

Assessing Disaster Management Infrastructure and Strategies in South Eastern Nigeria

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Abstract Natural disasters have continued to attract attention due to increased human, economic and environmental consequences. The study assessed the effects of disasters and the effectiveness of the response infrastructure in communities of South Eastern Nigeria. The questionnaire survey, participatory research method and field measurements were used to generate data from purposively sampled locations in the region. The data were analysed using descriptive and analytical techniques. The result showed that flooding, landslide and windstorm ranked as the most common disasters affecting the area. These disasters have significantly resulted in food scarcity (food insecurity) and property loss, representing 26% and 25% of the study population. Furthermore, the study reveals several infrastructures as mitigation measures, including financial donations, reconstruction of damaged buildings, bridges, provisions of household materials, and food, among others. The One-way Analysis Variance (ANOVA) results showed a significant difference in the effectiveness of stakeholder involvement in natural disaster mitigation (F-value of 7.737, > the table value of 2.17 at a 0.05 level of significance). This analysis implies that the activities of government, communities, and donor agencies were rated differently in terms of their overall performances in infrastructure provision to disaster-affected areas and people. It was recommended that disaster management education, early warning signs and participatory disaster management response be

practised in South Eastern Nigeria.

Keywords Disaster, Management, Consequences, Stakeholders, Participation

1. Introduction

The occurrence of natural disasters has become frequent and a worldwide phenomenon with devastating consequences. This has posed the challenge of ensuring sustainable livelihood and has affected all segments of our societal structure. Nigeria's approach to catastrophe risk management is heavily reliant on the government. Therefore, the current situation is disturbing at all levels of government as they work to improve the elasticity of mitigating disasters while struggling with the flaw of their capability [1,2]. However, the government appropriates resources in management, but significant challenges and service gaps still exist, and government measures can be besieged [2,3]. As a result of this, the scale and the extent of disasters are expanding and will almost certainly put the entire world under pressure. The increased changes in technology and population are making the consequences associated with disasters more complex to control and manage.

In furtherance of the above, [1,3] noted that one prospect

requesting urgent needs stemmed from disaster. The increasing population transfer into windstorm and flood-prone areas has aggravated the impact of the disaster. The economic growth and development shifts put further strain on blockade islands, coastal floodplains, ecological systems that sustain the tourism and hospitality sector, suburban housing development, and food production. Studies by [1,2,3] further revealed that other demographic changes that affect disaster management efforts increase the number of persons with disabilities living in communities rather than institutions and those living with chronic diseases such as asthma and obesity.

Nonetheless, most human interaction with living creatures, nature and technological tools has led to disasters. Disasters can strike quickly, unexpectedly, or slowly and steadily. Various forms of disasters have an ongoing impact on our daily lives. Humans, pioneering creatures, have explored novel ways to mitigate the devastation caused by natural disasters. For many years, man's response to disaster management has been rash and discouraging. Sometimes many communities and regions might be cognizant of the hazards they face and may likely not wait for a catastrophic event to occur before activating plans and measures. Social, human, and economic development has also led to defenselessness, diminishing man's ability and strength to cope with the rising calamities and their specific effects.

Studies conducted by [1,3,4] revealed that a disaster is an occurrence concentrated in space and time in which a community or one of its subcategories undergoes social disturbance and physical damage, whereby all or part of the society's or subdivision's necessary activities are disrupted. The necessity that an event is rigorous in space and time is critical in distinguishing between landslide deaths, which may number as low as fifty in minutes, and floods, which kill around 40,000 people in the United States of America each year.

Over the last two decades, disasters have risen from roughly 200 to over 400 annually. It seems inevitable that 9 out of 10 of these disasters were caused by climate change. Climate change forecasts suggested that these disasters would persist, and weather-related risk measures would become more prevalent and explosive. Increasing urbanisation and awareness of dangerous and deadly urban decay and exposing coastal zones, illness incidence, poor quality, and inadequate measures and attention to changing the patterns of risk positions many people in areas prone to disaster [1,2,4]. Never before has the issue of substantially lowering the impacts of disasters and making emergency preparedness a significant component of improving policies and programmes stated in the Hyogo Framework for Action 2005-2015 been more compelling or pressing. In the aftermath of the Asian Tsunami in 2005, over 168 governments pledged to implement Hyogo's Framework that seeks strategic goals, including incorporating disaster response into global sustainability planning and policies, to build institutions, instruments, and competence. Build

elasticity to risks and incorporate risk reduction-wise approaches into the preparedness, implementation and execution of emergency response and rehabilitation services [2,4].

Natural disasters are, therefore, a worldwide concern which impeded human growth, and the amount of disaster risk in a given community is related to the development preferences of that area [1,3,4]. The relationship existing between development and disaster has been well studied by researchers and recorded in the literature. The notion that most natural disasters influence growth and development and that as development increases, it reduces the risk of disasters is well acknowledged. Until recently, Nigeria has suffered devastating losses yearly, hampered progress and left most people's livelihoods in jeopardy [5]. For instance, the minister of humanitarian affairs, disaster management and social development in Nigeria, in a broadcast of the 2022 flood occurrence, asserted that despite concerted efforts to avert the consequences, the disaster was considered as overwhelming. Thus, the toll of lives lost and property damaged rose astronomically, with over 603 lives being lost, 1,302,589 persons displaced, 2,504,093 affected, and on the whole, 2,407 persons injured. Again, 82,053 houses were completely damaged, and 108 392 hectares of farmland were partially destroyed. In contrast, 332,327 hectares were destroyed, including many roads and other critical infrastructure. Instead of continuing the unsustainable natural disaster management loop, the country has long gone in designing multi-stakeholder disaster risk responses.

In tackling this disaster-related problem, the World Health Organization (WHO) based its strategic advocacy on prior calamities [5,6]. For instance, the reaction to Mozambique's floods in 2000, the worst in almost a century, was a huge success. News headlines heralded the helicopter rescue of a mother who gave birth while sheltering in a tree. The 45 000 lives rescued, mainly by local rather than foreign rescuers, have received less attention. More floods devastated Mozambique a year later, and local rescuers rescued over 7000 people. Additionally, due to the exceptional expertise in controlling the floods in 2000, the ones in 2001 had a negligible impact on the number of lives lost. In terms of preparation for a low-income nation, Mozambique well surpassed expectations [1,5,7]. Another well documented event is the 1997 storm that devastated the Cox's Bazaar district of southeast Bangladesh, displacing 1.5 million people, where about 127 individuals were killed by the typhoon [2,5,8]. If these scenarios continue unchecked, disasters will wreak havoc on the world, and in Nigeria in particular.

