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EFFECT OF COMMUNITY-BASED ADAPTATION STRATEGIES ON CLIMATE CHANGE IMPACTS AMONG RESIDENTS OF COASTAL COMMUNITIES IN LAGOS STATE, NIGERIA

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ABSTRACT

Coastal communities are more susceptible to the negative impacts of climate change than those in inland areas. Although, researchers have examined the adaptation measures of costal population to climate change impacts, but little is known about the effect of community-based adaptation strategies on the impacts of climate change, specifically among residents of coastal communities in Lagos, Nigeria. Therefore, this paper bridges this gap in knowledge by investigating the effect of adaptation measures on climate change impacts among residents of coastal communities in Lagos State, Nigeria. The study adopted a mixed methods approach (both quantitative and qualitative) to collect and analyse data. Results revealed that some of the community-based adaptation measures such as tree planting, waste management initiatives, and climate change awareness programmes were critical adaptation measures adopted by the participants. It was recommended that stakeholders and climate adaptation-related practitioners need to scale-up these climate adaptation initiatives because of their effectiveness in strengthening the resilience of the people to climate change impacts.

Keywords: Climate change, climate adaptation, resilience, vulnerability

INTRODUCTION

Climate change adaptation is the preparedness of human beings for the adverse impacts of climate change. That is, people's readiness to cope with the negative impacts of climate change (Hassnoot et al., 2020). Unlike climate mitigation, climate adaptation is generally accepted as a local issue by climate change scholars and practitioners (Mees & Driessen, 2019; Carman & Zint, 2020). This is because climate adaptation research without a local dimension will be of little significance. This is due to the peculiarities of local people to climate change impacts that are not captured in international agreements (Aguiar et al., 2018). Studies on adaptation are always concerned with two major concepts, which are resilience and vulnerability (Feldmeyer et al., 2019; Romsdahl et al., 2018).

Vulnerability originates from the potential and possible distress of people and places because of the negative effects of climate change. According to Ford et al. (2018), vulnerability is a consequence of exposure to a hazard, and human capacity to cope, prepare or recover from impacts of extreme weather events or natural disasters. Invariably, vulnerability is determined by socio-economic and environmental assets (Feldmeyer et al., 2019). Resilience is the capacity to adapt and persist during extreme weather events and climate stress (Pacifici et al., 2015). The essence of climate adaptation is to build and strengthen the capacity of people to cope with the adverse effects of climate change (Ford et al., 2018). There seems to be a consensus among scholars (see Kasperson & Kasperson, 2012; McLeman, 2010; Thornton et al., 2014) of adaptation research that vulnerability is socially differentiated, and that poor

communities and individuals will experience the more damaging effect of climate change due to their social, economic, political and geographical assets.

Globally, geographical features and fragile infrastructure have increased the negative impact of climate change in the Global South (Araos et al., 2017). Significantly, nations in coastal areas, due to flooding and the rise in sea level, are majorly affected by the impacts of climate change (Araos et al., 2017). Lagos State is one of the fastest growing economies in West Africa and the economic hub of Nigeria. However, her geographical features which include low topography, wetlands, and water bodies of approximately 40% and its proximity to the coast makes it vulnerable to climate change. The impacts of climate change in Lagos State include rise in sea level, increase in temperature, soil, and coastal erosion, increase in the duration and intensity of rainfall and floods (Akinola, 2021). However, the impacts that residents of coastal communities are more prone to is sea level rise which has increased the likelihood of flooding (Adelekan, 2016). A clear case was felt in designated areas of the state between 2015 and 2016, with massive floods in Oworonshoki, Bariga, Ketu, Ikorodu, Lekki and Okokomaiko areas displacing more than 100,000 people and properties estimated at billions of naira were destroyed (Adelekan & Asiyanbi, 2016). Lack of adequate infrastructure such as proper drainage system, poor urban planning coupled with poor governance have increased the vulnerability of coastal residents to floods.

The incessant flooding in Lagos State which is worsened by climate change has spurred several climate change adaptation measures. Some of these adaptation strategies include temporary relocation, construction of bridges, proper disposal of waste as well as clearing of drainages (Adelekan & Asiyanbi, 2016). Meanwhile, studies (e.g., Arimi, 2014; Omenai & Ayodele, 2014; Nkwusi et al., 2015) have examined these adaptation measures. For instance, Arimi (2014) reported that early warning information and avoidance of flood prone areas as the most common adaptation strategies employed by fish farmers in Epe local government area. Omenai and Ayodele (2014) identified crop rotation and crop diversification as the climate change adaptation methods used by farmers to adapt to climate change. Adelekan & Asiyanbi, (2016) confirmed that high-income households have more flooding-related climate change adaptive capacity compared to low-income households.

