COMMUNITY ENGAGEMENT INITIATIVES AND PERCEPTION OF FLOOD RISKS AMONG RESIDENTS IN COASTAL COMMUNITIES IN CALABAR SOUTH, CROSS RIVER STATE, NIGERIA

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ABSTRACT
This study examined the relationship between community engagement initiatives and residents' perceptions of flood risks in Calabar South LGA, Cross River State, Nigeria. The study adopted a quantitative research approach, utilizing a cross-sectional survey design to gather data from a representative sample of coastal communities in Calabar South. The non-experimental nature of the study allowed for the collection of data on both nominal and ordinal scales, with socio-economic characteristics measured on the ordinal scale. Primary data were gathered using a structured questionnaire and direct field observations, while secondary data were sourced from national population records, community flood reports, and satellite imagery. The sampling strategy involved a multistage approach, where three flood-prone communities—Jebs/Ibesikpo Axis, Anantigha, and Eneobong Avenue—were purposively selected. The systematic random sampling technique was used to obtain data from households, with a total sample size of 585. Data analysis was conducted using canonical correlation analysis (CCA) to test the relationship between community engagement and residents' flood risk perception. The results indicated a strong positive relationship, with the first canonical correlation coefficient of 0.96115, explaining 98.7 per cent of the variance. The findings highlight that higher community engagement is associated with reduced concern about flood risks, aligning with contemporary literature on community-based disaster risk reduction. The study emphasized the importance of incorporating community engagement in flood risk management strategies. The findings further support global frameworks like the Paris Agreement and the Sendai Framework, advocating for participatory approaches to disaster resilience. The results provided valuable insights for policymakers to enhance flood risk management by fostering collaboration between local authorities, NGOs, and communities.

KEYWORDS: *Community Engagement Initiatives, Perception of Flood Risks, Coastal Communities of Calabar South, Cross River State, Flood Disaster Management*.

1. INTRODUCTION

Flooding is the most frequent natural disaster globally, exacerbated by climate change, which has impacted several water-related variables that increase flood risks. These risks threaten ecosystems, infrastructure, and human lives (Intergovernmental Panel on Climate Change, IPCC, 2022). Effective flood risk management has been practiced for decades, yet challenges remain in engaging local communities in flood mitigation efforts. Sustainable Development Goal 6 (SDG6)

emphasizes the need for community participation in water and sanitation management (Binns, 2022), but implementing these goals is often difficult (Makarigakis & Jimenez-Cisneros, 2019; Njoku, Efiong & Ayara, 2020). Flood risk management requires a comprehensive understanding of flood consequences and the development of strategies to minimize them (Lechowska, 2018). Central to this approach is resilience and adaptive capacity, which reduces the negative impact of flooding by enhancing communities' abilities to cope and adjust to future flood events (McClymont, Morrison, Beevers & Carmen, 2020).

Meanwhile, community engagement is recognized as essential in enhancing flood risk management, contributing significantly to community preparedness and resilience. Ryan, Johnston, Taylor, and McAndrew (2020) assert that community engagement improves risk perception and awareness, enabling tailored risk management approaches. Adame (2018) highlights that local knowledge can be invaluable in crafting context-specific solutions, provided mechanisms for integrating such knowledge into formal decision-making structures exist (Nowotny, 2003). Community engagement is also credited with promoting transparency and equitable decision-making, ensuring that local voices shape risk management strategies (Lawton & Macaulay, 2014; Agrawal, 1995).

Ryan, Johnston, Taylor and McAndrew (2020) conducted a systematic review of community engagement techniques in hazard preparedness, revealing that most approaches—particularly face-to-face communication—enhanced preparedness. The study emphasizes the importance of combining multiple engagement methods to effectively change behaviour and foster community-led preparedness efforts.

In New Zealand, Auliagisni, Wilkinson, and Elkharboutly (2022) examined how communities build resilience in flood-prone areas. They found that settlements close to rivers were particularly vulnerable, and the study recommended community-led response plans integrated with infrastructure improvements to mitigate flood risks.

In Nigeria, Berezi and Nwankwoala (2022) assessed community resilience and coping strategies in Bayelsa State. Their study revealed that flooding is a recurring problem, with most communities experiencing moderate to high vulnerability. They recommended periodic flood assessments and improved preparedness strategies to mitigate future flood risks.

Similarly, Obi, Nwachukwu, Okeke and Jiburum (2021) examined indigenous flood control knowledge in Nigerian coastal communities, finding that local methods were 61.2 per cent effective in reducing flood risks. They advocated for integrating indigenous knowledge with modern flood management strategies to develop sustainable flood risk reduction approaches. These studies collectively emphasized the importance of community engagement in enhancing flood resilience and managing flood risks.

In Calabar South Local Government Area of Cross River State, some regions are naturally prone to flooding, while others suffer due to unplanned development. Houses built on floodplains, valleys, and water channels, driven by the need to accommodate the growing urban population, are particularly vulnerable (Efiong, Efiong, Akintoye, Inah, Awan & Ogban, 2024). Flooding in these areas results in significant economic losses, including damage to property, infrastructure, livelihoods, and public health (Ekpoh, 2014).

