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THE EFFECT OF VULNERABILITY TO FLOOD ON PROFITABILITY OF FARMING HOUSEHOLDS IN KWARA STATE, NIGERIA

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ABSTRACT

Floods are a major obstacle to agriculture and food security of Nigeria. Thus, this study assesses the effect of vulnerability to floods on profitability of farming households in Kwara state, Nigeria.. Descriptive statistics, partial farm budget analyses and t-test were the analytical tools employed to achieve the research objectives. The result indicated that all the enterprises, except sole rice (E_1) enterprise yielded a positive average returns to farmer's labour and management (RLM). The maize/cowpea (E_5) enterprise has the highest RLM (₦7, 691/ha), while the sole rice (E_1) enterprise has a negative RLM (-₦4, 481/ha). The, maize/cowpea (E_5) and sole rice (E_1) enterprises are the most profitable enterprise among the vulnerable and non vulnerable households respectively. Overall the non vulnerable households have a higher estimated RLM than those of the vulnerable households. The t-test showed that the means are significant at 1% level. *There is a large and widening vulnerability gap between well-off people and the poor. It is vital to the sustainable development effort that this gap is addressed, as well as vulnerability itself. Policies that reduce the vulnerability of the poor should be given priority. This is in keeping with the general priority being given to poverty reduction as essential to sustainable development.* Also, policies that would promote flood insurance schemes, diversification as well as facilitate the development of infrastructures among farming households should therefore be encouraged.

Keywords: Vulnerability, Climate Change, Flood, Insurance Scheme, Sustainability And Farming Households.

INTRODUCTION

*Many natural phenomena pose threats, including extreme events such as floods, drought, fire, storms, tsunami, landslides, volcanic eruptions, earthquakes and insect swarms. Human activities have added to the list, with threats from explosions, chemical and radioactive contamination, and other technological incidents. The risk lies in the probability of exposure to any of these events, which can occur with varying severity at different geographical scales, suddenly and unexpectedly or gradually and predictably, and to the degree of exposure. With an increasing and more widely distributed global population, however, natural disasters are resulting in increasing damage, loss of life and displacement of populations (*Stoddard,. 2000). *In addition, human-induced changes to the environment have reduced its capacity to absorb the impacts of change thereby undermining sustainable development. The environmental factors that contribute to human vulnerability, however, are both varied and variable, and are not limited to disaster events; they span the whole sustainable development spectrum*.

In the past four decades, economic losses due to natural hazards such as, floods disasters have increased in folds and have also resulted in major loss of human lives and livelihoods, the destruction of economic and social infrastructure, as well as environmental damages during this period (Munich Re 2002). Flood is an overflowing or irruption of a great body of water over land not usually submerged (Oxford English Dictionary). It is an extreme weather event naturally caused by rising global temperature which results in heavy downpour, thermal expansion of the ocean and glacier melt, which in turn result in rise in sea level, thereby causing salt water to inundate coastal lands. Flooding is the most common of all environmental hazards and it regularly claims over 20,000 lives per year and adversely affects around 75 million people world-wide (Smith and Lenhart (1996)). Recurring floods and other disasters have been identified as a serious threat to sustainable development. Floods cause about one third of all deaths, one third of all injuries and one third of all damages from natural disasters (Askew 1999). Significantly, flood disasters result from human-created vulnerability which is an outcome of our interacting with the environment by some human activities such as designing and locating our infrastructure, exploiting natural resources, concentrating our population and so on *thereby putting sustainable development at risk* (Hualou (2011).