Although the highlighted studies have investigated the adaptation strategies to the adverse impacts of climate change employed by residents of coastal communities, little is known on the effectiveness of community-based adaptation strategies on climate change impacts among residents of coastal Communities in Lagos State, Nigeria. Therefore, this paper aims to bridge this gap in literature by investigating the effect of community-based adaptation strategies on climate change impacts among residents of coastal communities in Lagos State, Nigeria. This paper attempts to fill some identified gaps in literature by providing answers to two questions: What are the climate adaptation strategies among residents of coastal communities in Lagos? What are the effects of these community-based strategies on the impacts of climate change? To answer these questions the paper is divided into four sections: the first section delves into the methodology adopted for the study; the second section presents results and discussion, the third section deals with implications of findings and the last section presents the conclusion and limitations of the study.

METHODOLOGY

Research Approach

Mixed method was used as the most suitable approach for the study. Mixed method involves the use of both quantitative and qualitative method of data collection and data analysis either concurrently or consecutively in a given study (Gray, 2013). The justification for

a mixed research approach for this study is premised on the fact that quantitative method is capable of gathering data from a large sample, in this case from sample respondents in selected local government areas in Lagos State, while the qualitative method has the advantage of gaining elaborate and greater details of response from a small sample which include community leaders in this case. The choice of mixed method is because it assists researcher to achieve richer and contextual knowledge of the phenomenon under study than either approach alone (Creswell, 2014).

Study Population

Six coastal communities (Ijora-Oloye, Lekki, Makoko, Oworonshoki, Ketu, and Okokomaiko) in Lagos State were purposively selected for the study based on their proximity to the coast and frequent experience of floods. Residents in these communities are the target population of the study.

Sample Technique

The Yamane (1967) statistical formula was used to calculate the sample size; hence, 400 questionnaires were administered to residents in the study area. For equivalent allocation in each of the Local Government selected for the study, Bowley (1926) formula for proportional allocation was used. The questionnaires were randomly distributed in each of the community. The rationale for this is because almost all members of the community have experienced flood either directly or indirectly. Out of the 400 questionnaires 391 representing 97% were dully completed and returned the analysis was done using the 391 questionnaires, the remaining 9 were either lost or not returned. For the qualitative aspect of the study six community leaders: one in each LGA were purposively chosen. The choice of the community leaders was based on their role in the planning and execution of community-based adaptation strategies in their respective communities.

Participants

Table1: Demographic distribution of respondents

Socio-demographic Characteristics	Frequency	Percentage
Sex Distribution		
Female	228	58.3
Male	163	41.7
Age Distribution		
18-30Years	127	32.5
31-40Years	180	46
40Years and Above	84	21.5
Educational Background		
Primary	65	16.6
SSCE	80	20.5
ND	36	9.2
HND	28	7.2
B.Sc.	167	42.7
PGD	1	0.3
M.Sc.	14	3.6

Source: Field Survey (2021)

Table 1 presents the demographic distribution of respondents that participated in the study. On the gender of the participants, the study revealed that 58.3 percent of the respondents, were female while 41.7 percent of the respondents, were male. This result implies that more females participated in the study than males. Meanwhile, this does not infer that there are more females than males in Lagos State's population. Based on the data from the National Bureau of Statistics, 52 percent of the inhabitants of Lagos are males while 48 percent are females (NBS, 2017). The fact that female respondents dominate the study implies that women are more susceptible to the adverse effects of climate change than their male counterparts (Ajibade, McBean, & Bezner-Kerr, 2013). However, the male gender also had a robust representation which indicates that adverse impacts of climate change affect everyone irrespective of gender though the effects are more felt by women (Dankelman, 2010).

The respondents' age distribution showed that 32.5 percent of the respondents were between 18 and 30 years. Also, 46 percent of the respondents were between 31 and 40 years while 21.5 percent of the respondents were 40 years and above. This outcome denotes that most of the participants (78.5 percent) are between the ages of 18 and 40 years, indicating a high level of youth participation. Hence, they are more conversant with contemporary issues such as climate change and are more informed about the community-based adaptation strategies.

On the respondents' educational qualification, 16.6 percent of the respondents had Primary School certificates; 20.5 percent of the respondents had SSCE certificates. In the same vein, 9.2 percent of the respondents had ND certificates, and 7.2 percent of the respondents had HND certificates. 42.7 percent of the respondents had BSc certificates, while 0.3 percent had PGD certificate. 3.6 percent had a MSc qualification. The data indicates that majority (64 percent) of the respondents, have post-secondary school education. It implies that most of the respondents who participated in the study are educated, and they can easily comprehend and provide answers to the research questions. This, in a way, enhanced the credibility, reliability, and validity of the research findings.

