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Impacts of Building Collapse on Sustainable Development in Nigeria

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Abstract

Building collapse is a major disaster associated with constructions, developments, and national growth experienced by all nations of the world but its prevalence and devastating effects on sustainable development in Nigeria has become issues of concern. The incidences of building collapse in Nigeria have lead to irreparable loss of valuable lives and properties. This paper tied together strands of thought through review of literatures of various researchers, books and personal research/observations. It was discovered that most building collapse in Nigeria was as a result of structural defects, poor designs, dilapidation due to lack of maintenance, substandard construction materials, inadequate supervision and monitoring, carelessness, poor workmanship, excessive loading, illegal repair, greed/corruption, clients impatience and natural mayhem (flooding and rainstorm). It is the opinion of the paper that the attainment of sustainable development will remain a mirage in Nigeria if the current rate of building collapse is not stopped. The paper emphasized useful and far reaching recommendations in other to stem the tide of the menace and ensure safer and better built environment.

Keywords: Menace, Incessant, Building Collapse, Sustainable Development.

1.0 Introduction

Buildings are structures which are specially designed and planned to provide the spaces and facilities needed for its purpose. They serve as shelter for man, his properties and activities. Buildings are expected to be properly planned, designed, constructed, managed and maintained to offer desired satisfaction to the occupant, enhance the environment and aid national development (Babalola 2015). Good buildings, as characterized by Oni (2010) are those that offer security, safety, convenience, social satisfactions, psychological and economic satisfactions to the occupiers. Omole (2001), also noted that building condition is the totality of the 'state' of the physical, environmental and the satisfactory level of a particular dwelling unit, measured against some variable of liveability at a particular time. It is therefore expected of buildings to meet the needs of the present as well as contribute to future needs thereby echoing building sustainability. Furthermore, constant building failure and collapse have limited the contribution of real estate development to Nigeria's Gross Domestic Product as the potential of building sector has not fully yielded the desired results (Adesanya and Olanrewaju 2014). In some cases, buildings that are expected to meet the people's daily needs have become source of great concerns due to their incessant failure and collapses.

Building collapse poses negative impacts on the economy and sustainable development of Nigeria. Vast literature noted that the high rate of recurrence of building collapse, is however not limited to the urban centres but cuts across cultural, ethnical and geographical formations of the country (Ayedun, Durodola, & Akinjare, 2011). Adenuga (2012) also purported that building's life expectancy is affected by not only improper design but also by improper building construction and management. This was corroborated by Windapo and Rotimi (2012) that some stakeholders in construction industry engage in unsustainable practices by not considering the future in their practices, thereby contributing immensely to the general under performance of building, its failure and frequent building collapse in Nigeria. It is worthy of note that provisions of safe, secured and affordable homes are major contributors to sustainable development of any nation. As much has various governments both local and federal pursued adequate housing 'or housing for all', many housing provision deteriorate with time as it reflects the quality of design, materials, construction and maintenance employed for the buildings.

Development and construction of property is very necessary to the nation's growth, corporate and non-corporate organizations and every individual. Many

individuals construct properties for either personal or investment purposes. The magnitude of unceasing buildings collapse in Nigeria is becoming very unprecedented, alarming and worrisome to all stakeholders in the built environment. According to Fajobi (2009) cited in Oloyede, Omoogun & Akinjare (2010), Nigeria is not among countries with histories of much natural disasters but the country has her own share of disasters, which are mainly man-made among which building collapse ranks very high. Building collapse occurs in many countries of the world but the rate of occurrence and the intensity of damage are low in the technologically advanced economies. The reason for this is not farfetched; the developed countries impose strict building controls, enforce building codes and ethics of professionalism unlike Nigeria where negligence, unprofessionalism and lack of building control is the norm thereby making buildings to collapse more frequently.

This paper examines the trend of building collapse in Nigeria from 1974 when building collapse was first reported to 2018 when this study was carried out; its colossal effects on the economy, individuals and implication on sustainable development. In the same vein, the responsibilities of individuals, professionals in building industry and governments at all levels towards ameliorating the menace as well as the significance of the study to policy makers that will put a stop to the trend of incessant building collapse in Nigeria are discussed.