Over the past four years, South Eastern Nigeria has been seriously hit by many natural disasters, including windstorms and severe rains that caused floods and landslides. However, the National Emergency Management (NEMA) reported a flood disaster in South Eastern Nigeria as a hellish condition that has caused a devastating impact where over 500 people had died, 45,

249 houses were totally destroyed, 70,566 hectares of farmland were damaged etc. According to [5,9], this circumstance has led to psychological implications with an adaptive effect that will last long, like rapid changes in risk perception (beliefs about the possibility of a disaster occurring and its effects on the people) and more significant risk meddling (frequency of discussion and thought concerning hazard). These beliefs influenced residents' adoption of household exposure to changes and adjustments that lower their susceptibility to future disasters. On the other hand, the cognitive effects of disaster experiences on people do not seem to be large enough to modify household hazard adjustment programmes, policies, strategies, techniques, and plans. Although disaster management education is rarely considered, the director general of NEMA, in a press interview, reported that early warning signs from Nigerian Metrological Agency (NIMET) over the years, including 2022, have been given. Yet, people are yet to be prepared to face the occurrence of disasters. This is due to the expansion of the socio-economic activities along the waterways.

The rising frequency of most natural disaster occurrences is significantly connected with the constant threat to families and communities in most developing countries since earlier socio-economic weaknesses deficits may amplify the impact of natural disasters, hampering rehabilitation [4,6,7,9]. As a result, the consequences of such occurrences, an instant rise in deprivation and poverty, is observed [6,9,10]. Several academics have been somewhat contradicting. For example, [1,4,5] believed that natural disasters have a deleterious long-term impact on development and growth. While [2,3,6,8] assumed that such natural disasters may have a deleterious long-term impact on development and growth because there is a decrease in physical return capital but a rise in human capital, resulting in higher growth. Furthermore, [10,11] discovered that storms initially reduce the country's growth by 0.8% while rebounding by 0.2 % for the U.S. coastal areas. The authors also discovered that the effect of a damaging storm slows growth by 0.8% in Central America and the Caribbean. Similarly, [6,7,11] stated that various processes such as mitigation techniques, emergency preparation, support, and other factors should be considered to identify the effect of disasters. Nonetheless, [4,6] examined the consequences of tornadoes in the United States and discovered that the impact is not random in all situations since environmental, organisational, demographic, and technical variables all influence the impact of most natural disasters on the environment.

The aftermath of natural disaster occurrences may have created inequality, especially in rural areas. For example, [5,8,11] noted that poor people who face income volatility and have less access to financial services might be more likely to restrict spending and lessen shock in other household metrics. Again, there are many non-poor or near-poor. These people are uninsured against all those

dangers. They can likely fall into persistent poverty of recapitalising when dealing with the shock, based on the impact and possibility of falling into the poverty of the initial stock investments and coping strategies indicators.

Furthermore, natural disasters are becoming increasingly common as a phenomenon that we all perceive to directly influence the well-being of areas where they occur and particular household indicators in such locations. According to [6,8,9], landslides, windstorms, earthquakes, drought, floods, and other natural disasters may endanger lives, property, and productive assets and influence social indicators, destabilising the average stability of an area. Flood mortality in Europe averaged fewer than 250 per year throughout the 21st century, and between 1970 and 2006, the yearly flood damage in Europe had engulfed \$3.8 billion [5,11, 12]. Devastating floods, driven mainly by heavy rain, afflicted much of Europe in the first decade of the twenty-first century. The August 2002 overflow devastated five major countries (Germany, Czech Republic, Austria, Romania, and Hungary), resulting in about 55 fatalities and \$20 billion in material damage. After that, another severe flood in France killed almost 23 people and cost approximately \$1.2 billion in property damage [9,11,12].

In Nigeria, [5,9,11] catalogued significant disasters, including yearly epidemics such as cerebrospinal meningitis, cholera, ebola, and measles. They further stated that others include droughts in the Sudan-Sahel zone between 1982 and 1984, flood catastrophes in Ogunpa, Oyo state, in 1982 and the Bar Beach in Lagos state in 2001. Shiroro and Kaduna experienced it in 2003, while it was severe in Gombe and Jalingo in 2004 and 2005. The most important and terrible flood disaster in Nigerian history struck more than half of the country's states, particularly Cross River State, in 2012. Other disastrous calamities in Nigeria include dam collapse, erosion, oil leakage, communal clashes, landslides and fire.

These disasters posed a primary challenge to humanity today, particularly in the study area. The measures taken to mitigate them have emphasised society's readiness, the importance of insurance, improved planning policies, and collaboration with relevant institutions, like communities [9,11,13,14]. Such initiatives aim to create sustainable societies to provide the highest value for taxpayers and fairness to individuals who may face disaster threats. Should expenditures be focused on immediate post-disaster aid and relief packages, or should they be utilised to enhance flood adaptation, flood prevention, and landslide disaster preparedness [9]? According to [5,14,15], a landslide disaster damaged around 55 residential structures, including secondary school blocks, in Buanchor, Boki LGA of Cross River State due to four days of torrential rains. This might be due to a lack of suitable infrastructure and response tactics implemented by the government and non-governmental organisations, including the community assistance project.

Government roles in disaster mitigation strategies and

infrastructure interventions have been identified, especially in economic and technical factors. Studies employed social, economic and technical factors like labour losses, customer loss, industry interdependence, and infrastructure interdependence [16,17,18]. They also emphasised the significance of considering social and technological elements and economic variables like the monetary worth of the loss when analysing the various effects of disasters.

Communities' engagements are recognised as a primary component in natural disaster management to counteract the global trend of an exponential rise in disaster incidence [19,20,21]. People have tried several efforts to mitigate the physical effects of dangers, mainly through planning and improvisation [22,23,24]. Individual and organisational disaster response activities have changed significantly from most people's labels. Individuals typically behave in an adaptive way when most disasters happen [25,26,27]. Following proper procedure typically delays people's realisation that an unlikely occurrence is happening, so they seek verification of any first indicators of an emergency before starting protective activities. The great majority of individuals react in their traditional social units – particularly their houses and communities – which might take time to create organisations capable of meeting the needs of the crisis. There is a significant social and material component to disastrous consequences and a reduction in antisocial behaviours like crime [28,29,20]. Contrary to common opinion, emergency workers do not neglect their professional responsibilities to protect their families. Burnout is more common among emergency responders due to working too many continuous hours without rest [31,32,33] and, as a result, causing severe stress to the response team.

In furtherance of the above, emergent behaviour, which occurs when individuals recognise needs that are not being addressed and thus seek to meet them informally, is a critical component in disaster response [1,19,34]. Disaster demands outstrip the capabilities of people working individually, resulting in uncoordinated responses and the refusal of autonomous units to remove fragmentation, gaps in service delivery, and unneeded duplication of services [12,19,20]. People strive to assist themselves since the infrastructure supplied by the government is no longer enough to serve their needs.