Despite the well-documented flood hazards in this coastal area, there is limited research on the preparedness and resilience of the affected communities in Calabar South. Most studies have focused on the causes of urban flooding (Eze, 2008; Okon, Ogba, Idoko, Eni & Sule, 2015; Efiong & Uzoezie, 2017) or its socio-economic impacts (Ekpoh, 2014),

neglecting the specific vulnerabilities and capacities of coastal communities to adapt, manage, and recover from flood events. The absence of detailed assessments on these communities' resources, readiness, and coping mechanisms limits effective interventions by government and other agencies.

This study addresses these gaps by examining the relationship between community engagement initiatives and residents' perceptions of flood risks in Calabar South.

2. MATERIAL AND METHODS

2.1 Study area description

Calabar South Local Government Area lies between longitude 8^0 18` and $8^0$ 21` East of the Greenwich Meridian and latitude 4^0 53` and $4^0$ 58` North of the Equator (Figure 1). It is generally a low land on an average of 64 metres above sea level. It is a cosmopolitan urban area. It is bounded to the North by Calabar Municipality, to the South and East by the Great Qua River and to the West by the Calabar River. It has a landmass of 264km^2 (approximately). Much runoff during rainy season is emptied into Calabar South from the neighbouring Calabar Municipality and its areas with relatively higher elevations.

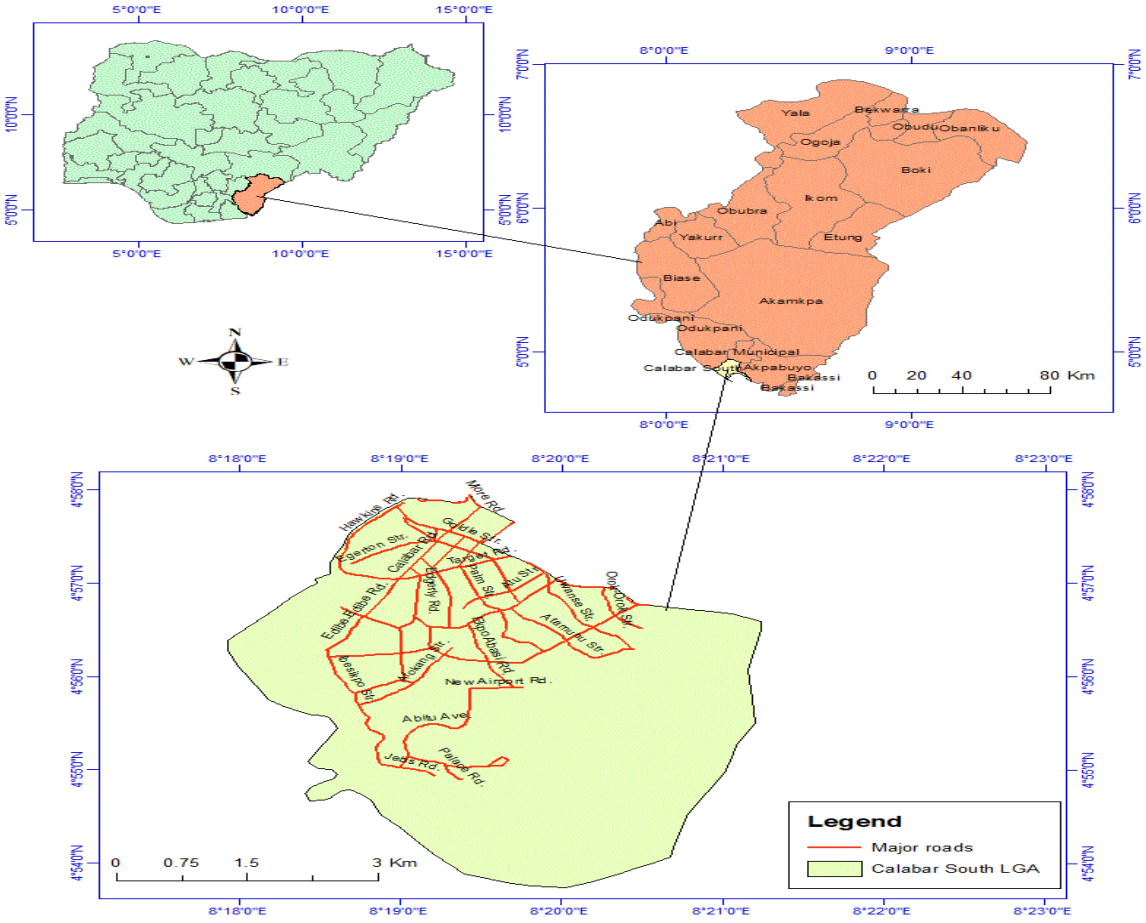

Figure 1. Calabar South Local Government Area

Source: GIS Laboratory, Department of Geography and Environmental Science, University of Calabar, 2024.

Calabar South has a lengthy wet season spanning 8-9 months (March to November) and a short dry season covering the remaining part of the year. Temperature is relatively constant throughout the year, with average high temperature usually ranging from 25 to 28 degrees Celsius. Harmattan, which significantly influences weather in West Africa, is noticeably less pronounced in the area.