According to Action Aid International (2006) flood hazards are natural phenomena, but damage and losses from floods are the consequence of human action. Flash flooding /urban flooding destroys the produce e.g. crop, rice paddy, fruit tree and vegetables thereby posing the risk of hunger to those engaged in subsistence farming and great loss to those engaged at a commercial scale (Kolawole et al. (2011)). With the increasing population worldwide, the number of people at risk or vulnerable to flood hazards is likely to increase. Any increase in disasters, whether large or small, will threaten development gains and hinder the implementation of the Millennium Development Goals (UN-ISDR 2008). Such disasters pose serious challenges to the economy of a nation. Disasters when they occur usually result in pains and huge losses to the economy and in most cases; it is always difficult to quantify the actual cost of damages and recovery. A single case of disaster such as the one that occurred in Kwara state, Nigeria in 2012 actually destroyed several years of developmental efforts. In flood disaster, there are loss of lives, destruction of public utilities, diversion of resources, epidemics, migration, food shortages and displacement of the people.

The economy of Nigeria is strongly natural resource dependent and agriculture accounts for about 42% of the GDP. Major floods in the country have a significant impact on national economic performance. Measures of fluctuations in GDP and in growth rates of agricultural and non-agricultural sector products demonstrate the sensitivity of the economies to water shocks. The expectation of variability of rainfall constrain opportunities for growth by encouraging risk averse behaviour and discouraging investments in land improvements and agricultural inputs. More importantly, however, for a justification of further investment in agricultural production and technology development in general, there is a need to assess the effect of vulnerability to floods on profitability of farming households in Kwara State, Nigeria.

CONCEPT OF VULNERABILITY

There is no consensus as to the precise meaning or vulnerability. For instance, social scientists view vulnerability as that which represents the set of socio-economic factors that determine people's ability to cope with stress or change (Allen 2005), while climate scientists view vulnerability in terms of the likelihood of occurrence and impacts of weather and climate related events (Adger et al. (2004)). IPCC Third Assessment Report has two definitions of vulnerability. In the first definition, vulnerability is defined as "the degree to which a system is susceptible to or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity" (IPCC 2001). The second definition, describes vulnerability as "the degree to which a system is susceptible to injury, damage, or harm. Sensitivity is in turn described as the "degree to which a system is affected by or responsive to climate stimuli" (IPCC 2001). The two definitions of vulnerability by IPCC above, however, are very different, and are not consistent. The first definition looks at vulnerability of a system as a function of its sensitivity while the second definition views vulnerability as a subset of sensitivity. Vulnerability in the second definition is a subset of one of the determinants of vulnerability in the first definition, hence making the two definitions contradictory, provided they are assumed to be describing the same vulnerability. Vogel (2001) describes vulnerability as "a multi-layered and multi-dimensional social space defined by determinate political, economic and institutional capacities of people in specific places at specific times". Biophysical vulnerability is concerned with the ultimate impacts of hazard event, and is often viewed in terms of the amount of damage experienced by a system as a result of an encounter with a hazard (Adger and Kelly (1999)). Biophysical vulnerability is described as that measured by indicators such as monetary cost, human mortality, production cost, and ecosystem damage. However, these are indicators of outcome rather than indicators of the state of a system prior to occurrence of a hazard event. According to Allen (2003) "the view of vulnerability as a state (i.e. as a variable describing the internal state of a system) has arisen from studies of the structural factors that make human societies and communities susceptible to damage from external hazard", as cited in Brooks (2003). Hence, it is the interaction of hazard with social vulnerability that produces an outcome, generally measured in terms of physical or economic damage or human mortality and morbidity (Brooks and Adger 2003 as cited in Brooks 2003). Therefore, social vulnerability may be viewed as one of the determinants of biophysical vulnerability. Brooks (2003) argues that the nature of social vulnerability will depend on the nature of the hazard to which the human system in question is exposed. Social vulnerability is not a function of hazard severity or probability of occurrence, but certain properties of a system, which will make it more vulnerable to certain types of hazard than others (Brooks, 2003). Therefore a hazard may cause no damage if it occurs in an unpopulated area or in a region where human systems are well adapted to cope with it (Brooks

2003). For this study, vulnerability is defined as “the degree to which a system is susceptible to or unable to cope with, adverse effects of climate change, including climate variability and extremes.

