital	***Mean Cost(₦)***
Quantitative Capitals	
A) Natural Capital	
i) Loss of farm land	*4,250*
ii) Loss of Natural water sources	*3,363*
iii) Damage to forest resources	*3,425*
Sub Total	***11,038***
B) Physical Capital	
i) Failed roads and Collapse	*4,115*
ii) Damage to School Infrastructures	*2,305*
iii) Damage to Health Facilities	*3,214*
iv) Damage to Housing Infrastructure	*17,806*
v) Damage to Market Infrastructure	*550*
Sub Total	***29,070***
C) Financial Capital	
i) Loss of crop farm income	*12,800*
ii) Loss of income from aquaculture	*42,700*
iii) Loss of income from livestocks	*27,500*
iv) Loss of income from other sources	*20, 250*
Sub Total	***103,250***
Qualitative Capitals	
D) Social Capital	
i) Loss of relationships	*high*
ii) Communication gap	*moderate*
iii) Loss of social groups	*moderate*
E) Human Capital	
i) Loss of life of relations/kins	*high*
ii) Health challenges	*very high*
iii) Loss of skills	*moderate*
iv) Loss of labour force	*high*

(Source: Survey Data, 2012)

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The result shows that impact of extreme climate event is particularly negative on the livelihood of people in the flood belt of Nigeria. The findings revealed that flood hazards in the coastal communities of Nigeria as perceived in terms of impact on livelihood capital were estimated to have caused the average household ₦11,038.00 in Natural capital, ₦29,070.00 in Physical capital, ₦103,250.00 in Financial capital, high loss of social capital and high loss of human capital for surveyed year (2012).

Table 2.0: flood impact on livelihood capital

Variables	Coeff.	t-value	Prob.	Remark
NATCAP	-0.667	-2.472	0.043	Sig.
PHYCAP	-0.641	-1.971	0.242	sig
FINCAP	-0.987	-2.532	0.019	sig
SOCCAP	-0.334	-1.411	0.712	Ns
HUMNCAP	-0.457	-2.117	0.067	sig
Constant	0.215	0.312	0.821	Ns
R^2	84%			

(Source: Feild survey Data, 2012)

- *The result shows that flood event has significant and negative impact on natural capital (NATCAP) (-0.67) , physical capital (PHYCAP) (-0.641) , financial capital (FINCAP) (-0.987) ,and human capital (HUMNCAP) (0.457).Though flood event has negative impact on social capital, the impact is not significant.* A loss of crops from flooding would
- Increase overall vulnerability. Increased food insecurity is the most notable vulnerability for communities in area.*The implication of this result is that frequent and flood event is a threat to livelihood capitals in the flood belt of Nigeria .Livelihood capital has direct relationship with Gross Domestic Product (GDP) of a nation.A threat to livelihood capital will pose a threat to the economy of vulnerable nation.*

Community-Based Climate Mitigation Model

The result of the effectiveness of community- based mitigation model is shown in table 3.0

Table 3.0: Effectiveness of Community-based Climate Mitigation Model

Variables	**Coeff.**	**t-value**	Prob.	**Remark**
INS	0.867	2.03	0.043	Sig.
COs	0.341	1.98	0.142	sig
FRB	0.927	2.13	0.049	sig
Constant	0.015	0.99	0.927	Ns
R^2	91%			

(Source: Field survey Data, 2012).

- *The finding shows that Flood response Inspiration (INS), Community response strength (COs) (0.341) and Community response Behaviour (FRB) (0.927,) entered the model with apriori expectation of possitive relatioship with the depended variable (effectiveness of community based flood management). The corresponding t-values and probability levels show that sources of flood response inspiration (INS) (0.867) sources and level of community strenght(COs)(0.341) and community flood response behaviour (FRB) (0.927),are significant (P<0.05) variables in the community-based mitigation model. The implication of this result is that these variables are reliable elements for policy formulation for flood managent in the flood belt of Nigeria and could be a template for other locations with similar extreme climate challenges in Africa.*

Economic Implications of Extreme Climate Change Event (Flood) in the Flood Belt of Nigeria

- *Economic implications of models are not well understood until the theoretical basis are made explicit. This study provides sufficient theoretical and empirical evidences of extreme climate change event (flood) and its impact on the economy of Nigeria. No doubt extreme climate change event through impact on livelihood has introduced distorttion/shocks into the economy of Nigeria. Gross Domestic Product (GDP) is generated from aggregate livelihood activities of the people. Any attack on the livelihoods has a reverberative effect on GDP. Economic theory has it that GDP is an index of the performance of the economy. Agriculture-based economies that are vulnerable to extreme climate change events such as flood will definitely suffer a decline in performance through loss of productivity and investment on climate change mitigation, be it at community level or national level. Resources set aside for the attainment of Millennium Development Goals (MDGs) will be diverted to combat extreme climate events mitigation. There is the likelihood that Emerging Economies such as Nigeria may be submerged by the impact of extreme climate events.Economic implications of extreme climate events on livelihood capital fall within the purview of achieving the Millennium Development Goals of reducing extreme poverty by half, come 2015.*

CONCLUSION/ RECOMMENDATIONS

- *What is quite obvious in the flood belt of Nigeria is that climate change will compilcate existing rural development challenges including income generation, food and water security, and health. Economic resources available to rural people to fall back on, are quite limited and are further depleted by extreme climate events. Rural populations are extremely vulnerable to flood shocks in their livelihood production, making climatic unpredictability extremely dangerous for their continued existence. In addition, the increase in flooding will require more emphasis to be placed on disaster management measures as well as disaster warning systems using community participation approach in Nigeria. Sustainable adaptation to extreme climate events in the flood belt of Nigeria, will drain much resources meant for development. A strong political will is needed, nationally as well as internationally, to perform now.*

Contd.

On the basis of the findings, we recommended that:

1). There should be increased technical capacity-building to upgrade the natural capital (reforestation/tree-planting), physical capital (construction of dams and roads), financial capital (funding), social capital and human capital especially for rural farming households in the flood belt of Nigeria.

2). Policy makers and development planners should factor adaptation to extreme climate events into poverty reduction and sustainable development equation in Nigeria in particular and Africa in general.

3). Capacity enhancement of community people to participate in the management of extreme climate events, will require environmental education, sensitization workshops.

- ***Suggestion for further research***

  It should be emphasized that this report should not be seen as a comprehensive assessment of climate change impacts, but rather a base for further research in Nigeria.

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