Instrument

The research instruments used for this study were questionnaires and semi structured interviews. The questionnaire was used to collect information such as the demographic characteristics of the respondents, their climate change adaptation strategies, and the impacts of these strategies in reducing their vulnerability to climate change. Semi structured interviews were held with communities leaders to obtain further insights into the process of planning and the implementation of community-based climate adaptation strategies.

Procedure

The fieldwork was done between January and March 2021. Participants were randomly selected for quantitative data. The researcher clearly explained the research objectives to respondents before giving them the questionnaire to fill. Participants are aware that their participation is voluntary and not compulsory. For the qualitative data, consent declaration form was duly signed before the commencement of the interviews and the participants agreed that the interview should be recorded. A tape recorder was used to record the interview which lasted for about 45 minutes. Anonymity was guaranteed throughout the process of reporting; the name of the participants was not mentioned.

Data Analysis

The analysis of both qualitative and quantitative data was done concurrently. While the qualitative data were analysed using content analysis, the analysis of the quantitative data involved the use of descriptive and inferential statistics. The descriptive statistics include the use of frequency and percentage distribution table to analyse the responses of the respondents to the research questions, and the inferential statistics adopts Multiple Regression Analysis.

Multiple regression model was used to determine the effect of community-based adaptation strategies on the impacts of climate change. The dependent variables were the impacts of climate change which include increase in rainfall, flood, heavy windstorm and coastal erosion. The independent variables included in the model were climate change awareness campaign, use of renewable energy, proper disposal of waste and tree planting campaign.

The explicit form of the regression model that was used for this study is thus specified:

$Y = \alpha + \beta X_i + \varepsilon_i$ ..... (1)

Where,

Y is impact of climate change

α = Intercept term

β = Regression coefficient of explanatory variable

X_i = Explanatory variables

i = 1 to 4

ε_i= disturbance term

$Y= f(X_1, X_2, X_3, X_4,)$

Where:

X_1: Climate change awareness

X_2: Use of renewable Energy

X_3: Proper disposal of waste

X_4: Tree planting campaign.

RESULTS AND DISCUSSION

The results and discussion were done concurrently and guided by the research questions.

RQ 1: What are the climate change adaptation strategies among residents of coastal communities in Lagos State?

The lack of adequate adaptation measures that can meet the peculiarities of local people necessitates their involvement in designing appropriate initiatives that will strengthen their adaptive ability. The data revealed the following as the climate change adaptation strategies employed in the study area.

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Coping strategies for the adverse impacts of climate change

Table 2: Responses on Climate Change Adaptation Strategies in Local Communities

S/N	Response	Disagree		Strongly Disagree		Undecided		Agree		Strongly Agree		Total	
		Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	There is a coping strategy for managing negative impacts of climate change in your community	4	1	29	7.4	47	12	263	67.3	48	12.3	391	100
2	Community members design and implement their own coping strategy	6	1.5	25	6.4	22	5.6	253	64.7	85	21.7	391	100
3	There is awareness campaign on climate change by members of your community	8	2	12	3.1	16	4.1	281	71.9	74	18.9	391	100
4	Community members know of the effects of their daily energy consumption on the environment	140	35.8	84	21.5	6	1.5	100	25.6	61	15.6	391	100
5	Community members do encourage the use of renewable energy	104	26.6	48	12.3	6	1.5	144	36.8	90	23	391	100
6	Community members do encourage proper disposal of wastes	4	1	15	3.8	28	7.2	234	59.8	110	28.1	391	100
7	Community members do encourage tree planting	18	4.6	47	12	37	9.5	220	56.3	69	17.6	391	100
8	Community members know the adverse effect of bush burning on the environment	31	7.9	7	1.8	1	0.3	152	38.9	200	51.2	391	100

Source: Field Survey, 2021.

The data showed that 1 percent of the respondents were in disagreement that the community has coping strategies, 7.4 percent disagreed strongly, 12 percent showed uncertainty, 67.3 percent agreed, while 12.3 percent agreed strongly. As revealed in Table 2, it can be deduced from this data that most of the respondents (79.6 percent), affirmed that community members have their coping techniques for handling the adverse effects of climate change.