CONCEPT OF SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT

As a working definition, sustainability can be defined as the practice of maintaining processes of productivity indefinitely—natural or human made—by replacing resources used with resources of equal or greater value without degrading or endangering natural biotic systems (Melvin, 2014). Sustainability is a function of social, economic, technological and ecological themes (Hasna, 2007). Sustainable development ties together concern for the ca\rrying capacity of natural systems with the social, political, and economic challenges faced by humanity. As early as the 1970s, the concept of "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems (Stivers, 1976).

The United Nations World Commission on Environment and Development (WCED) in its 1987 report Our Common Future defines sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs Brundtland Commission (1987). Under the principles of the United Nations Charter the Millennium Declaration identified principles and treaties on sustainable development, including economic development, social development and environmental protection. Broadly defined, sustainable development is a systems approach to growth and development and to manage natural, produced, and social capital for the welfare of their own and future generations. The term sustainable development as used by the United Nations incorporates both issues associated with land development and broader issues of human development such as education, public health, and standard of living. Sustainable development is a road map, an action plan, for achieving sustainability in any activity that uses resources and where immediate and intergenerational replication is demanded. As such, sustainable development is the organizing principle for sustaining finite resources necessary to provide for the needs of future generations of life on the planet. It is a process that envisions a desirable future state for human societies in which living conditions and resource-use continue to meet human needs without undermining the "integrity, stability and beauty" of natural biotic systems.

The term *sustainable development* rose to significance after it was used by the Brundtland Commission in its 1987 report Our Common Future. In the report, the commission coined what has become the most often-quoted definition of sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission (1987). The United Nations Millennium Declaration identified principles and treaties on sustainable development, including economic development, social development and environmental protection.

METHODOLOGY

The Study Area

The research was carried out in Edu and Patigi LGAs of Kwara state, Nigeria. The state was created on May 27, 1967 along with eleven other states in the federation. The state lies between latitude 7º 45N and 9º30N and longitudes 2º30E and 6º25E. The annual rainfall ranges between 1,000mm and 1,500mm. Average temperature ranges between 30^0C and 35^0C. The state has a land area of about 32,500 square kilometers and shares boundaries with Niger state in the North,

Kogi state in the East, Ondo and Osun states in the South and Oyo state in the West, it also shares an international border with republic of Benin as shown in figure 1.

Figure 1: Map of Nigeria showing the position of Kwara State.

According to the 2006 National Population Census report, the population of Kwara state stood at 2.73 million. Popular ethnic groups found in the state include; Yoruba, Fulani, Batunu, Nupe, Bokobanu and Gambari. Over 90 percent of the rural populace is involved in farming (Kwara Ministry of Information 2004). The state has two main climatic seasons; the dry and wet seasons.

The natural vegetation of the state comprises the wooden and rain forest savannah. Major land forms in the state are plains, undulating hills and valleys. The favourable climate and the large expanse of land makes the wooded savannah in the state well suited for the cultivation of a wide variety of crops including cereals, tubers, legumes and vegetables like spinach, okra etc**.** The state is classified into four agro ecological zones by the Kwara State Agricultural Development Project (KWADP). The classification is based on the ecology and administrative convenience. These are: Zone A: Baruteen and Kaima Local Government Areas; Zone B: Edu and Patigi Local Government Areas; Zone C: Asa, Ilorin East, Ilorin West, Ilorin South and Moro Local Government Areas; and Zone D: Ekiti, Ifelodun, Irepodun, Offa, Oyun, Isin and Oke-Ero Local Government Areas.

Methods of Data Collection

The method of data collection includes an extensive literature search to conceptualize the study and to develop appropriate survey and analytical tools. A "transect walk" in the study area that facilitated the selection of the sampled villages was also carried out. Field data collection was done using structured questionnaires. The field survey was carried out with the farming household as the unit of analysis. For this study, vulnerability is defined as "the degree to which a system is susceptible to or unable to cope with, adverse effects of climate change, including climate variability and extremes. Essentially, there are two groups those affected by floods (vulnerables) and the unaffected (non-vulnerables).