The failure of vital infrastructure is inextricably tied to the state of critical infrastructure. Most infrastructures, particularly those in the United States, have been damaged by age and deterioration, rendering them prone to natural disasters. In other regions, infrastructure is overstretched due to frequent disasters. The 2009 American Societies of Civil Engineers (ASCE) report card for infrastructure assigns an average grade of "D" to U.S. infrastructure, indicating the necessity of immediate restoration and rehabilitation [1,7,9,32,33]. Natural disasters impact vital infrastructure systems, impacting the services and operations of most industries and communities during

disaster occurrences. For instance, since Haiti's devastated areas had little or no infrastructure, the number of fatalities and property losses surged considerably during the earthquake. The devastated infrastructure hampered the relief efforts of emergency-related organisations by delaying their arrival in Haiti's impacted districts [5,9,12,19]. Damage and repercussions from the earthquake may have been considerably avoided if they had identified and strengthened the critical infrastructure (the communication networks and main roadways) prone to earthquakes ahead of schedule.

Several disaster management declarations, strategies, policies, plans, and response programmes were issued in 2000. Nonetheless, despite various inter-regional and high-level debates, discussions, and intervention measures that have been set up, South Eastern Nigeria is still faced with increasing challenges of natural disasters. This may be attributed to the inappropriate performance of disaster management infrastructure and strategies in the rural communities of the study area, notably in Cross River State, Nigeria. This research is being conducted in response to this circumstance to evaluate the level of performance of the disaster management infrastructure and strategies preparedness and recommend appropriately the smooth response of agencies to the incidence of natural disasters.

2. Research Methods

The study area is South Eastern Nigeria. The area is positioned between latitudes $4^{\circ}44'$ and $7^{\circ}00'$ N and longitudes $7^{\circ}40'$ and $9^{\circ}50'$ E. It is bounded in the North by Benue State, in the East by the Cameroun Republic, West by Ebonyi and the Abia States and South by the Atlantic ocean (Fig. 1) and covers an area of 2,074.43 square kilometres with a population of over 2.88 million people [35,36]. The rock formation in the area is characterised by sedimentary rocks that belong to the Calabar flank, which contain poorly exposed rock. The mean monthly temperature is from 24.2°C and 27.4°C . The average annual rainfall ranges between 2000mm to 3500mm. The study area is generally characterised by ferrasols derived from ancient metamorphic rocks of basement complex and sedimentary structures. The vegetation is dominated by tropical rainforest and the derived savannah.

The study utilised primary and secondary sources of data. The primary data was through the use questionnaire survey, participatory research methodology using interviews, participant observation and transect walk with key informants. The questionnaire also included Likert scale questions used to assess the performances of disaster infrastructure and stakeholders in the sampled locations. The respondents were made to score the effectiveness and performance of the interventions by various organs such as government, NGOs, communities, donors, churches, private companies, and others.

The study purposively selected 12 local government

areas as sample locations, including Yala, Ogoja, Obubra, Obudu, Boki, Etung, Odukpani, Biase, Ikom, Abi, Calabar south and Calabar municipality. The choice of these locations was attributed to the frequency of natural disasters, the impact on the people, and the level of responses by various organisations. The sample size used for data collection was 900 respondents representing 10%

of the household heads across the sample communities within the Local Government Areas selected. However, descriptive and inferential statistics were used for data analysis. The One-way Analysis of Variance (ANOVA) was used to establish the level of difference in the stakeholders' performance in Natural Disaster management measures.

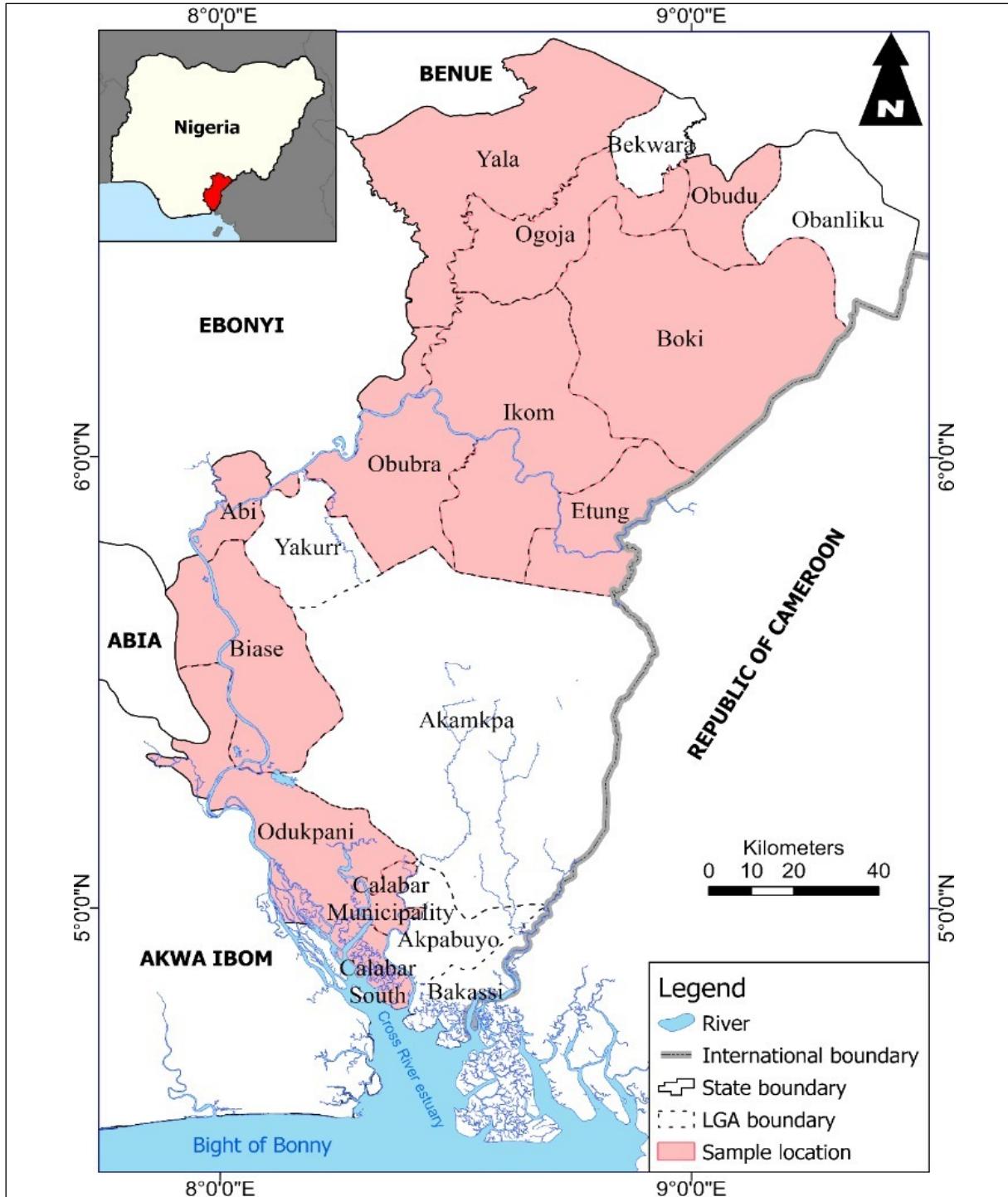


Figure 1. The study area showing Cross River State, South Eastern Nigeria

3. Results and Discussion

This section presents the results and discussion of the findings.