2.0 Building Failure

Building Failure is the inability or insufficiency of the building components to perform their expected functions as specified in the design and construction requirements. Building failures can be categorized as physical or structural and performance failures. Physical or structural failure occurs in building due to loss of certain characteristics and strength thereby making such building not strong enough to support the applied load. Performance failure on the other hand, is the reduction in function of building below an established acceptable limit (Douglas and Ransom 2007). According to Ede (2010) "Every structural system is designed to meet some needs and be safe to avoid loss of live, property and damage to the environment. In a normal setup, building collapse is not expected within the projected lifespan of structures, but due to the imperfection in the actions of human beings and the existence of so many other external factors that influence the safety of structures, failures do occur."

Building failure is a common phenomenon all over the world and not peculiar to Nigeria, a number of cases were reported at the international level, but the frequency of occurrence and the consequence devastating effects in the developing countries like Nigeria has become a reoccurring decimal, a worrisome menace nightmare and an embarrassment. In Asia for instance, Mumbai recorded one of the highest numbers of building collapse between 2008 and 2012. Due to scarcity of land and high rent, constructing new houses was difficult for the middle and low class citizens. They were forced to live in old dilapidated properties which resulted into over 100 building collapses in the city in which 53 people died and 103 others were injured. Lack of maintenance, use of substandard materials, inadequate supervision and non-adherence to building codes were all attributed as the causes of the disaster. According to Corbett (2015) cited in Babalola (2015) Dhaka also had her share of the menace. The shortage of land and flooding problem facing the country made a factory owner to construct additional floors without reference to building codes and approvals. As a result, a deadliest factory collapse was recorded in 2013 leading to the death of over 547 people.

Structural failure in buildings comes in various forms and degrees of severity ranging from deterioration to decay and a total loss of bearing strength, resulting in sudden breakdown, physical depletion and/or falling apart is termed a collapse. Akinpelu (2002) ascribed environmental changes, natural and manmade hazards, improper presentation and interpretation in the design as the major causes of structural failure in building. Oloyede et al (2010) described the causes of building failure as improper design, incompetent contractor, faulty construction methodology, poor Town Planning approval /development monitoring process, non-compliance with specifications/standards by developers/contractors, use of substandard materials and equipment, inadequate supervision or inspection/monitoring, economic pressures, incompetent conversion, change of use of buildings, aged buildings as well as poor maintenance culture. Taiwo and Afolami (2011) pointed at inadequacies of empirical rules such poor construction, mistakes by construction supervision and lack of adequate understanding of the new construction technologies and structural intricacies as causes of building failure. Building failure is peculiar to different building situations and when it is not addressed, it results in building collapse. Adenuga (2012) revealed that the building industry is proliferated with the activities of quacks and inexperienced contractors which have led to collapse of many buildings in Nigeria. He also highlighted poor management and leadership on the part of the Site Engineers and Builders as some of the causes of building failures in Nigeria.

It can therefore be inferred from all the above assertions that greed, incompetence, corruption, poor planning, poor enforcement of building codes, inadequate public awareness and education, and limited financial and technical resources are the major factors responsible for building collapse in Nigeria.

3.0 Building Collapse and Sustainable Development in Nigeria

Sustainability is meeting the need of the present generations without jeopardizing the potential of people in the future to meet their own needs. Provisions of safe, secured and affordable homes are major contributors to sustainable development of any nations. Designers and property developers may deliberately utilize high technological innovation in construction; such innovative ideas must put in mind the need for sustainability. It must be able to endure various parameters both now and future. Sustainable properties therefore are those that are expected to meet all requirements, add value to the present generation without limiting their future use, increase the national asset stock and enhance Gross Domestic Product. Sustainable development can therefore not be achieved without reliable built structures.