The area is characterized by double maxima rainfall pattern in which two high rainfall peaks occur within the year, typical of the southern region of Nigeria. Precipitation is lowest in January with an average of 50mm/2.0 inch and highest precipitation in July with average of 434mm/17.1 inch. The high rainfall characteristics of the study area would worsen the coastal flood vulnerability in event of a possible future sea level rise due to any factor (Efiong & Ushie, 2019).

2.2 Research Design

The quantitative research approach was adopted in this study. Basically, the cross-sectional survey design involving the collection of data from a cross-section of the study population (sample) was adopted. This allowed for every collection and analysis of data within the time frame of the study in line with the study's specific objectives. The study was also non-experimental.

Data for the study were obtained from both primary and secondary sources. Primary sources of data consisted of those sources in which the researcher obtained data that relates with the study directly by himself or trained assistant. Such sources included the structured questionnaire and direct field observation. Secondary sources of data for this study included records of the National Population Commission, (NPC), Community records of flood disaster incidents and any other published and unpublished documents. Satellite images and maps (hard and soft copies) also served as secondary sources of data for the study.

2.3 Sampling

Four main aspects of sampling were considered in this study. They included the determination of the population of study, sample size or fraction, sampling frame and sampling techniques. The population of study consisted of all residential houses in the selected study area. Three (3) communities were purposively selected from all the coastal communities in Calabar South for study. This was done to ensure that the study is carried in areas that are regularly affected by floods. These areas included Jebs/Ibesikpo Axis, Anantigha and Eneobong Avenue. The distribution of samples in the study are shown in Table 1

Table 1: Distribution of samples in the study

Location	Total Number of buildings	Minimum Sample
Jebs/Ibesikpo (A)	386	186
Anantigha (B)	511	242
Eneobong Avenue (C)	326	155
Total	**1233**	**585**

Source: Author's compilation (2023).

The areas are demarcated in the Google Earth Maps shown in Figure 2.

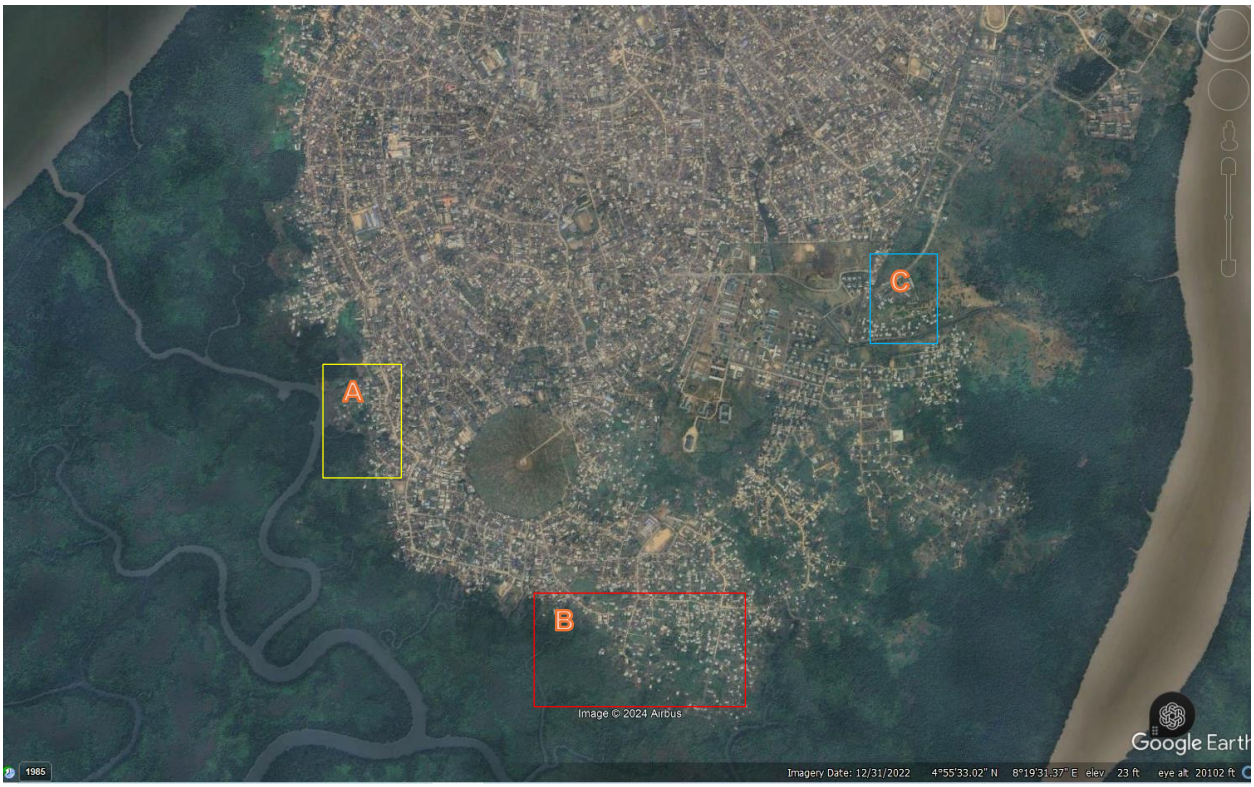

Figure 2. Google Earth map of Calabar South

2.4 Sampling techniques

The multistage sampling technique was adopted in this study. First, the purposive sampling technique was used to select the coastal communities in Calabar South Local Government Area for the study as indicated earlier. All the buildings in each of the selected communities were numbered from 1 to the last number in an orderly and systematic manner (NPC Field Officers' Manual, 2023). The list of these buildings constituted the sampling frame of the study. The systematic sampling technique was then adopted in selecting the actual buildings for sampling. For Jebs/Ibesikpo Community, the sampling interval was every other building. The simple random sampling technique was used to determine the first point of sampling between the first two buildings to avoid bias. The same approach was adopted for the other two communities.