3.1. The Nature of Disaster Affecting the People in the Area

The study area had been impacted by several devastating disasters, including flooding, landslides, windstorms, fire, hailstones, gully erosion, and thunderstorms. The participatory study rated disasters based on their perceived level of impact on the people. The findings indicate that flooding, landslides and windstorms, representing 26%, 24%, and 22%, respectively, were considered the highest in terms of impacts on the landscapes, properties, infrastructures, human lives, and farmland destruction (see Fig. 2). It was discovered that these disasters sometimes act in combination to produce hazards. For instance, the landslides in Boki and Biase were accompanied by massive flooding downslope. Similarly, the gully erosion menace in Calabar and Yala were associated with flooding, while drought disaster was rated least based on a regular occurrence.

Furthermore, the study observed that natural disasters and impacts vary from one location to another in the area.

The nature of disaster as perceived by the people reveals that flooding is the most frequent and impacting disaster across the study locations, representing 34% of the responses. This was closely followed by landslides with 33%, while windstorms ranked third with 22% (Table 1). Flooding was considered a perennial problem in the area attributed to heavy rainfall, deforestation, blocking of drains, watershed degradation, etc. The flood is more frequent, especially in urban centres such as Calabar, than in any other place. The most common floods in the area are urban flooding, river flooding and coastal flooding. Similarly, landslides with devastating effects are not as widespread as flooding but gradually increases due to intense human activities across the study locations. At the same time, other natural disasters like gully erosion and forest fire rarely occur, attracting 11%, but are severe and devastating. However, this result agrees with [1,2] assertion that natural disasters vary drastically in terms of their impact on individuals, societies, and governments and that one natural disaster occurrence may create destruction differently than other natural events. Also, natural disasters vary, but the population's vulnerability can also differ. Similarly, [1,4] noted that devastating natural disasters occur more often and are more destructive in places with no prior history of disaster.

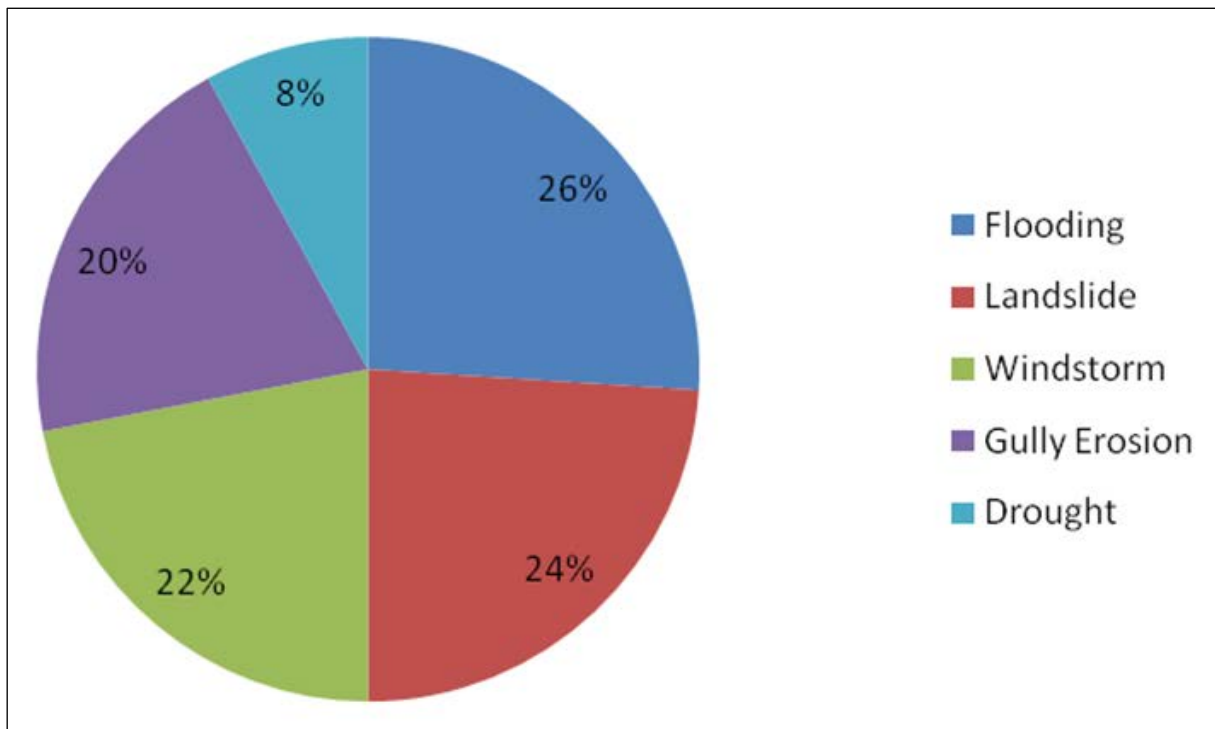


Figure 2. The nature and the most impacting disasters in the study area

Table 1. Perception of the nature of disaster affecting the people

Sample locations	Flooding	%	Land - slide	%	Wind storm	%	Others	%	Total	%	Average
Yala-Okuku	41	13.39	10	3.32	20	10.25	111	11.22	82	9.11	20.5
Obudu-Ukpe	11	3.59	13	4.32	5	2.56	21	21.43	50	5.56	12.5
Boki- Buanchor	18	5.58	25	8.31	13	6.67	12	12.24	68	7.56	17
Obubra	19	6.21	36	11.96	14	7.18	11	11.22	80	8.89	20
Ikom	28	9.15	25	8.31	21	10.77	4	4.08	78	8.67	1.5
Etung	22	7.20	10	3.32	8	4.10	0	0	40	4.44	10
Odukpani	20	6.54	32	16.41	11	5.64	1	1.020	64	7.11	16
Ogoja	21	6.86	22	7.31	21	10.77	6	6.12	70	7.78	17.5
Abi	22	7.19	17	5.65	21	10.77	2	22.04	62	6.89	15.5
Biase	11	3.59	67	22.26	3	1.54	3	3.06	84	9.33	21
Calabar south	33	10.78	19	6.31	28	14.36	22	22.45	102	11.33	25.5
Calabar municipality	60	1.61	25	8.31	30	15.38	5	5.10	120	13.33	30
Total	306	100	301	100	195	100	98	100	900	100	225
%	34		33.44		21.67		10.89		100		

