

Environmental Disasters and Management: Case Study of Building Collapse in Nigeria

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Abstract The age-less interaction between man and his built environment has always had positive and negative impacts on the two. Environmental disaster of varying origin from man-made to natural is one of the most negative effects of the built environment on man. An assessment of the magnitude of these disasters and an evaluation of the existing capacities to prevent, mitigate or prepare for them are necessary tools to provide future safe living for man in his built environment. Building collapse established to be caused by many factors is one of such disasters wielding its great impact of loss of lives and properties on man. This study assessed the scale of human casualties from reported cases of building collapse in some selected Nigerian cities for twenty years between 1990 and 2009. The study was carried out by relying on printed and web sources to gather the required data. Descriptive analysis of the data shows that the “monster” called building collapse killed more people in Lagos, Abuja and Port-Harcourt which may not be unconnected with the high-rise buildings which are the common sights in these cities. The factors responsible for the high incidence of loss and their management inputs were assessed with a mathematical model. After an appraisal of the effectiveness of the emergency management outfits in Nigeria, the study concludes with necessary recommendations.

Keywords Environmental Management, Building Collapse, Disaster, Nigeria, NEMA

1. Introduction

The quality of the built environment, both natural and man-made, depends on its management, that is, its process of control and organization. Often, there are forces that cause events that leads to unsafe built environment for water, land and air inhabitants. While these forces are generally categorized into natural and man-made, their resultant affects are multifarious, calamitous and disastrous. These resultant effects are generally called disasters. Disaster occurs in different parts of the world at different times and in various scales leaving behind various magnitude of loss to lives and properties.

The aim of environmental management is to reduce or completely eliminate the chances of vulnerability of the environment to disaster through prevention, mitigation, preparedness or capacity building. Hewitt[1] established that vulnerability is the principal component of risk in his disaster studies. He insisted that hazard is the other main component which he regarded as merely the trigger of risk conditions while arguing that vulnerability accounts for the bulk of the propensity to suffer harm. According to Boyce[2], this formulation is commonly used when dealing with extreme poverty.

A natural disaster is the consequence of a natural hazard (e.g. volcanic eruption, earthquake, landslide, flood, cyclones, cold waves, drought, thunderstorm, heat waves, mudslides and storms) which affects human activities. Human vulnerability, exacerbated by the lack of planning or appropriate emergency management, leads to financial, environmental or human losses. In the view of Bankoff et al[3], the resulting loss depends on the capacity of the population to support or resist the disaster, and their resilience. The implication is that “disasters occur when hazards meet vulnerability”[4]. Therefore, a natural hazard will hence never result in a natural disaster in areas without vulnerability, e.g. strong earthquakes in uninhabited areas.

Alexander[5] noted that the term natural has consequently been disputed because the events simply are not hazards or disasters without human involvement. Also, many natural hazards are related for instance earthquakes can result in tsunamis, drought can lead directly to famine and diseases. A concrete example of the division between hazard and disaster is that the 1906 San Francisco earthquake was a disaster, whereas earthquakes are hazards. Consequently, hazards are relating to a future occurrence while disasters relates to past or current occurrences.

This background understanding implies that environmental management has the following components: Disaster Management, Hazard Management, and Capacity Building. Because of the incessant disaster that is ravaging the world starting from the 19th century to date, agencies to undertake environmental management functions have been put in place

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in many parts and countries of the world. These include Nigeria (NERA, NEMA, SEMA, LEMA), India (NPCBAERM), United Nations (ISDR, IDNDR), among others.

Basically, man-made disaster results from technological inventions like aircraft, automobiles, and industrial developments. At other times man-made disasters results from civil conflict like riot, unethical, non-professional and careless endeavours like fire outbreak, damaged pipelines, building collapse, chemical spill, road accident, food poisoning, epidemic industrial disaster, crisis, deforestation, war, environmental pollution and plane crash, among others. Still yet, disasters may occur from natural forces like earthquake, volcanic eruption acting negatively on man-made inventions like buildings, boats, ships, cities and artificial islands. For instance, nearly 2,000 people died in September, 2002 in the sinking of Senegal's Joola ferry, one of the worst maritime disasters in history just as 100 people were feared dead and 22 bodies were recovered after a boat capsized in the Niger River in Kebbi State on Tuesday 11th September 2003 after hitting a rock[6]. Furthermore, the National Programme for Capacity Building of Architects for Earthquake Risk Management (NPCBAERM) in India[7] saw building collapse as the major issue in earthquake vulnerability and argued that earthquakes are natural hazards but the disasters are man-made. The programme pointed out that "earthquakes don't kill, unsafe buildings do" and "the Latur earthquake of 1993, caused large-scale collapse of non-engineered houses, due to faulty design, weak construction material and poor maintenance, non-compliance to seismic safety regulations in engineered buildings lead to extensive collapses.