2.5 Method of Data Collection

Data for this study were collected primarily using a structured questionnaire. The questionnaire consisted of five (5) main sections. Section 1 obtained data on the socio-economic and demographic attributes of respondents/household. Section 3 obtained data on community engagement. The questionnaire was administered face-to-face to ensure a high return rate. The administration of the questionnaire was done in the month of September 2024 during the peak of the rainy season. Most of the data obtained were on the nominal and ordinal scales.

2.6 Hypotheses testing

It was hypothesized thus:

H_o: Community engagement initiatives do not have significant relationship with the perception of flood risks among residents in coastal communities of Calabar South LGA.

H_1: Community engagement initiatives have significant relationship with the perception of flood risks among residents in coastal communities of Calabar South LGA.

Canonical correlation was used to analyze the data and test this hypothesis. Canonical is the statistical term for analyzing latent variables (which are not directly observed) that represent multiple variables (which are directly observed). It is basically an analysis of multiple-X multiple-Y correlation. The canonical correlation coefficient measures the strength of association between two canonical variates.

The x and y canonical correlation analysis constructs are given as:

$$CV_{X1} = a_1x_1 + a_2x_2 + a_3x_3 + \ldots + a_nx_n \quad \text{eqn. 1}$$

$$CV_{Y1} = b_1y_1 + b_2y_2 + b_3y_3 + \ldots + b_my_m \quad \text{eqn. 2}$$

where;

x_1 = Participation in community meetings or forums

x_2 = Extent of involvement in local decision-making processes regarding flood management

x_3 = Frequency of community's organize engagement activities related to flood awareness

y_1 = Level of concern about the risk of flooding

y_2 = Perception of flood risk changed due to community's engagement activities

y_3 = Informed level on the measures to reduce flood impact in your community

y_4 = Confidence on community's ability to respond effectively to a flood

The canonical weights $a_1 \ldots a_n$, and $b_1 \ldots b_n$ are chosen in such a way that they maximize the correlation between the canonical variates CV_{X1} and CV_{Y1}.

3. RESULTS

3.1 Socio-economic characteristics of respondents

Table 2 presents data on age distribution of respondents across the three study locations (Jebs/Ibesikpo, Anangtigha and Eneobong Avenue). Cumulatively, majority of respondents (44.1 per cent) were in the age bracket of 35 – 44 years. This was followed by those in the range of 25 – 34 years (28.0 per cent) and then 12.5 per cent for those within the age bracket of 55 - 64 years. Respondents 65 years and above constituted the least in the sample with just 1.0 per cent those in the 18 – 24 years were only 9.7 per cent of the sample. There were no respondents below 18 years in the sample.

TABLE 2: Age distribution of respondents

Age Group (Years)		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
< 18	Count	0	0	0	0
	% of Total	0	0	0	0
18-24	Count	11	28	18	57
	% of Total	1.9	4.8	3.1	9.7
25-34	Count	58	70	41	169
	% of Total	9.9	12.0	7.0	28.9
35-44	Count	85	101	72	258
	%of Total	14.5	17.3	12.3	44.1
45-54	Count	21	34	18	73
	%of Total	3.6	5.8	3.1	12.5
55-64	Count	10	9	3	22
	% of Total	1.7	1.5	0.5	3.8
65 and above	Count	1	3	2	6
	% of Total	0.2	0.5	0.3	1.0
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

The distribution of gender in the sample is found in Table 3. Here, 65.1 per cent of the sample were males while the remaining 34.9 per cent were female. Hence, there were more males than females in the study sample.

TABLE 3: Gender distribution of respondents

Gender		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Male	Count	122	150	109	381
	% of Total	20.9	25.6	18.6	65.1
Female	Count	64	95	45	204
	% of Total	10.9	16.2	7.7	34.9
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

Educational level completed by respondents are distributed in Table 4. Here, only 0.5 per cent of respondents reported "No schooling completed. This was only recorded in Eneobong Avenue area. Secondary education with 41.09 has the highest number of respondents. This was followed by those who had completed undergraduate education (31.1 per cent) and then those with primary education (24.1 per cent). Respondents with postgraduate education made up the remaining 3.2 per cent.

On employment status (Table 5), 6.8 per cent respondents were not employed, 25.3 per cent claimed they were students, 22.4 per cent were employed in manual labour while 16.9 per cent were in non-manual labour. Those who were self-employed constituted 25.5 per cent while retirees made up 1.2 per cent respondents in other categories of employment made up the remaining 1.9 per cent. It can be seen from the table that majority of respondents were in one kind of employment or the other. Only very few were unemployed. It also appears that even students who completed the questionnaire did so on behalf of their parents and were not consistent in their responses.