Source author's fieldwork 2022

3.2. Causes of Natural Disasters in the Area

People's perception of the causes of natural disasters, as presented in Table 2, indicates that intense rainfall and deforestation are the primary causes of natural disasters in the sample location, accounting for 27% and 23%, respectively. Other causes include watershed degradation, mining, construction work and windstorm. However, construction activities and mining can only have the least strength in triggering disasters, as reflected in the people's level of response. The result also reveals that watershed degradation is accelerated by deforestation and erosion, which drain sediment into streams and river channels. This makes them have shallow beds, causing flooding, while mining activities, windstorms, and other factors have occasional impacts which may not cause widespread and severe disasters in the area. They only constitute a small portion of the attribute with the value of 11 and 10, respectively. Differences exist in the causes across the study locations. For instance, windstorm is dominant in Ikom, while deforestation and intense rainfall are the common causes in Biase, Calabar South, Obubra, Calabar municipality and Yala. Abi is greatly influenced by intensive rainfall (Table 2). The result contradicts the findings by [10,20], which noted that the increasing population transfer into susceptible areas results in a windstorm and affects flood-prone areas. The economic growth and development shift put a strain on blockade islands, coastal flood plains, ecological systems that

sustain tourism and hospitality sectors, suburban housing development and food production. Given the high variability of natural disasters and the varying vulnerability of societies and landscapes, several consequences are associated with these events. The study results revealed varying degrees of impacts associated with natural disasters based on the scale and extent of the occurrence.

3.3. Perception of the Effect of Disaster in the Study Area

The challenge of the study population is the multiplicity of effects on the landscapes due to disaster. Group interviews revealed several consequences of disasters based on the scale and extent. Figure 3 indicates that food scarcity and loss of properties were scored highest, accounting for 26% and 25%, respectively. These impacts seemed to have affected the entire population, including women and children. It was discovered that these impacts could occur simultaneously, thus resulting in several complexities in mitigations. For instance, the study found out that loss of farmland can lead to scarcity of food and destruction of properties such as residential buildings and school buildings, amongst others, which is the basis of displacement of families or homes. It was mainly observed during the landslides in Agwagune in 2005, 2006 and 2009, while more than 60% of Buanchor people relocated from their settlement, including school children, to neighbouring villages.

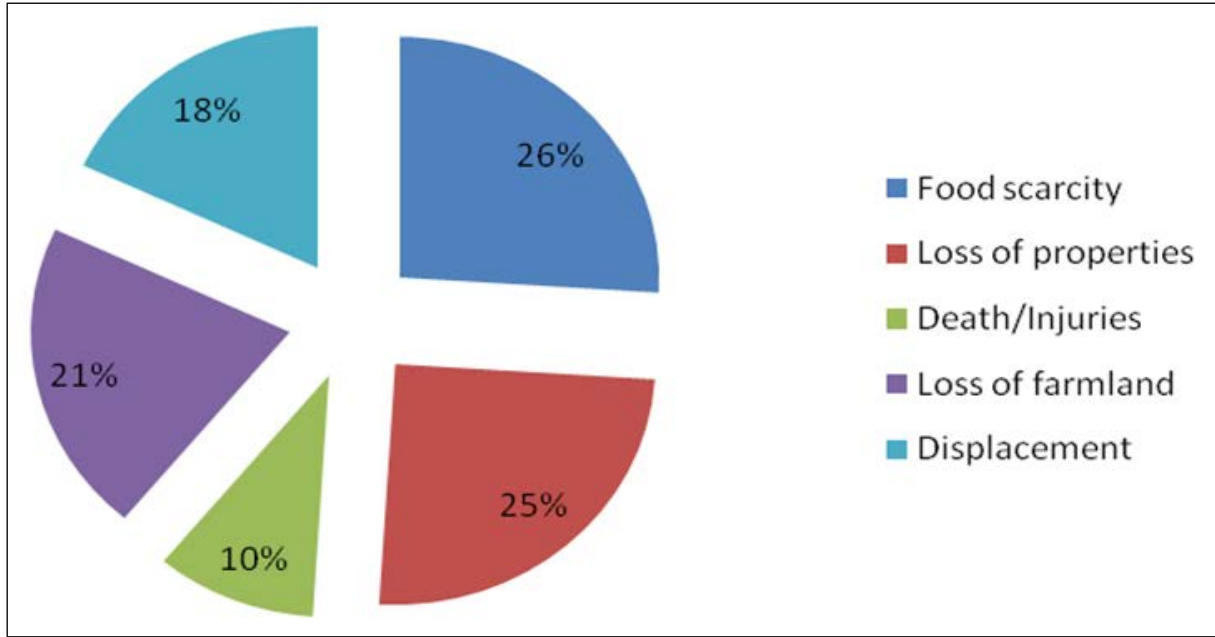


Figure 3. The nature of the effect of disasters in the study area

Table 2. Perceived causes of natural disasters in the study area

Sample locations	Deforestation	Heavy rainfall	Watershed degradation	Mining/ Quarrying	Construction activities	Wind storm	Others	Total	%
Yala	19	22	12	2	3	1	23	82	9.11
Obudu	9	11	4	13	3	6	4	50	5.56
Boki	13	21	9	7	5	8	7	68	7.56
Obubra	23	25	5	6	3	9	9	80	8.89
Ikom	11	13	3	5	13	27	6	78	8.67
Etung	11	13	3	5	1	4	3	40	4.44
Odukpani	10	21	8	6	5	7	7	64	7.11
Ogoja	15	17	10	2	3	2	21	70	7.78
Abi	8	21	8	6	5	7	7	62	6.89
Biase	26	25	6	6	3	9	9	84	9.33
Calabar south	25	27	12	7	6	3	22	102	11.33
Calabar municipality	35	27	12	7	9	7	23	120	13.33
Total	205	243	92	70	59	90	141	900	
Average	17.08	20.25	7.67	5.83	4.92	7.5	11.75	75	
%	22.78	27	10.22	7.78	6.56	10	15.67	100	

Source author’s fieldwork 2022

The study also reveals that in 2012, 113,837 people were displaced by various disasters, 2,076 were affected by fire disasters, and windstorms destroyed over 1,541 properties in the study area. Recently, these levels of destruction have increased due to a lack of sustainable disaster mitigation measures. Injuries and deaths were scored at least 10%

since the death rate was insignificant. There was a variation in the scale of effects of natural disasters across the study locations (Table 3). The respondents indicate that food shortages and loss of properties were more in terms of the severity of their impacts. However, these effects were significantly different. In confirmation of the above, [28,37]

revealed that natural disasters significantly impact the public health and well-being of the affected population and that negative impacts can be direct or indirect. The high cost of natural disasters is attributed to destroying expensive and essential infrastructure such as roads and buildings. They further alluded that natural disasters also cause a substantial economic burden, and from 2000 to 2009, natural events cost \$891 billion in damage worldwide. However, [26,29,38] observed that the levels of disaster risk prevalent in communities are connected to the development preferences of those communities.