In Nigeria, building collapse, defined as a state of complete failure when the structure has literally given way and most members have either caved-in crumbled or buckled[8], and aircraft disasters are multiplying their alarming effects on the populace in recent times. Indeed, building collapse has become a common feature of Nigerian cities. For instance, 57 people were buried as a building collapsed on them in Ebute Meta, Lagos on 18th July, 2006[9]. On 12th June, 1997 the collapse of an unfinished three-storey building in Enugu killed 20 people[10]. In Lagos, a four-storey residential building caved-in suddenly in July, 2006 killing 37 people and leaving 50 survivors to be pulled out of the rubble[10].

The cases of building collapse in Nigeria has reached a worrisome level in view of its alarming losses. It has been the concern of numerous authors[9,11,12,13,14,15] to search for the causes of this monster, in order to proffer adequate solution of prevention, mitigation or preparedness. The Nigerian Institute of Building said 84 buildings had collapsed in the past 20 years in Nigeria, claiming more than 400 lives based on reported cases only[10]. Oyewande[12] discovered that 50% of building failure cases in Nigeria is attributed to design faults, 40% to construction fault and 10% to product failures. According to Chinwoku[13] and Windapo[14], about 37% of these collapses are believed to

be caused by carelessness and greed on the part of construction professional and 22% are traceable to design faults[cited by 16]. Also, about 40% of the reported cases of collapse building are residential[14].

Uzokwe[17] submitted that the cause of a building failure is almost always unique to the particular building in question. However, he advanced some general reasons why buildings may be susceptible to collapse which includes the quality of the blocks used, the quality of the concrete used, poor compaction and consolidation of foundation soil and weak soil. Adebajo[18] summarized the causes of structural collapses and failures in Nigeria from a series of building collapse investigations by the Nigerian Institute of Structural Engineers as:

- Non adherence to the approval regulation;

- Absence of the involvement of a professional structural engineer in one or more of the stages of the project execution;

- Incompetent and low quality workmanship;

- Lack of soil investigation and improper interpretation of site conditions;

- Lack of professional site supervision;

- Lack of knowledge of the guiding principles concerning construction of the proposed development;

- Greed and the desires to maximize profit;

- Excessively rushed construction;

- Poor or inadequate form and false work;

- Corner cutting by the client or the contractor;

- Construction by all-comers due to the perception of engineering projects as an easy access window to make quick money;

- Unethical dealings between project promoters and the relevant planning authorities.

Obiechina[8] pointed out that the various stakeholders in the building industry are responsible for building collapse. He categorized the stakeholders into government, developers, professionals, regulatory bodies, and civil society and non-governmental organizations. While adducing reason for high rise buildings as a means of maximizing the value and utilization of scarce and expensive land, he lamented that most developers do not appreciate the dangers associated with such high-rise buildings and therefore engage services of those who do not have the expertise on such projects. Unethical practices and procedures during the stages of design, approval and construction of buildings are the banes of Nigerian construction industry generally.

The aim of this study is to examine the magnitude of disaster that the Nigerian populace has suffered from reported cases of building collapse in recent times, particularly loss of lives. The study also review the concepts of disaster, risk, hazard, vulnerability and capacity building to give a theoretical model of reducing the toll of the negative influences of the environment, especially on man. The study concludes with an appraisal of the functions of the various existing government agencies on emergency management generally and gave recommendations on how to reduce cases of building collapse in the country.

2. Methodology of Study

To achieve the aim of this study, printed and web sources that recorded the number of people that died and those that sustained injuries in reported cases of building collapse in Lagos, Abuja, Port-Harcourt, Enugu, Lokoja, and Ogbomoso between 1990 and 2009 were relied upon. Such literatures include printed dailies, on-line dailies, reports, assessments and other similar research documents. These disasters are grouped based on severity into two: Casualty Toll (injuries) and Death Toll.

In view of the causes of building collapse in Nigeria and the possible capacities that could be developed to prevent, mitigate or prepare for future occurrences of building collapse, a mathematical model was applied to assess vulnerability to building collapse in Nigeria.

3. Findings and Discussion

Table 1 below shows the casualty of the disasters in various building collapse in Lagos between 1999 and 2009.