TABLE 4: Educational level

		Location			
Education Level		Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
No schooling completed	Count	0	0	3	3
	% of Total	0.0	0.0	0.5	0.5
Primary Education	Count	44	72	25	141
	% of Total	7.5	12.3	4.3	24.1
Secondary education	Count	73	97	70	240
	% of Total	12.5	16.6	12.0	41.0
Undergraduate education	Count	65	66	51	182
	% of Total	11.1	11.3	8.7	31.1
Postgraduate education	Count	4	10	5	19
	% of Total	0.7	1.7	0.9	3.2
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

TABLE 5: Employment status

Employment status		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Unemployed	Count	8	20	12	40
	%% of Total	1.4	3.4	2.1	6.8
Student	Count	52	60	36	148
	% of Total	8.9	10.3	6.2	25.3
Employed (manual labour)	Count	46	51	34	131
	% of Total	7.9	8.7	5.8	22.4
Employed (non-manual labour)	Count	33	39	27	99
	% of Total	5.6	6.7	4.6	16.9
Self-employed	Count	37	70	42	149
	% of Total	6.3	12.0	7.2	25.5
Retired	Count	7	0	0	7
	% of Total	1.2	0.0	0.0	1.2
Other	Count	3	5	3	11
	% of Total	0.5	0.9	0.5	1.9
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024).

3.2 Community Engagement Initiatives

Table 6 presents data on respondents' participation in community meetings or forums on flood risk and preparedness. It shows that 35.7 per cent of the sample never participated while only 30.3 per cent rarely participated. Table 6 further reveals that only 22.2 per cent of the sample participated. Sometimes, 10.3 per cent, often participated while only 1.5 per cent always participated. This shows a clear lack of interest in flood risk and emergency preparation by majority of respondents.

TABLE 6: Participation in community meetings or forums

Participation in community meetings or forums		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Never	Count	71	86	52	209
	% of Total	12.1	14.7	8.9	35.7
Rarely	Count	60	71	46	177
	% of Total	10.3	12.1	7.9	30.3
Sometimes	Count	42	52	36	130
	% of Total	7.2	8.9	6.2	22.2

Often	Count	10	31	19	60
	% of Total	1.7	5.3	3.2	10.3
Always	Count	3	5	1	9
	% of Total	0.5	0.9	0.2	1.5
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024).

Table 7 shows data on involvement in local decision-making processes regarding flood management in the study area. Like table 10, the result reveals that 43.1 per cent of the sample did not get involved while Participation in Community meetings or forums about flood risk and preparedness,19.3 per cent were slightly involved. Also 18.8 per cent, 16.9 per cent and 1.9 per cent were either 'moderately involved', very involved or 'extremely involved' respectively.

Table 8 shows data on the frequency of community engagement activities related to flood awareness in a year. The table reveals that 26.5 per cent of respondents did not engage in community activities related to flood awareness, 30.1 per cent did so, but rarely (only once) while 27.7 per cent were engaged sometimes (2-3times). The table further reveals that 14.0 per cent were engaged often (4-5 times) while 1.7 per cent did so always (> 5 times in a year).

TABLE 7: Extent of involvement in local decision-making processes regarding flood management

Extent of involvement in local decision-making processes regarding flood management		Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	
Not involved	Count	84	105	63	252
	% of Total	14.4	17.9	10.8	43.1
Slightly involved	Count	40	42	31	113
	% of Total	6.8	7.2	5.3	19.3
Moderately involved	Count	32	48	30	110
	% of Total	5.5	8.2	5.1	18.8
Very involved	Count	27	45	27	99
	% of Total	4.6	7.7	4.6	16.9
Extremely involved	Count	3	5	3	11
	% of Total	0.5	0.9	0.5	1.9
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

TABLE 8: Frequency of community's organize engagement activities related to flood awareness

Frequency of community's organize engagement activities related to flood awareness		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Never	Count	52	65	38	155
	% of Total	8.9	11.1	6.5	26.5
Rarely	Count	60	70	46	176
	% of Total	10.3	12.0	7.9	30.1
Sometimes	Count	50	63	49	162
	% of Total	8.5	10.8	8.4	27.7
Often	Count	21	42	19	82
	% of Total	3.6	7.2	3.2	14.0
Always	Count	3	5	2	10
	% of Total	0.5	0.9	0.3	1.7
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

Table 9 presents data on level of concern about risk of flooding in the study area. About 4 per cent of respondents were not concerned at all, 26.7 per cent were slightly concerned and 37.3 per cent were moderately concerned. Further, 20.7 percent were very concerned and 11.3 per cent were extremely concerned. The results shows that a great majority of respondents were concerned about the risk of flooding in the study.