3.4. Types of Disaster Infrastructure Interventions in the Area

The study carried out a survey of infrastructure interventions towards all types of disasters in the study area, and the result is presented in Table 4. The result shows that the most common and frequent interventions in infrastructure response to natural disaster hazards are providing food materials, non-food materials, medical services and financial support. These accounted for 32%, 20%, 15% and 14%, respectively. The common food items include rice, beans, plantain, garri, provisions including milk, bournvita, magi, and indomie, while the non-food materials are building materials, wrappers, stoves, sewing machines, computers, beds, chairs etc. Medical services are

provided primarily for those injured during the disaster occurrence. The participatory study using group interviews confirms that from 2015 to 2022, disaster occurrences resulted in over 28 deaths, 320 230 people displaced, 2801 houses destroyed, and 58720 farmland of all crops across the sampled location destroyed. These extents of damage have greatly affected the livelihood of the people in the study area. However, relocation and camping were the least intervention indicated with 1%, but immediate measures are required to reduce the scale of impacts. The findings further reveal that the primary stakeholders in providing these infrastructures include government, non-governmental organisations, churches, private companies and donors. The response to infrastructures such as camping and relocation was based on the level of stakeholders involved in those issues as they affect the victims in the area. These findings collaborate with the assertion of [39,40] that emphasises emergency relief in terms of rapid rural appraisal of the affected area and working with organisations and necessary stakeholders to provide the affected people shelter, access to clean water, healthcare, and food materials, and primary essential materials. Nevertheless, [9,10,17] stressed that government roles in disaster mitigation strategies and infrastructure interventions had been identified, especially in economic and technical factors.

Table 3. Perception of the effect of disaster

Sample locations	Death/Injury	Loss of farmland	scarcity (insecurity)	Displacement of people	loss of properties	Others	Total	%
Yala-Okuku	3	19	38	7	9	6	82	9.11
Obudu-Ukpe	8	8	16	11	3	4	50	5.56
Boki- Buanchor	4	11	22	12	8	11	68	7.56
Obubra	6	9	24	11	3	27	80	8.89
Ikom	2	18	21	12	7	18	78	8.67
Etung	0	3	18	6	7	6	40	4.44
Odukpani	4	11	14	3	8	24	64	7.11
Ogoja	7	9	23	8	12	11	70	7.78
Abi	4	12	18	6	9	13	62	6.89
Biase	7	21	31	8	13	4	84	9.33
Calabar south	11	21	39	2	17	12	102	11.33
Calabar municipality	21	19	41	7	19	13	120	13.33
Total	77	161	305	93	115	149	900	100
Average	6.45	13.45	25.42	7.75	9.58	12.42	75.07	
%	8.56	17.89	33.89	10.33	12.78	16.56	100	

Source author's fieldwork 2022

Table 4. Perception of the nature of interventions

Sample locations	Items	Non-Items	Financial support	Medical care	Relocation/Camping	Rehabilitation programmes	Total	%
Yala-Okuku	26	13	11	12	0	20	82	9.11
Obudu-Ukpe	18	8	4	13	2	5	50	5.56
Boki- Buanchor	22	11	13	11	3	8	68	7.56
Obubra	25	13	2	9	0	31	80	8.89
Ikom	19	11	8	13	1	26	78	8.67
Etung	14	7	3	2	0	14	40	4.44
Odukpani	21	23	5	11	0	4	64	7.11
Ogoja	12	17	19	3	0	19	70	7.78
Abi	27	13	12	7	1	2	62	6.89
Biase	29	3	6	18	0	28	84	9.33
Calabar south	31	24	21	17	0	9	102	11.33
Calabar municipality	41	33	22	16	0	8	120	13.33
Total	285	176	126	132	7	174	900	100
Average	23.75	14.67	10.12	11	0.58	14.5	74.62	
%	31.67	19.56	14	14.67	0.78	1.33	100	

Source author's fieldwork 2022

3.5. Temporal Analysis of Disaster Infrastructure Provision in the Area

Furthermore, the study considered and uncovers the time of provision of necessary infrastructure by different stakeholders in disaster-affected areas and people. FIG. 4 indicates that the temporal analysis of disaster infrastructure provision reveals that materials of all kinds are always provided, affecting a disaster occurrence and accounting for 66% of the population response. Most stakeholders, including government and NGOs, desire to acquire results of a rapid rural appraisal of any disaster occurrence before planned actions of infrastructural provisions are carried out. Stakeholders' intervention comes a little during the few disaster occurrences; after some time, a more stable provision is established, and the remaining population become irreversibly expectant. One of the critical features of this process is that it increases the chances of many people affected by disaster to benefit from the infrastructural provision. However, 23% of the respondents confirmed that few stakeholders provided their infrastructure and mitigation materials during the period of occurrence of the disaster. This was observed in a few communities sampled where transportation infrastructure was provided to evacuate victims in

disaster-prone areas and also provided necessary food items to sustain them in internally displaced persons (IDP) camps. Only 8% ascertain no specific time frame for infrastructural provision to affected disaster victims. This happens when some stakeholders intervene after several months or years of disaster occurrence in the area while a few people (3%), especially in urban settlements, receive assistance from government institutions to relocate them from disaster-prone areas after early warning signs. From the analysis in Fig. 4, it is necessary for stakeholders to consider infrastructure provisions before and during disaster occurrence in order to mitigate and reduce the level of impact on the people. This should be part of emergency preparedness towards disaster, especially for people occupying flood-prone and landslide areas.

Similarly, the regularity of disaster infrastructure provision was ascertained from the study population (Fig. 5). The result shows that the provision of infrastructure to affected areas and the victim is not regular, accounting for a high response of 38% in several communities sampled, it was confirmed that these infrastructure and mitigation occasionally come. However, 28% and 23% indicate regularity and seasonal provision. At the same time, only 11% affirmed very regular infrastructure provisions.