In Nigeria, various cases of building collapse have caused irreparable losses of lives and properties thereby limiting the future uses of those lost lives and properties which in turn have negatively impacted the socio-economic status of its citizenry and working contrary to the sustainable development goal. Building collapse if not checked by all standards, would create a vacuum in the supply-demand dichotomy of the property market, which otherwise would have brought about economic growth and development. Adequate assessment at conception, development and maintenance/management stages will prevent poor quality material utilization or workmanship. Adesanya and Olanrewaju (2014) inferred that incessant building collapse resulted from non-conformity with the basic principles of sustainable development which advocated the use of durable and sustainable materials, proper planning approval procedures and sustainable building construction management.

4.0 Causes of Building Collapse in Nigeria

Building collapse is the failure of all or a substantial part of a building, where full or partial replacement may be needed (Oni, 2010). Distresses and collapse are the outcome of failure in a building. In terms of functionality, collapse occurs when the entire or a substantial part of a structure comes down thereby losing the ability to perform its function. Building collapse is the total loss of bearing strength resulting in a sudden breakdown, physical depletion and/or falling apart (Oloyede, et al., 2010). Oni (2010) classified building collapse as either total or partial collapses. Total collapse occurs when some or many primary structural members of a building have fallen down completely, while partial collapse occurs when only some of the primary structural members of the building components have fallen down. Building collapse occurs when building is overloaded or overstressed beyond its bearing capacity thereby causing breaks up of its structural members. Natural and Man-made factors are responsible for such overloading and overstressing. Natural, when caused by nature and not by human influence such as earthquakes, wind, rain and typhoons while man-made when caused by man's negligence, carelessness and unsustainable practises such as faulty building design, poor foundation works, poor quality of building materials, lack or inadequate monitoring of craftsmen and poor quality of workmanship (Oloyede, et al., 2010).

Knowing the major causes of collapse in Nigeria and finding permanent solution have been one of the major concern to all stakeholders in building industry, government and researchers as there must be a way out of the menace and its effects. Olawunmi and Fagbenle (2010) pointed at the factors responsible as hasty construction, unprofessional attitudes in which most private clients handle their building projects, low level of compliance with the approval of building plans before construction commencement, and the ineffective monitoring mechanism put in place by the relevant government. Further study by Akande et al (2016) showed that among the above listed factors, substandard materials and poor workmanship contributed 45% to building collapse in Nigeria. This was corroborated by Oloyede, et al., (2010) that poor building materials, engagement of craftsmen instead of professionals to supervise building construction and making the building code ineffective due to lack of political will by the enforcement agencies are all indices for most of the collapsed buildings in Nigeria. Olanitori (2011) also stated the causes of building collapse in Nigeria to include compromise in the structural integrity of the building, construction errors and the lack of local code of practice which would have taken into consideration the effect of the quality of our local materials for construction.

Akande et al., (2016) posited that building collapse mostly resulted from defects and/failures in building which when not quickly, properly and adequately corrected. Such defects could be one or all of; unstable/faulty

foundation, cracking of walls, dampness penetration, insect or termite attack, roof defects, defective plastered renderings, peeling paint, fungus stain and harmful growth on building and poor installation of building services. It is impossible to avert building deterioration due to ageing but it must be of utmost importance that proper measure and adequate maintenance is properly carried out on buildings at the right time to avert failure and collapse. Buildings start to deteriorate immediately after construction is completed therefore the need for maintenance in order to keep them in good condition should begin immediately after construction. Thus, the rate of building deterioration, failure and collapse depends largely on nature and manner of maintenance. Ageing and deteriorations of building fabrics starts immediately its construction started (i.e. wear and tear) with some affecting the structural stability of the building. It should not be expected of any building to last forever but a good quality control, periodical checks to identify defects with possible causes and adequate maintenance make buildings last longer. Maintenance is referred to as "a stitch in time that saves nine". Olatubara and Adegoke (2007) posited that maintenance of building is related to repairs, replacements and/or redecoration of any building to achieve aesthetics, enhanced useful economic life and value. It is a continuous and prompt exercise of correcting defects or damages in building as soon as they appear before further damage is done. Adenuga (2012) advocated three different types of maintenance for building which are; curative maintenance, preventive maintenance and planned maintenance. According to Ogunbajo (2013), building maintenance involves the collective upgrading of all component parts of building to the original functional efficiency and currently acceptable standard. Maintenance therefore transcends the building structure to the internal facilities and equipment as well as the relationship with the adjoining building structures. A form of maintenance information system analysis is therefore advocated for building structures for effective predictions and job performance.