From table 1, the total number of people that died from reported cases of building collapse in Lagos between 1999 and 2009 was 130 which are majorly storey buildings. Also, the total number of casualty from building collapse in Lagos alone during the period was 250. Indeed, this disaster is alarming. Little wonder that Umar Maigira, a Red Cross disaster officer said in respect of the Ebute Metta, Lagos building collapse of 19th July, 2006 that[10]:

“I seriously doubt if anybody could still be brought out alive. I believe it is late now. Our concern is to clear the site of the bodies still buried under debris. All those brought out of the place yesterday were all dead. I don’t think there is still hope for any more survivors”.

Similarly, one resident said[10]:

“It was an accident waiting to happen. Less than six months after people packed into the building, the staircase linking the second and third floors collapsed and for about two weeks, movement in the building was restricted”

Furthermore, a friend of one of the deceased victim said ‘He died with his wife and three children’ what an incalculable loss.

Table 1. Building Collapse Casualty in Lagos between 1999 and 2009

Date	Location	Type of Building	Casualty Toll	Death Toll	Total Number of People Affected	Source
April 1999	Lagos	Two-storey apartment building under construction	5	3	8	[19]
2006	Lagos	Four-storey	n. a.	28	28	[20]
January 2006	Lagos	Three-storey	n. a.	7	7	[21]
March 22, 2006	Lagos	24-storey building belonging to the Bank of Industry	‘some’	4	4	[21]
July 03, 2006	Lagos	n. a.	n. a.	2	2	[21]
July 2006	Lagos	Four-storey apartment building	35	11	46	[22]
July 19, 2006	Ebute Metta, Lagos	Residential building of 36 flats, a penthouse and some shops	50	57	107	[9]
March 25, 2008	Idi-Araba Lagos	Residential building	n. a.	11	11	[20]
June 2009	Iddo Lagos	Two-storey building	30	7	37	[23]
		Grand Total		130	250	

Table 2. Building Collapse Casualty in Port-Harcourt, Enugu, Lokoja, Abuja and Ogbomoso Between 1990 and 2009

Date	Location	Type of Building	Casualty Toll	Death Toll	Total Toll	Source
15th June 1990	Port-Harcourt	Sague Comprehensive Primary and Secondary School	n.a.	50	50	[24]
13th June 1997	Enugu	Three-storey building under construction	n.a.	20	20	[25]
22nd January, 2006	Lokoja	Three-storey residential building	20	8	28	[26]
29th July 2008	Utako District Abuja	Four-Storey shopping centre under construction	30	70	100	[27]
March 2009	Ogbomoso	Four-storey hospital building under construction	None	5	5	[28]
		Grand Total		160	203	

Table 2 below shows the casualty of the disaster in reported cases of building collapse in the cities of Abuja, Lokoja, Enugu and Port-Harcourt and Ogbomoso between 1990 and 2009. The table shows that a large number of people totaling 160 died in building collapse in these cities during the period. Table 2 also shows that a total of 205 people suffered casualty of building collapse in these cities during the period.

Table 3 below shows the total casualty of reported cases of building collapse in the cities of Lagos, Port-Harcourt, Enugu, Lokoja, Abuja and Ogbomoso between 1990 and 2009.

Table 3. Total casualty of reported building collapse in some selected Nigerian cities between 1990 and 2009

City	Death Toll	TotalToll	TotalToll Percentage of Grand Total
Lagos	130	250	55.19%
Port-Harcourt	50	50	11.04%
Enugu	20	20	4.42%
Lokoja	8	28	6.18%
Abuja	70	100	22.08%
Ogbomoso	5	5	1.10%
Grand Total	283	453	100.00%

Source: Author's analysis, 2009

Table 3 reveal that a total of 283 people died while a whopping total of 453 people were involved as casualties in building collapse in the cities of Lagos, Port-Harcourt, Enugu, Lokoja, Abuja and Ogbomoso during the period under study. Table 3 also reveal that the total toll decreases from Lagos (55.19%), Abuja (22.08%), Port-Harcourt (11.04%), Lokoja (6.18%), Enugu (4.42%) to Ogbomoso (1.10%) in that descending order. This is also true for death toll: Lagos (250), Abuja (100), Port-Harcourt (50), Enugu (20), Lokoja (8) and Ogbomoso (5).

The high incidences and associated disasters of building collapse in Lagos, Abuja and Port-Harcourt may not be unconnected with the high rise buildings which is the common sight in these cities compared to Enugu, Lokoja and Ogbomoso. Also, as similarly pointed out by Obiechina[7] the great incidence of building collapse in Lagos and Port-Harcourt indicate that the nature of the soil is very central and a culprit in the building collapses especially during the raining season when most of the collapse took place.