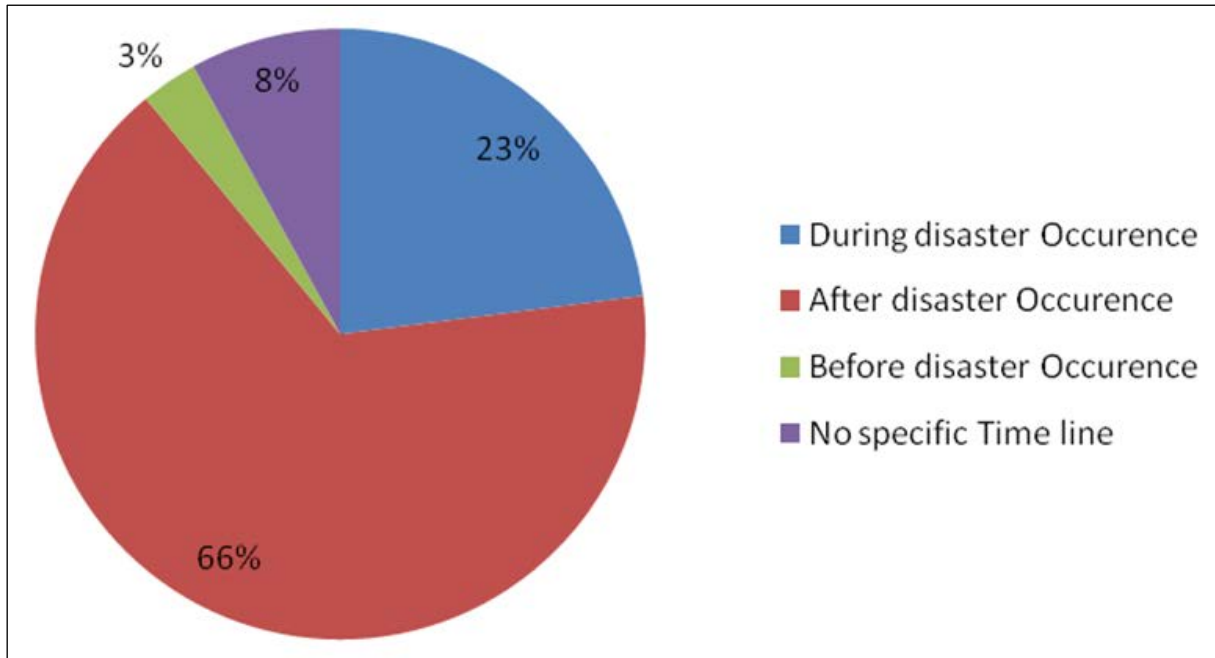


Figure 4. Responses to time of disaster infrastructural provision in the area

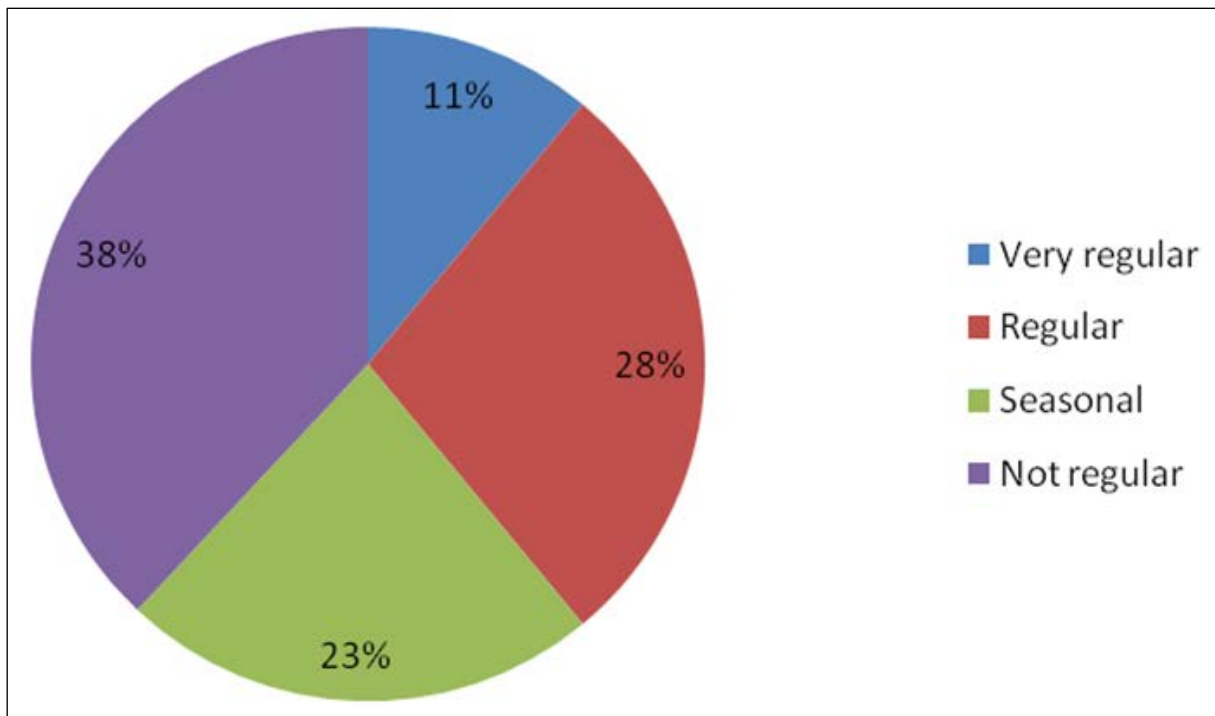


Figure 5. Responses to responses to regularity of disaster management infrastructure provision

Most interventions and mitigations infrastructure are provided only in seasons disaster occurred and ceased after the conditions of the affected people are alleviated. This infrastructure area is associated with government agencies and political officeholders. However, sustainable strategies are rarely adopted. The regularity of the provision of infrastructure attracted 28% of responses associated with

certain international NGOs, including the Red Cross society, WHO, DFID, and UNDP, among others. Regularity implies consistency in response to the provision of infrastructure to the affected areas and victims of disaster occurrence. A participatory interview confirmed that a few respondents who affirmed very regular provision of infrastructure (11%) are associates and relations of

politicians (political office holders) who adopt such strategies as empowerment programmes from their constituents. This may not translate to a sustainable method of mitigating disaster in the study area. It is of necessity to be holistic, starting with educating people about disaster issues, providing early warning signs and infrastructure required for such events in our societies.

3.6. Analysis of Stakeholders Involvement in Disaster Infrastructure Provision

The study population was requested to rate the efficiency of disaster infrastructures and stakeholder involvement, such as government, NGOs, donors, private companies, churches and communities in mitigating natural disasters in the area. Table 5 presents the results of the effectiveness of infrastructures.

The result indicates that 32% of the study population rated disaster infrastructures as not being effective, 23% observed a considerable attempt, and a few 12% rated them high. These findings suggest that disaster infrastructure requires improvement to meet the affected victims' expectations and ensure sustainability. The study further noted that although some respondents have rated the performance as excellent and sound, implementing this infrastructure is unsustainable. They noted that disasters vary in nature and type, and mitigation measures should

recognise this variation and be based on the nature of impacts instead of adopting a holistic approach for all kinds of disasters. In addition, the existing infrastructures are still skeletal and are in the hands of elites and political leaders who use them for political settlements for families and friends.

The study further carried out a detailed assessment of stakeholders' level of contribution to disaster infrastructure, and the results are presented in Table 6. The result indicates that, in aggregate, the stakeholders have not effectively provided the necessary disaster infrastructure to ensure sustainable mitigation of disaster hazards. It was discovered that the donor agencies, including WHO, UNICEF, DFID, UNDP, and others, do not work directly with the affected communities and victims of natural disasters; instead, they collaborate with government ministries and agencies to provide the necessary disaster infrastructures. Their focus is mainly on medical services, financial support and the provision of non-food items. Similarly, NGOs collaborate with the government, especially on capacity building and empowerment as a sustainable means of ensuring tenure, continuation and further dissemination of information about mitigations. NGOs also embarked on environmental awareness about the sustainable use of environmental resources. However, sensitisation on disaster issues should focus on people and communities rather than political issues.