5.0 Incidences of building collapse in Nigeria

Building collapse in Nigeria dates back to the 70's when a multi-storey building under construction in Mokola Ibadan collapsed. It was the first documented building collapse after independence in Nigeria which resulted to the death of about 27 people. Thereafter lots of building collapses have occurred in Nigeria leading to loss of many live and properties. Building collapse in Nigeria is non-respecter of location, size or uses of building (Oluwunmi and Fagbenle 2010). Its occurrence ranges from residential building, office complex, school building and religious building. The fence of a Nursery and Primary School that collapsed at Olomi area, Ibadan, in March, 2008, thereby killing thirteen (13) pupils of the School corroborate this fact (Folagbade 2001). Building collapse in Nigeria occurs at any time and at different stages of construction, the time of occurrence is unpredictable while the frequency is alarming. The past few years in Nigeria witnessed the collapse of many buildings at various stages of completion as enumerated in the table below, wherein many lives were lost and properties worth millions of naira destroyed (Adenuga 2012).

Table I: Detail analysis of reported building collapse in Nigeria between 1974 and 2018

S/N	TYPE OF BUILDING STRUCTURE	LOCATION OF BUILDING	DATE OF COLLAPSE	SUSPECTED CAUSE(S)	LIVES LOST/ INJURED
1.	Multi-storey Building under construction	Mokola, Ibadan, Oyo State	October 1974	Excessive loading/structural failure	27 died
2.	Hostel Building	O.A.U., Ile-Ife, Osun State	1976	Structural Failure	Nil
3.	One Storey building	Ondo State	1976	Substandard Building Materials/Structural Defect	8 died
4.	Two Storey building	Oyo state	May 1977	Substandard Building Materials/Structural Defect	10died
5.	Residential Building	Barnawa Housing Estate, Kaduna State	August 1977	Faulty design	28 died
6.	School Building	Secondary school, Makarfi, Kaduna	July 1977	Carelessness	Not reported
7.	Four Storey building	Borno State	October, 1977	Poor Performance by Contractor	10 died
8.	3-storey building	Western Avenue,	1978	structural defects	Not reported

		Surulere, Lagos			
9.	Four Storey building	Rivers State	March, 1978	Lack of Concrete Services to hold Foundation	16 died
10.	3-Storey Residential Building	Barnawa Housing Estate, Kaduna	1980	Structural design	6 died
11.	Two Storey building	Ondo State	June 1982	Heavy Downpour / Structural Defect	7 died
12.	4-storey building–	Lewis St. Lagos Island	1983	structural defects	Not reported
13.	2-storey building	Iponri, Lagos	1983	structural defects	Not reported
14.	2-storey building	Oju-elegba Road, Lagos	1983	structural defects	Not reported
15.	2-storey building	Beecroft street, Lagos	1984	structural defects	Not reported
16.	Four Storey Uncompleted Building	Allen Avenue, Ikeja Lagos	January 1985	Excessive Loading, Structural Defects, carelessness	Nil
17.	Two storey Residential Building	Ojuelegba Area, Lagos	May 18, 1985	Poor Materials, Rainstorm	Undisclosed
18.	Residential Building (Uncompleted 4 Storey Building)	Western Avenue Iponri, Lagos	May 20, 1985	Structural Failure, excessive loading, carelessness	13 died
19.	Three Storey Residential Building	Victoria Island, Lagos	July 18, 1985	Excessive Loading, Structural Defects	13 died (all of the same family
20.	Residential Building	Gboko, Benue State	Sept. 1985	Carelessness	1 died
21.	Cental pavilion of Anambra State Trade fair Complex	Anambra State	Sept. 1985	Not reported	Not reported
22.	Three Storey Building	Adeniji Adele, Lagos	1985	Faulty design, Carelessness, Structural Defects	2 died
23.	High Court Building	Isala Area, Imo State	February 1986	Structural Failure	2 died
24.	Mosque Building	Osogbo, Osun State	May, 1986	Structural Failure	2 died
25.	Residential Building	Ona Street, Unuga, Anambra State	1986	Not reported	2 died
26.	Uncompleted Three Storey Building	Usabi, Maryland Lagos	1986	poor materials	Not reported
27.	Uncompleted Six Storey building	Western Avenue, Iponri Lagos	1986	poor materials	Not reported
28.	Uncompleted 3storey building	Orile–Iganmu Lagos	1986	poor materials	Not reported
29.	2-storey Uncompleted Building	Berkley lane, Lagos Island	1986	poor materials	Not reported
30.	Uncompleted Three Storey Building	Idunsagbe Lane, Lagos Island	1986	poor materials	Not reported
31.	A Bungalow Building	Beere Ibadan Oyo State	June, 1986	Not reported	Not reported
32.	Two Storey Building	Akinade village, Ikeja, Lagos	1987	structural defects	Not reported
33.	Two Storey Building under Construction	Agege, Lagos	May 9, 1987	Structural defects	2 died
34.	Three Storey Building	Idumagbo area, Lagos	1987	structural defects	Not reported
35.	Four Storey Building	20, Idusagbe Lane, Idumota Lagos	Sept. 14, 1987	No Structural Design	17 died
36.	Three Storey Building	Ikorodu Road, Lagos	Sept. 1987	Rainstorm, Structural Defects	4 died