TABLE 9: Level of concern about the risk of flooding

Level of concern about the risk of flooding		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Not concerned at all	Count	8	10	6	24
	% of Total	1.4	1.7	1.0	4.1
Slightly concerned	Count	52	65	39	156
	% of Total	8.9	11.1	6.7	26.7
Moderately concerned	Count	75	85	58	218
	% of Total	12.8	14.5	9.9	37.3
Very concerned	Count	33	55	33	121
	% of Total	5.6	9.4	5.6	20.7
Extremely concerned	Count	18	30	18	66
	% of Total	3.1	5.1	3.1	11.3
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

3.3 Perception of Flood Risk

Table 10 reveals data on perception of flood risk arising four community engagement activities. From the table, 34.0 per cent of respondents perceived that no change arising from community engagement activities. However, about 25 per cent perceived a change in the positive (decreased flooding) while about 41 per cent perceived change in the negative (increased flooding).

TABLE 10: Perception of flood risk changed due to community engagement activities

Perception of flood risk changed due to community engagement activities		Location: Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Significant decreased	Count	4	5	3	12
	% of Total	0.7	0.9	0.5	2.1
Somewhat decreased	Count	44	55	33	132
	% of Total	7.5	9.4	5.6	22.6
No change	Count	68	79	52	199
	% of Total	11.6	13.5	8.9	34.0
Somewhat increased	Count	52	76	48	176
	% of Total	8.9	13.0	8.2	30.1
Significantly increased	Count	18	30	18	66
	% of Total	3.1	5.1	3.1	11.3
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

Table 11 records data on how informed respondents were on measures to reduce flood impact in the community. The table reveals that 10.3 per cent of the sample were not informed at all, 39.0 per cent were slightly informed while 24.4 per cent were moderately informed. It is also evident that another 24.4 per cent of the sample were very informed while 1.9 per cent were "extremely informed".

Table 12 presents data on respondence confidence on the ability of the community to respond to flood hazard effectively. The table reveals that 16.4 per cent of respondents are not confident at all, 42.2 are slightly confident while 16.9 per cent are moderately confident. Also, 16.9 per cent are very confident while 7.5 per cent are extremely confident.

From the above, it was proposed that a significant relationship exists between community engagement initiatives and perception of flood risks among residents in coastal communities of Calabar South Local Government Area, hence, hypothesis which states that:

TABLE 11: Informed level on the measures to reduce flood impact in your community

Informed level on the measures to reduce flood impact in your community		Location			
		Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Not informed at all	Count	20	25	15	60
	% of Total	3.4	4.3	2.6	10.3
Slightly informed	Count	76	94	58	228
	% of Total	13.0	16.1	9.9	39.0
Moderately informed	Count	48	56	39	143
	% of Total	8.2	9.6	6.7	24.4
Very informed	Count	39	65	39	143
	% of Total	6.7	11.1	6.7	24.4
Extremely informed	Count	3	5	3	11
	% of Total	0.5	0.9	0.5	1.9
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

TABLE 12: Confidence on community's ability to respond effectively to a flood

Confidence on community's ability to respond effectively to a flood		Location			
		Jebs/ Ibesikpo Area	Anantigha Area	Eneobong Avenue Area	Total
Not confident at all	Count	32	40	24	96
	% of Total	5.5	6.8	4.1	16.4
Slightly confident	Count	84	99	64	247
	% of Total	14.4	16.9	10.9	42.2
Moderately confident	Count	31	41	27	99
	% of Total	5.3	7.0	4.6	16.9
Very confident	Count	27	45	27	99
	% of Total	4.6	7.7	4.6	16.9
Extremely confident	Count	12	20	12	44
	% of Total	2.1	3.4	2.1	7.5
Total	Count	186	245	154	585
	% of Total	31.8	41.9	26.3	100.0

Source: Author's fieldwork (2024)

3.4 Data Analysis

It was hypothesized that: Community engagement initiatives does not have significant relationship with the perception of flood risks among residents in coastal communities of Calabar South LGA.

Tables 13 and 14 present matrices of correlations among variables X and Y respectively. Table 15 is the matrix on intercorrelations between X and Y variable sets. There is a high intercorrelations between the variables of the two data sets.

TABLE 13: Matrix of correlations among the X variable sets

Variable	X_1	X_2	X_3
X_1	1		
X_2	0.507	1	
X_3	0.647	0.883	1

Source: Author's statistical analysis (2024)

TABLE 14: Matrix of correlations among the Y variable sets

Variable	Y_1	Y_2	Y_3	Y_4
Y_1	1			
Y_2	0.931	1		
Y_3	0.887	0.879	1	
Y_4	0.904	0.921	0.919	1

Source: Author's statistical analysis (2024)

TABLE 15: Matrix on intercorrelations between X and Y variable sets

Variable	X_1	X_2	X_3
Y_1	0.528	0.886	0.881
Y_2	0.602	0.882	0.913
Y_3	0.567	0.912	0.891
Y_4	0.526	0.914	0.900

Source: Author's statistical analysis (2024)

Table 16 shows the result of the analysis of variance for the canonical test. The output starts with a sample description and then shows the general fit of the model reporting Pillai's, Helling's, Wilk's and Roy's multivariate criteria. The commonly used test is Wilk's lambda. For the present study, all the tests were found to be significant ($p < 0.5$) (Table 16).