Sampling Techniques and Sample Size

The farming households in Patigi and Edu Local Government Areas (LGAs) of Kwara State constitute the target population for this study. This was because the major flood disaster of 2012 occurred in these 2 LGAs (This Day Newspaper 2012). A two-stage sampling technique was used to select sample for the study. The first stage involved a purpose selection of Patigi and Edu LGAs of Kwara State. In the second stage, 10 villages were randomly selected from the list of affected communities in each of the two LGAs. In each village, 4 farming households each were randomly selected among the farming households that were affected by floods and those that were not affected to make up a sample size of 160 farming households. However, only 150 questionnaires were returned and analysed.

Analytical Techniques

Descriptive statistics, partial farm budget analyses and t-test were the analytical tools employed to achieve the research objectives. Descriptive statistics comprising the use of measures of central tendency (mean, mode and median), percentages, frequency distribution of variables and tabulation were used to describe the socio-economic characteristics of the household heads. Farm budget is one of the oldest and simplest tools used in farm management and production studies. A farm budgeting is a detailed physical and financial plan for the operation of a farm for a certain period (Olukosi and Erhabor (1988)). The aim of the farm budget is to compare the profitability of different kinds of enterprise combinations. A farm budget analysis focuses on the returns to the farming households labour and management (RLM). The model for estimating the farming household's RLM is outlined thus:

Gross value of output (GVO) which was obtained by multiplying the total output with market prices of output expressed in naira.

Less

Total variable cost of production comprised expenses (direct and imputed) on seeds, fertilizers, agro-chemicals, mechanical services, hired labor, transportation and marketing etc.

Equals

Gross margin (GM):

Less

Interest on capital: This is made up of cost of formal and informal capital used by farming household.

Less

Imputed rent on land: This item represented the amount which the farming houshold would have paid for land if they did not own it.

Less

Depreciation charges: This was determined using the straight line method with no salvage value for items like water pumps, hoses, open wells, hoes, cutlasses, baskets, sprayers, jute bags, fertilizer bags, etc.

Less

Imputed cost of family labor: Unpaid family labor (in man days) employed by each household was calculated. Family labor is assumed to have opportunity cost equal to the prevailing wage rate in the study area at the time of the survey.

Equals

Returns to farmer's labor and management (RLM): This is given as the net income less than the imputed cost of family labor. This is the focal point for the costs and returns analysis of this study.

RESULTS AND DISCUSSION

Socio-economic characteristics of the household heads

The age of the farming households' heads ranged between 35 and 67 years with an average of 47.8 years as indicated in **Table 1**. This has implication on the available family labour and productivity of labour

Table 1. Socio-economic characteristics of the household heads

Variables	Frequency	Percentage
i) Age of the Household Head		
21-40 years	37	24.7
41-60 years	96	64.0
61-80 years	17	11.3
Total	150	100
ii)Sex of the Household Head		
Male	128	85.3
Female	22	14.7
Total	150	100
iii)Marital Status of the Household Head		
Married	117	78.0
Single	26	17.3
Widower/Separated	6	4.7
Total	150	100
iv)Household Size		
1- 5	15	10.0
6- 10	69	46.0
11-15	66	44.0
Total	150	100
v)Education Status of the Household Head		
Formal Education	78	52.0
No formal Education	77	48.0
Total	150	100
vi)Major occupation of the Household Head		
Farming	109	72.7
Agricultural Trading	19	12.7
Non-Agricultural Trading	22	14.6
Total	150	100
vii)Farming Experience of the Household Head		
1- 20	19	12.7
21-40	55	36.7
41-60	76	50.6
Total	150	100
viii) Major Crop Combinations		
Sole Rice	45	30.0
Maize/Cowpea	38	25.3
Sole maize	19	12.7
Maize/Sorghum	31	20.7
Maize/Groundnut	17	11.3
Total	150	100