Table 5. perception of the stakeholders involvement in disaster infrastructure provision

S/N	Element rating	Number of people	%
1	Excellent	111	12
2	Good	121	13
3	Average	182	20
4	Fair attempt	195	23
5	Poor	291	32
	Total	900	100%

Source author's fieldwork 2022

Table 6. perceptions of stakeholders' effectiveness in disaster infrastructures provision

S/N	Element rating	Number of people	%
1	Excellent	44	5
2	Good	69	8
3	Average	184	20
4	Fair attempt	211	23
5	Poor	392	44
	Total	900	100%

Source author's fieldwork 2022

Furthermore, the results of rating the effectiveness of various stakeholders involved in disaster infrastructure provision are presented in Table 7. The findings indicate that various stakeholders, including communities, are engaged in mitigations through infrastructures; however, government and communities are the primary providers of the necessary infrastructures for disaster mitigation, representing 23% and 18%, respectively. It was discovered that government effort was complemented by Donors (16%) and NGOs (13%). Other important stakeholders include churches and private companies operating in the area. The study observed that the contribution of all the stakeholders is significantly different from each other. The participatory study shows that the stakeholders' approaches are not sustainable but rather crowded with short-term benefits.

Also, the study indicated that the State Government pays more attention to disaster response infrastructures representing 23%. This is followed by the communities' donations to affected people, while NGOs scored the least in effectiveness, accounting for 13 % (Table 7). The result also shows that irrespective of the efforts of the stakeholders in responding to disaster effects, there is still a gap to be filled, and the people are not assured of all the intervention measures. The need to bring in experts and more sustainable measures to tackle these dangerous and harmful hazards is required.

In order to determine the stakeholder s level of effectiveness in infrastructure provision, a one-way Analysis of Variance (ANOVA) was adopted using data in Table7. The result is presented in Table 8.

Table 7. Specific rating stakeholders in the provision of natural disaster infrastructures

Sample locations	Government	NGOs	Donors	Community	Churches	Private companies	Total	Average	%
Yala-Okuku	52	31	40	52	20	40	235	39.17	7.63
Obudu-Ukpe	41	30	35	53	26	35	220	36.67	7.15
Boki-Buanchor	68	42	43	45	30	15	243	40.5	7.89
Obubra	59	28	44	66	20	15	232	36.67	7.54
Ikom	52	34	41	55	42	54	278	46.33	9.03
Etung	42	20	48	40	28	65	243	40.5	7.89
Odukpani	70	31	51	32	53	60	297	49.5	9.65
Ogoja	61	36	31	32	20	34	214	35.67	6.95
Abi	62	22	21	47	28	72	252	42	8.18
Biase	61	33	52	57	20	21	244	40.67	7.92
Calabar south	73	42	38	49	48	49	299	49.83	9.71
Calabar municipality	60	45	50	55	60	52	322	53.67	10.46
Total	701	394	494	583	395	512	3079	511.18	100
Average	58.42	32.83	41.16	48.58	32.92	42.67	256.55		
%	22.77	12.80	16.04	18.94	12.83	16.63	100		

Source author's fieldwork 2022

Table 8. Analysis of variance result of the effectiveness of stakeholders involved in disaster infrastructural provision across the study locations

Variance	Sum of Squares	Df	Mean Squares	F	Sig
Between Groups	6036.236	5	1207.247 156.042	7.737	.010
Within Groups	10298.750	66			
Total	16334.986	71			

Source author's statistical analysis 2022

The One-way Analysis Variance (ANOVA) results showed a significant difference in the effectiveness of stakeholder involvement in natural disaster mitigation (F-value of 7.737, > the table value of 2.17 at a 0.05 level of significance. This analysis implies that the activities of government, communities, and donor agencies were rated differently in terms of their overall performances in infrastructure provision to disaster-affected areas and people. These findings agree with [29,39-41], which stated that community engagement is a primary component in natural disaster management to counteract the global trend of an exponential rise in disaster incidence. It contradicts the assertion of [42-45] that individual and organisational disaster response activities have changed significantly from most people's labels. Individuals typically behave in an adaptive way when most disasters happen. Also, there are no standard approaches for managing natural disasters, and total prevention of all disasters is not possible. However, the goal of management is to help as many people as possible using the available resources. Learning from other climes is imperative for reducing the impact of disaster events.

4. Conclusion

The increasing nature of natural disasters and associated hazards require pragmatic and sustainable infrastructure. Disaster mitigations are meant to lessen the effect triggered by concomitant causes. The nature of disasters and their effects should be the basis for mitigation approaches. Understanding disaster processes and effects should be the beginning of mitigations to target the necessary infrastructures for the affected communities and people, rather than the holistic approaches of using the same measures for all kinds of disasters and effects. In addition, this study uncovered that disaster infrastructure is yet to take appropriate form in terms of adaptation, retrofitting, and construction of resilient systems for communities to mitigate natural disaster events and hazards in increasing dimensions in the study area. Furthermore, communities in the area that are faced with the challenges of disaster hazards need to be exposed to capacities that will enable them to analyse the risk of potential natural disasters. They should consider the most appropriate improvement and understand the budget and timelines for implementing the improvement of resilient infrastructure, especially in the rural communities of South Eastern Nigeria. Therefore, to promote sustainable mitigation of natural disasters in the study area, the study recommends continuous evaluation/research and monitoring of disaster occurrence and mitigation infrastructure in South Eastern Nigeria.

In addition, it was recommended that disaster management education, early warning signs and participatory disaster management response should be practised in communities occupying disaster-prone areas in South Eastern Nigeria. Furthermore, reforestation of

degraded areas should include watersheds. Again, the study suggested that sustainable land-use planning should consider disaster-prone areas and provide adequate legislation on the use of high and low-disaster-risk areas. Other recommendations were the re-enforcement of the existing disaster-based infrastructures in the study area and the establishment of disaster-based management committees in all communities, especially the affected areas. This will bring several communities to the centre point of hazard analysis and identification, risk appraisal or assessment, and disaster management. Also, the study suggested streamlining disaster resilience in sectors like health, security and climate change adaptation in Cross River State and Nigeria in general. It was concluded that there should be a direct rehabilitation and reconstruction of disaster-affected properties instead of the current piecemeal distribution of non-materials. Therefore, it is necessary for various stakeholders and scholars to consider infrastructure provision before and during disaster occurrence to mitigate and reduce the impact on the people. This should be part of emergency preparedness towards disaster occurrence, especially for people occupying flood-prone and landslide areas.

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