Table 16: Analysis of variance for the canonical test

Test Name	**Value**	**Approx. F**	**Hypoth. DF**	**Error DF**	**Sig. of F**
Pillais	1.06759	80.10788	12.00	1740.00	.000
Hotellings	12.28370	590.30000	12.00	1730.00	.000
Wilks	.06548	229.68760	12.00	1529.54	.000
Roys	.92380				

Source: Author's statistical analysis (2024)

Table 17 presents the canonical correlation coefficients and the eigenvalues of the canonical roots. The first canonical correlation coefficient is 0.96115 with an explained variance of the correlation of 98.70 per cent and an eigenvalue of 12.12364. (Table 17). This indicates that the hypothesis is correct. Hence, community engagement initiatives and perception of flood risks among residents in coastal communities of Calabar South LGA are positively correlated.

TABLE 17: Eigenvalues and canonical correlations

Root No.	Eigenvalue	Pct.	Cum. Pct	Canon Cor	Sq. Cor
1	12.12362	98.69681	98.69681	0.96115	0.92380
2	0.13278	1.08091	99.77771	0.34236	0.11721
3	0.02731	0.22229	100.00000	0.16303	0.02658

Source: Author's statistical analysis (2024)

Thus far, the output only showed overall model fit. The next result is test of the significance of each of the roots. A maximum of 3 canonical variates were extracted in the analysis. It was observed that the three possible roots were significant at p <.05. Since the model contains the three variables of community engagement (participation in community meetings, involvement in local decision making and frequency of community engagement activities) and four flood perception risk variables (level of concern about flood risk, perception of flood risk change, informed state on measures to reduce flood impact and confidence on community's ability to resilience to flood) extracts three canonical roots or dimensions. The first test of significance tested all three canonical roots of significance (F=229.68760 p <.05), the second text excluded the first root and tested roots two to three (F = 15.19913, p <0.05) and the last test tested root three by itself (F = 7.91845, p <0.05). In this study, all the roots are significant p <.05 (Table 18).

TABLE 18: Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.06548	229.68760	12.00	1529.54	0.000
2 TO 3	.85932	15.19913	6.00	1158.00	0.000
3 TO 3	.97342	7.91845	2.00	580.00	0.000

Source: Author's statistical analysis (2024).

Tables 19a and b presents results of standardized correlation for the independent and dependent variables respectively. From the results presented, these canonical weights cannot be accurately interpreted because they do not represent the correlations between the original variables and the canonical variates extracted. The canonical structure loadings were however considered for interpretation.

Tables 20a and b present results for the canonical structure matrix (loadings) for the independent and dependent variables. The cut-off mark of 0.5 (Arimah, (1990) was adopted for the interpretation of canonical loadings in this study. Hence, all variables in the first data set in Table 20a load highly on the first canonical variate in the second data set (Table 20b). The implication is that the first canonical variate reveals that the predicted "level of concern about the risk of flooding" (y_1) which had a canonical loading of 0.947 was negatively related to community engagement initiatives from the following points: the 'participation in community meetings or forums' (x_1), 'extent of involvement in local decision making' (x_2) and 'frequency of community's organize engagement activities related to flood awareness' (x_3). All this community engagement initiatives measures had canonical loadings of 0.5 and above.

TABLE 19a: Standardized Canonical Correlation Coefficients for independent variables

Variable	1	2	3
Participation in community meetings or forums	-.026	-.890	-.994
Extent of involvement in local decision making	-.536	1.281	-1.658
Frequency of community's organize engagement activities related to flood awareness	-.479	-.727	2.286

Source: Author's statistical analysis (2024)

TABLE 19b: Standardized Canonical Correlation Coefficients for dependent variables

Variable	1	2	3
Level of concern about the risk of flooding	-.098	1.478	.599
Perception of flood risk changed due to community engagement activities	-.300	-3.071	.592
Informed level on the measures to reduce flood impact in your community	-.382	-.412	-2.624
Confidence on community's ability to respond effectively to a flood	-.256	2.011	1.442

Source: Author's statistical analysis (2024)

TABLE 20a: Canonical structure matrix (loadings) for the independent variables

Variable	1	2	3
Participation in community meetings or forums	-.607	-.712	-.353
Extent of involvement in local decision making	-.972	.189	-.143
Frequency of community's organize engagement activities related to flood awareness	-.968	-.173	.180

Source: Author's statistical analysis (2024)

TABLE 20b: Canonical structure matrix (loadings) for the dependent variables

Variable	**1**	**2**	**3**
Level of concern about the risk of flooding	-.947	.072	.127
Perception of flood risk changed due to community engagement activities	-.963	-.205	.172
Informed level on the measures to reduce flood impact in your community	-.968	.048	-.248
Confidence on community's ability to respond effectively to a flood	-.972	.141	.119

Source: Author's statistical analysis (2024)

This canonical variate also reveals a linkage between 'perception of flood risk changed due to community engagement activities' (y_2) with a canonical loading of 0.093 on one hand and the various community engagement initiative measures on the other hand. This was also the case of y_3 and y_4.