Source: Field survey, 2013

Sex distribution varies appreciably, 14.7% and 85.3% of the household heads were females and males respectively. The average household size is 10 persons in the study area. Most (65.1%) households are polygamous in nature. Polygamous nature of the people probably explains the large family size recorded in the area. Majority (72.7%) of the household heads are predominantly farmers, while others were involved in both agricultural and non-agricultural trading, business

and civil service as their secondary sources of livelihood. Most (52%) farming household heads are literate with most of them having primary education. The farming households head's years of experience ranged between 5 and 45 years with an average of the average of 38.1 years. Farming experience is expected to have a considerable effect on their productive efficiency. Basically, five crop combinations were popular among the sampled households. Sole rice had the largest number of occurrence (30%). This may be due to the easy adaptation of rice to the environment. Maize-cowpea, maize-sorghum, sole maize and maize-groundnut are the second, third, fourth and fifth widely adopted crop mixtures.

Profitability of cropping systems (₦/ha) of households that were vulnerable to Floods

Table 2 present the respondents' costs and returns structure to cropping systems of households that were affected by floods. The costs and returns are expressed in Naira per hectare.

Table 2: Profitability of cropping systems (₦/ha) of households that were affected by floods.

ITEM	E_1(SR)	E_2(SM)	E_3(M/S)	E_4(M/G)	E_5(M/C)
i. Gross Revenue (GR)	188,446	106,231	114,300	131,599	136,500
Less					
ii. Total variable costs (TVC)	99,926	35,830	39,060	57,669	59,509
Seeds/planting materials	29,400	4,331	5,560	10,300	7,301
Fertilizer	18,105	10,541	11,300	4,121	4,600
Agro-chemical	3,488	3,451	3,600	7,586	9,300
Hired Labour	34,333	14,441	15,200	30,462	33,428
Marketing and Transport costs	14,600	3,066	3,400	5,200	4,880
Equals					
iii. Gross margin (GM)	88,520	70,401	75,240	73,930	76,991
Less					
iv. Imputed interest on Capital	12,259	10,303	10,403	11,682	10,200
Less					
v. Imputed rent value of Land	10,445	10,558	10,850	11,300	10,600
Less					
vi. Depreciation on farm tools	4,851	4,480	3,500	4,600	5,100
Less					
vii. Imputed costs of unpaid family labour	65,446	38,500	44,900	42,450	43,400
Equals					
viii. Returns to farmers labour and management (RLM)	-4,481	6,560	5,587	3,898	7,691

[xx] E_1(SR) = Sole Rice; E_2(SM) = Sole Maize; E_3(M/G) = Maize/Groundnut; E_4(M/S)=Maize/Sorghum;E_5(MC) = Maize/Cowpea.

The cost of seed inputs had to be imputed because most of these inputs were not purchased, they were plough back. The variable cost dominated the cost of production and a large proportion of the variable costs were also attributable to labour input. The cost of labour was however, dominated by the imputed costs of unpaid family labour. The costs of seeds, fertilizer, and agrochemical were relatively low. All the enterprises, except sole rice (E_1) enterprise yielded a positive average returns to farmer's labour and management (RLM). The maize/cowpea (E_5) enterprise has the highest RLM (₦7, 691/ha), while the sole rice (E_1) enterprise has a negative RLM (-₦4, 481/ha). Thus, maize/cowpea enterprise is the most profitable enterprise among the vulnerable households.

Profitability of cropping systems (₦/ha) of households that were not vulnerable to floods

The variable cost also dominated the production cost, and a large proportion of the variable costs were attributable to the labour input, thus labour is identified as the single most costly input in the production process. This situation is expected, since most farm operations were accomplished through manual labour. The cost of family labour, although not directly incurred by the farming households, was imputed. The result revels that all the enterprises yielded a positive average return to farmer's labour and management. This implied that all the five enterprises are profitable (Table 3). The sole rice enterprise (E_1) has the highest RLM (₦112,019/ha), on the other hand, the maize/sorghum enterprise (E_3) has the lowest RLM (₦49,587/ha). Thus, sole rice enterprise is the most profitable enterprise among the non vulnerable households. Overall, the non vulnerable households have a higher estimated RLM than the vulnerable households. *This indicates that vulnerability to flood is detrimental to sustainable development of any country.*

Table 3. Profitability of cropping Systems (₦/ha) of households that were not vulnerable to floods.