According to a community member: "*At times we pay levies to build drainage channels, wooden bridges so that there will be a free flow of water and flood will reduce".*[1] In high-income residential areas such as the state's Eti Osa local government area, community members contribute money to buy boulders that protect the community from storm surges. In some communities, they use canoes as a means of movement during a severe flood incidence. The above strategies at both individual and community level are critical to climate adaptation, especially in the absence of adequate support from the state government. This confirms the

[1] An interview with a community member at Oworonshoki

finding of Reid et al, (2009) that in most developing countries, community members design and implement coping strategies with little or no support from the state, while in developed countries, most local actions are supported by the local authority.

Awareness campaign on climate change and its impacts

Awareness on climate change is essential to achieve sustainability in developing countries. Creating awareness of climate change at the local level is imperative due to the increasing rate of climate-related disasters in different countries of the world (Shahid and Piracha, 2016). As shown in the data, there is an awareness campaign going on regarding climate change impacts at the community level in Lagos State. Table 2 showed that 2 percent of the respondents were in disagreement that there exists an awareness campaign regarding climate change at the community level. 3.1 percent disagreed strongly, 4.1 percent recorded indecision, 71.9 percent agreed, and 18.9 percent agreed strongly. This result indicates that an overwhelming majority of respondents, constituting 90.8 percent affirmed that community members in Lagos State do create awareness on climate change impacts. The qualitative data substantiated this result. A community leader in Eti Osa local government affirmed that:

> *"we do have a monthly sensitisation and awareness campaign on the need to keep our environment clean and ensure proper waste disposal so that there can be a free flow of water and we can prevent floods"*[2].

It implies that the level of knowledge on how the role individuals can play in ensuring that they are protected from the adverse influence of climate change is high (see Adelekan, 2016).

Use of Green and Renewable Energy

The shift from fossil fuel-based energy sources to green and renewable energy has been identified by climate scientists and climate governance experts as a key climate mitigation action (Quaschning, 2019). Of all the respondents, Table 2 shows that 27 percent disagreed that they know the importance of green and renewable energy usage, 12 percent strongly disagreed, 1.2 percent were undecided, 37 percent agreed, and 23 percent agreed strongly. 60 percent of the respondents affirmed that members of the communities in Lagos do encourage the utilisation of renewable energy in the protection of the environment. However, a significant percentage of the respondents, 39 percent disapproved of this claim (see Table 2). This implies that while it may be difficult to assume that community members in Lagos State do not know the importance of renewable energy, a considerable number are aware of its importance.

Tree Planting Campaign

Table 2 revealed that the community members embark on tree planting. The quantitative data showed that of all the respondents, 4.6 percent disagreed, 12 percent disagreed strongly, 9.5 percent were undecided, 56.3 percent agreed, and 28.1 percent agreed strongly. This result infers that majority (74.4 percent) of the respondents affirmed that members of the community do campaign and encourage tree planting. This means that people at the community level in Lagos State know the importance of tree planting as a carbon sink

[2] Interview with a community member at Okokomaiko

and as a protection for their building against windstorm. Similarly, community members are also conscious of the adverse effects of bush burning. Table 2 showed that an overwhelming majority (90.1 percent) of the respondents affirmed that members of the community in Lagos State know the adverse effect of bush burning. These high percentages of agreements can also be because most of the respondents are well educated hence, they can easily assess information on climate change adaptation strategies from both print and electronic media.

Waste Management Initiatives at the Local Level

The result shows that community members encourage proper disposal of waste. 1 percent disagreed, 3.8 percent disagreed strongly, 7.2 percent expressed uncertainty, 59.8 percent and 28.1 percent agreed strongly. This result indicates that most of the interviewed persons, representing (87.9 percent), affirmed that members of the Lagos State communities do encourage proper disposal of wastes (Table 2). This implies that the level of wastes management at the community level in Lagos state is impressive, and it is a key adaptation measure.

These results show that local communities in Lagos State have adopted several ways and techniques to cope with the adverse impacts of climate change. However, do any of these strategies have effect on the impacts of climate change? The next section proffers answer to this question.

RQ 2: What are the effects of community-based adaptation strategies on impacts of climate change in coastal communities in Lagos State?

To test the effect of local community-based adaptation strategies on climate change impacts, the respondents' scores on four independent variables of community-based adaptation strategies which include: (climate change awareness programme, use of renewable energy, proper disposal of waste, and tree planting campaign) and the dependent variables which are impacts of climate change were calculated and run through multiple regression analysis and the results is presented in Table 3.

Table 3: Estimated effect of adaptation strategies on the impacts of climate change in Lagos State

Variables	Coeff.	Std. Error	t-value	p-value
Constant	1.896	0.243	7.811	0.000
Climate change awareness programme	0.215	0.082	2.601	0.010
Use of renewable energy	0.056	0.077	0.725	0.469
Proper disposal of waste	0.152	0.094	1.610	0.108
Tree planting campaign	0.377	0.058	6.463	0.000
R	0.589			
R Square	0.347			
Adj. R Square	0.339			
F Stat.	40.976(0.000)			

Dependent variable: Impacts of Climate Change
Source: Field Survey, 2021.