From Table 20a and b, the second and third pairs of the canonical variates do not reveal any clear-cut pattern of relationships. This is because the loadings of these two variates across the variables are too low (< 0.5) standard that was set for the interpretation of the loadings. Hence, it was not possible to establish any meaningful linkages between the

canonical loadings of the second and third variates for both the dependent and independent variables.

4. DISCUSSION AND IMPLICATIONS FOR POLICY AND PRACTICE

The aim of this study was to investigate the relationship between community engagement initiatives and perception of flood risk among residents in the coastal communities of Calabar South, Cross River State, Nigeria. The canonical correlation analysis (CCA) results shed light on the relationship between community engagement initiatives and flood risk perception in the coastal communities of Calabar South Local Government Area (LGA). These findings align with contemporary literature on community-based disaster risk reduction (CBDRR), which highlights the significance of active community participation in disaster preparedness and risk mitigation (Ahrens & Rudolph, 2021; Lassa, Suryowati & Nurhidayati, 2020).

The multivariate test results, as shown in Table 16, including Pillai's, Hotelling's, Wilk's Lambda, and Roy's tests, all exhibit significance. The Wilk's Lambda value of 0.06548, with an associated F-statistic of 229.68760 and a p-value < 0.05, indicates that the model is statistically significant. The low Wilk's Lambda value suggests that the model explains a significant portion of the variance in the relationships between community engagement variables and perceptions of flood risk. This is consistent with recent studies that demonstrate how community engagement can influence perceptions of disaster risks, leading to better risk awareness and preparedness (Mavhura, 2020; Cutter, 2021).

The first canonical correlation coefficient (0.96115) explains 98.70 per cent of the variance (Table 17), with a high eigenvalue of 12.12362, indicating a strong positive relationship between community engagement and residents' perception of flood risk. This finding is aligned with research demonstrating that active community participation in risk management processes leads to heightened awareness of local hazards and improved flood resilience (Lopez, Jansen & Duyne, J2021; Campbell, Devereux & Koch, 2019). Communities that are more engaged tend to have a greater understanding of flood risks, enabling more informed decision-making in both emergency response and long-term disaster preparedness.

The dimension reduction analysis (Table 18) shows that all three canonical roots are statistically significant. The statistical significance of these roots reinforces the idea that flood risk perception is multidimensional and influenced by a combination of engagement factors such as participation in decision-making, meeting attendance, and active involvement in community programs (Amaratunga & Haigh, 2021). These findings are consistent with studies that highlight the complexity of disaster risk perceptions, shaped by social, cultural, and environmental factors (Wachinger et al., 2018).

The canonical loadings (Tables 19a, 19b, 20a, and 20b) show strong associations between community engagement and reduced concerns about flood risk. The negative loadings for participation in community meetings (-0.607), involvement in local decision-making (-0.972), and frequency of engagement activities (-0.968) suggest that higher levels of engagement correspond to lower levels of concern about flood risks. This outcome aligns with findings from several recent studies, which have demonstrated that active involvement in disaster risk reduction initiatives builds trust and resilience within communities, thereby reducing anxiety or fear associated with potential disasters (Gaillard &

Mercer, 2020; Koerth, Vafeidis & Hinkel, 2021).

The "level of concern about flood risk" (y_1) with a loading of -0.947 underscores the fact that communities that are actively engaged in risk management strategies feel more confident and better prepared to face flooding events. Recent research supports this, showing that community-based disaster preparedness programs foster a sense of security and reduce perceived vulnerability to hazards (Doyle, Becker & Johnston, 2021). The absence of a clear pattern in the second and third canonical variates may suggest that the most critical aspects of engagement influencing flood risk perceptions are captured in the first canonical root, as is often the case in canonical correlation analyses (Schönfelder & Bogner, 2021).

The findings underscore the importance of prioritizing community engagement in flood risk management strategies. Recent policies and frameworks, such as the United Nations' Global Assessment Report on Disaster Risk Reduction (United Nations Disaster Risk Reduction (UNDRR), 2023), emphasize the crucial role of local communities in disaster resilience. Strengthening participatory processes, such as encouraging community involvement in local decision-making and risk assessment activities, can empower residents to take proactive steps in mitigating flood risks.

Moreover, integrating community engagement into flood risk management frameworks aligns with the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR, 2023). These global initiatives stress the importance of inclusive and participatory approaches to building disaster resilience, particularly in vulnerable communities.

Flood risk management policies in regions such as Calabar South LGA should continue to focus on empowering local communities by fostering collaboration between local authorities, NGOs, and residents. This collaborative approach not only increases flood awareness but also strengthens the overall capacity of communities to respond effectively to disasters, as highlighted in recent disaster management literature (Few, Scott & Wooster, 2020; Taylor, Campbell, & Aunger, 2022).

5. CONCLUSION

The canonical correlation analysis reveals a significant relationship between community engagement and flood risk perception in the coastal communities of Calabar South LGA. The strong canonical correlation coefficient and significant canonical roots confirm that community involvement plays a crucial role in shaping residents' awareness and preparedness for flood risks. These findings reinforce the argument that community-based approaches to disaster risk reduction are vital in improving resilience to floods and reducing the overall level of concern about potential risks. The results align with recent research that emphasizes the importance of fostering community engagement as a cornerstone of sustainable flood risk management strategies.

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