ITEM	E_1(SR)	E_2(SM)	E_3(M/S)	E_4(M/G)	E_5(M/C)
i. Gross Revenue (GR)	318,446	156,231	164,300	201,599	226,500
Less					
ii. Total variable costs (TVC)	90,926	32,930	46,060	52,669	59,509
Seeds/planting materials	9,400	2,831	3,560	5,300	6,301
Fertilizer	19,105	9,541	3,300	3,121	3,600
Agro-chemical	13,488	3,451	4,600	8,586	11,300
Hired Labour	34,333	13,441	29,200	30,462	31,428
Marketing and Transport costs	14,600	3,666	5,400	5,200	6,880
Equals					
iii. Gross Margin (GM)	227,520	123,301	118,240	148,930	166,991
Less					
iv. Imputed interest on Capital	22,259	15,303	16,403	17,682	18,200
Less					
v. Imputed rent value of Land	19,945	10,558	10,850	10,300	11,600
Less					
vi. Depreciation on farm tools	10,851	5,480	4,500	5,600	5,101
Less					
vii. Imputed costs of unpaid family labour	62,446	34,500	36,900	32,450	35,400
Equals					
viii. Returns to farmers labour and management (RLM)	112,019	57,460.	49,587	82,898	96,690

E_1(SR) = Sole Rice; E_2(SM) = Sole Maize; E_3(M/G) = Maize/Groundnut; E_4(M/S)=Maize/Sorghum;E_5(MC) = Maize/Cowpea.

The independent samples t-test shows that the means are significant at 1% level for all enterprises among the vulnerable and non-vulnerable households as presented in Table 4.

Table 4: A Comparism of Gross Margin (GM) among vulnerable and non vulnerable Households.

Crop Combination	Mean Difference	Std. Error Difference	t-value
Sole Rice $GM_{vulnerables}$ Vs $GM_{non\text{-}vulnerables}$	136608.05	4109.46	32.24
Sole Maize $GM_{vulnerables}$ Vs $GM_{non\text{-}vulnerables}$	60550.96	1165.79	51.94
Maize/Sorghum $GM_{vulnerables}$ Vs $GM_{non\text{-}vulnerables}$	44086.69	1154.47	38.19
Maize/Groundnut $GM_{vulnerables}$ Vs $GM_{non\text{-}vulnerables}$	73730.03	1358.55	54.27
Maize/Cowpea $GM_{vulnerables}$ Vs $GM_{non\text{-}vulnerables}$	90180.65	981.12	91.92

Source: Data Analysis, 2013.

CONCLUSION

The impact of floods is often ignored in the long-term national development plan. Floods, however, have considerable negative impacts on the economy of Nigeria each year in terms of direct losses in assets, reduction of GDP, food insecurity and poverty. This study shows that the outputs of vulnerable and non-vulnerable households are significantly different from zero at 1% level for all enterprises. Thus, floods are a major obstacle for agriculture and food security of the country. Indications suggest that flood events are becoming more frequent in the country, and thus the average annual impact might become even greater in the future. *This study shows that there is a large and widening vulnerability gap between well-off people, with better all-round coping capacity, who are becoming gradually less vulnerable, and the poor who grow increasingly so. It is vital to the sustainable development effort that this gap is addressed, as well as vulnerability itself. For the most significant improvements, priority should go to policies that reduce the vulnerability of the poor as part of general strategies for poverty reduction. This is in keeping with the general priority being given to poverty reduction as essential to sustainable development.* Thus, there is need to improve the infrastructure, such as roads, water supply, electricity, health centres and schools. Good access road and electricity will surely help in opening up and diversifying economic activities in these communities instead of depending on agriculture alone. Also, provision of schools and communication facilities will reduce illiteracy level and increase environmental awareness among the communities. The media should also assist in educating the public on flood consequences. These will help improve the welfare of the communities and reduce their vulnerability to flood events.

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