The Table shows R^2 value indicating the level of variation in the dependent variable explained by the independent variables was found to be 0.347; this implies that climate change awareness programme, use of renewable energy, proper disposal of waste and tree planting brought about 34.7 percent variance on impacts of climate change. This is proven

further by the value of the adjusted R^2 (0.339) which reveals the goodness of fit of the model, the implication of which is that upon the correction of all errors and adjustments made, the model can only explain 33.9 percent of the variation in climate change brought about by actions of community members. In comparison, the remaining 66.1 percent variance experienced in the impacts of climate change is as a result of the error term in the surveyed model, as shown in Table 3.

The unstandardised beta co-efficient of the climate change awareness programme was 0.215 having a t value of 2.601 and (p= 0.010 < 0.05). The result indicates that community awareness programme has a positive and strong relationship with climate change impacts. This implies that within the communities, there is awareness creation on climate change impacts. Climate change's unfavourable impacts manifest with or without warning; however, creating awareness about its causes and impacts is critical to enhancing the resilience of the people (Pace et al., 2015).

The unstandardised beta co-efficient of renewable energy was 0.056. The t value = 0.725 with (p = 0.426 < 0.05), indicating that renewable energy has an unsignificant positive effect on climate change impacts in Lagos state communities since the p-value = 0.426 is greater than 0.05. The result suggests that the members of the communities know the importance of using renewable energy for the environment, but they cannot use it because of its unaffordability, so majority of them still rely on fossil fuel-based energy as a major source of energy. The cost of acquiring a solar inverter panel is higher than getting a fuel-based power generator.

The unstandardised beta co-efficient of proper disposal of waste was 0.152 with t= 1.610 and (p= 0.108 > 0.05). The result showed that the proper disposal of waste has an insignificant positive influence on climate change impacts in Lagos State communities. This implies that the community members know the importance of proper disposal of wastes, but they do dispose of their wastes indiscriminately due to insufficient provision for waste management by the government. Proper disposal of waste is the primary way of not only keeping the city clean but also avoiding the blockage of drains, which often leads to flooding during heavy rain. Proper management of waste is a vital step in climate mitigation and adaptation in several ways (Ayantoyinbo & Adepoju, 2018).

The unstandardised beta co-efficient of tree planting was 0.377 with t= 6.463 and (p-value = 0.000 < 0.05). This finding indicates that tree planting possesses a positive and strong influence on climate change impacts, and it implies community members are committed to the tree planting campaign of the Lagos state government. The finding provides empirical support for Adelekan's (2016) study on flood management in Lagos state, where she maintains that local initiatives play a key role in the adaptation of the local communities to climate change.

Implications of findings

The findings from this study implies that community-based adaptation measures such as tree planting, proper disposal waste, and climate change awareness programmes have significant effect on the impacts of climate change. This shows that scaling up of these measures will go a long way in reducing the vulnerability of people to climate change and strengthen their capacity to cope with adverse impacts of climate change. Most importantly, it is not out of place to argue that local community members perform an important role in climate adaptation, especially in their domain through several innovative methods. This result is not surprising because several studies globally have shown how local people are adapting to climate change using indigenous knowledge (see Rankoana, 2016; Shahid & Piracha, 2016;

Aguiar et al., 2018). This study provides empirical supports for studies such as (Ford et al., 2018; Pacifici et al., 2015) which argue that the slow pace of action on climate mitigation and adaptation at both national and international levels of governance has spurred several innovative measures at community level where people that are most hit by adverse effects of climate change reside.

CONCLUSION AND LIMITATIONS

This article examined climate change adaptation strategies in local communities in Lagos State and the effect of these strategies on climate change impacts. The study revealed that due to the failure of the Lagos State government to adequately respond to the challenges posed by climate change, community members design and implement several adaptations strategies such as proper disposal of wastes, tree planting, and awareness creation among others. Imperatively, some of these strategies have reduced the vulnerability of the people to climate change. Conclusively, the study recommends the need to intensify awareness creation on climate change impacts, proper disposal of wastes and tree planting campaign. This is because they are effective in strengthening the resilience of the people to adverse impacts of climate change. As a limitation to this study, the use interviews and questionnaires to collect data may give room for undue exaggeration by the respondents, and responses may be too value-laden, hence, future studies could adopt a more scientific method by comparing past and present events and their impacts to have a more scientific based understanding of the effects of community-based initiatives on climate change adaptation.

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