Tables 1 to 3 clearly shows that building collapse is a monster that ravages Nigeria year in year out from 1985 to date. The mathematical model expressed in the equation below can assist us to assess this great levels of disaster and proffer solutions in terms of capacity building against future occurrence of building collapse in Nigeria:

$P_D = f(H_{nat} + H_{man})(R_H)(V_{nat} + a_1 + a_2 + b_1 + b_2)$ [coined from 28]

This equation can be interpreted in terms of total casualty resulting from human building collapse by making the following substitutions:

P_D is the probability that building collapse will lead to

human casualty resulting from building collapse. In the Nigerian experience, this probability is very high. This is evident from the high casualty figure of 453 for the selected cities just between 1990 and 2009.

f is a function of the relationship between H_{nat} , H_{man} , R_H , V_{nat} , a_1 , a_2 , b_1 , b_2 .

H_{na} is the effect of natural forces like earthquake, landslide, tremors, hurricane Andrews etc on buildings that leads to collapse

H_{man} is the sum total of the human negligence and unethical procedures in building delivery as listed by Adebajo[18] from a series of building collapse investigation earlier cited.

R_H is the probability (risk) that this hazard (H) will lead to building collapse. Such risk include structural failure like deflection which exceeds $L/250$ where L is the span of the element and crack widths which exceeds 0.3mm[8]

V_{nat} is the resultant vulnerability to building collapse from ground movements, and weak soil.

a_1 is the vulnerability augmentation of not vacating a building at the notice of structural failure of excessive deflection and excessive crack before a total collapse. For instance the carelessness of the occupiers of the Ebute Metta building that collapsed on 19th July 2006 earlier cited is a case of vulnerability augmentation.

a_2 is the vulnerability mitigation of building collapse awareness campaign by the government, elimination of quackery in building professions, ethical building delivery procedures, appropriate statutory building permit processing procedures, professional supervision of construction projects by competent manpower from clients and relevant government bodies, regular post-occupancy building assessment and enforcing Nigerian building code 2006.

b_1 is the counter-productive disaster response of accidentally heaping more rubbles on some victims of building collapse in the process of rescuing other victims, either dead or alive.

b_2 is the productive disaster response of rescuing survivors of building collapse, prosecuting culprits and promulgating laws like the Nigerian Building Code 2006.

This illustration of the equation above clearly points to the fact that greater capacity should be built by individuals, organizations and the government to reduce the vulnerability of Nigerian populace to incidence of building collapse and thereby reduce or eliminate the risk of loss of lives and injuries to victims.

Disaster Management Agencies in Nigeria: Historical Sketch, Responsibilities and Appraisal

The total capacity building (C_{tot}) against disaster in Nigeria dates back to 1906 when the Police Fire Brigade (now Federal Fire Services) was established to function beyond fire fighting role to saving of lives, properties and provision of humanitarian services in emergencies. Chronologically, this development was followed by establishment of National Emergency Relief Agency (NERA) by Decree 48 of 1976 which was conceived as an

inter-ministerial committee charged with the task of collecting and distributing relief materials to disaster victims. Later, in 1990 the International Decade for Natural Disaster Reduction (IDNDR) was set up by Decree 119 of 1993 along with other member countries of the United Nations to address natural disasters reduction in Nigeria.

Furthermore, in 1997, NERA organized a national workshop involving major stakeholders in disaster management in Nigeria including oil companies, construction companies, government and non-governmental organizations and representatives of United Nations Development Programme (UNDP) at the end of which a communiqué was issued for restructuring of NERA activities to (NEMA, undated):

- Search and Rescue;
- Policy and Strategy;
- Infrastructure, Education and Prevention;
- Administration, Finance and logistics;
- Relief and Rehabilitation;
- Research and Planning.

From this communiqué, the National Emergency Management Agency (NEMA) was born out of NERA and established via Act 12 as amended by Act 50 of 1999.

Through NEMA, the federal government has a mandate to assist states and local governments in disaster response and recovery by establishing State Emergency Management Agency (SEMA) in all the 36 states of the federation and the Federal Capital Territory, Abuja. The states are in turn mandated to establish Local Emergency Management Agency (LEMA) in all the local government areas of the respective state.

Recovery personnel at the National Emergency Coordination Centre (NECC) in turn with this mandate are required to closely monitor response activities and to obtain valuable data regarding the severity and intensity of the event, the geographic area and the potential unsatisfied critical needs of the affected population.

In the event of a disaster, the activities of NEMA, SEMA and LEMA are co-ordinated through a co-located Disaster Office (DO). Post-disaster concerns are also resolved by these three agencies in the DO.

The National Disaster Response Plan (NDRP) prepared within the span of two years through researches and analysis of experts from different fields with relevance to disaster management and approved by the Federal Executive Council (FEC) is the policy guideline for disaster management in Nigeria. The document's scope is mainly guided by the concepts of response and recovery[30].

Response activities include direction and control, early warning, evacuation and emergency services. These are designed to address immediate and short-term effects of the onset of an emergency or disaster. They help to reduce casualties and damage and also to speed up recovery program.

Recovery includes both short and long-term activities. Short term operations seek to restore critical services to the community and provide for the basic needs of the public.

Long-term recovery focuses on restoring the community to its normal or improved state or affairs. Recovery actions could be temporary housing and feeding, restoration of non-vital government services, and reconstruction of damaged areas.

The Support Service Areas (SSAs) are detail responsibilities of each stakeholder and various arms are clearly spelt out in the document. The SSAs has the following specializations of Transport, Communication, Public Works and Engineering, Fire Fighting, Information and Planning, Mass Care, Resource Support, Health and Medical Services, Search and Rescue, Hazardous Materials, Food and Water, Military/Police Support.

An appraisal of the effectiveness of these disaster management agencies in Nigeria is not far-fetched. Firstly, the procedure of obtaining worthwhile emergency assistance from the agencies are too cumbersome, bureaucratic and not 'emergent' enough. Secondly, the activities of NEMA is limited to urban centres where the headquarters and zonal offices are located. Thirdly, it is doubtful whether the so-called LEMA is not just a "paper work" even though there is no statistics to this fact but mere observation reveals that there is negligence on the establishment of LEMA on the parts of state and local governments in Nigeria.

Regrettably, NEMA is constantly denied financial support to be effective in its operations. This is not just a fourth mishap to the whole system but a situation that has led NEMA and so-called SEMA to be "a watch-dog on the printed pages." For instance, Salemi[31] pointed out that "the emergency problem is attributable to the failure of governance". He remarked that:

"On January 18, 2008, the Director General of NEMA, Air Vice Marshal Audu Bida told the Senate Committee on Federal Character that the federal government was owing the agency N9.4billion of un-remitted ecological funds, which would have gone a long way to acquire a warehouse of emergency equipment".

The Director General said further that "in 2007, the agency was to receive N4.7billion, but, unfortunately, we got nothing." But the question that comes to mind is that if these huge amounts were released to NEMA, would the money not have been siphoned into private coffers. A national emergency agency like NEMA to prevent, mitigate and prepare for disasters for a big and highly populated country like Nigeria cannot but be epileptic with only one rescue helicopter. The Director General of NEMA is also aware of this fact. This is evident when he decried that[31]

"NEMA does not have the manpower that quails disaster physically. We count on other agencies who are trained for different types of emergency situations to come in like when there's flooding, we expect the Civil Defence to come in to rescue people physically. When there's building collapse, we don't expect the Civil Defence to be there"

He said further that "when there's fire incidence of course, we expect the fire fighters to be there. So these are the issues. We just coordinate their things. We don't have the specialized personnel to handle some of these mishaps. The

whole of NEMA staff is less than 300”

Concerning the incidence of building collapse on Tuesday, July 29, 2008 at Utako District, Jabi, Abuja with 70 death toll, the Abuja Branch Secretary of the Red Cross Society, Mr. Nwaubani, has this to say[30]:

“The level of emergency in the country is poor. We do not have equipment on ground. If not for the construction companies (Dantata and Sawoe and Costain) that came to assist, I wonder what would have happened. Berger joined us this (Wednesday) morning. The body recovered this morning was still fresh. That shows that if the emergency situation was better, he would have survived.” All emergency management agencies can put the past behind them and awake to the cry of the dying Nigerian masses from environmental disasters and building collapse.

4. Recommendations and Conclusions

Considering the magnitude of human loss associated with building collapse and other disaster and the ineffectiveness of the emergency management agencies in Nigeria, there is need for immediate review of practical policy guidelines by the government that should be carried out to letter to make Nigeria safe for living. In view of this, the following recommendations are necessary for implementation by all stakeholders in disaster management generally and building collapse in Nigeria:

Policy review of the emergency agencies to simplify their hitherto bureaucratic procedures of operations;

Adequate funding and monitoring of the activities of all emergency management agencies (NEMA, SEMA, LEMA, Red Cross Society, Fire Services, NGO's, among others);

Creation of adequate emergency management awareness to the Nigerian populace, both rural and urban;

Appointment of qualified and expert building professionals - architects, engineers, etc - by building clients for design and supervision;

Statutory implementation of all physical development planning regulations, acts, bye-laws and codes in the processing of building permit, actual construction and post occupancy follow-up;

Prosecution of physical development and planning culprits.

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