37.	Residential Building	Calabar, Cross River State	Oct. 9, 1987	Rainstorm	3 died
38.	Residential Building	Kano State	1988	Not reported	Not reported
39.	Four Storey Building	Adeniji Adele, Lagos Island	1989	dilapidation	Not reported
40.	Six Storey Royal Hotel	Idumota, Lagos Island	1989	structural defects	Not reported
41.	School Building	Beecroft lane, Lagos island	1989	structural defects	Not reported
42.	One-Storey Hotel Building	Benin-City, Edo State	July 1989	Not reported	Nil
43.	6-storey Hotel Building	Akinwunmi street, Mende Village, Lagos	October 1989	Faulty design	Nil
44.	Bungalow School Building	Obasiolu - Diobu, Port-Harcourt, River State	June 15, 1990	Ignorance of the owner and absence of structural design	50 died
45.	Three Storey Uncompleted Building	Idi-Oro, Mushin Lagos	1990	structural defects	Not reported
46.	Four Storey Office Block	Idumagbo, Lagos Island	1990	structural defects	Not reported
47.	Three Sstorey Uncompleted Building	Idumota, Lagos Island	1990	structural defects	Not reported
48.	School Building	Alagbado, Ogun State	Oct 1990	Not reported	Nil
49.	Three Storey Building	Moyosore close, gbagada, somolu Lagos	1991	structural defects	Not reported
50.	Lecture Hall,	Unilag, Faculty of Education, Akoka Lagos	1991	structural defects	Not reported
51.	One Storey	Kano	July 1991	Substandard Materials	3 died
52.	One Storey	Sokoto	July 1991	Heavy Downpour/Structural Defect	4 died
53.	2-storey building–	Hawley road, Sabo, Yaba Lagos	1992	structural defects	Not reported
54.	Three Storey Uncompleted Building	Alafia Street, Mushin Lagos	1992	poor materials	Not reported
55.	Two Storey Building	Oyadiran Estate, Yaba Lagos	1992	structural defects	Not reported
56.	Multi-purpose Indoor Sports Complex Storey	Area 10, Abuja	March 1993	Structural failure/Poor workmanship	Not reported
57.	6-storey Hotel Complex	Okupe Estate Maryland, Lagos	1993	Structural Failure	Not reported
58.	Multi-purpose Indoor Sports Complex Storey	Area 10, Abuja	March 1993	Structural failure/Poor Workmanship	Not reported
59.	Multi-storey Building NICON-NOGA Staff Housing Project	Karu, Abuja	March 25, 1993	Structural failure/use of incompetent Supervision	Not reported
60.	Block of 4No. flats	Adeniyi Close, Bariga Lagos	1993	structural defects	Not reported
61.	One Storey Building	Kano State	Oct 1993	Dilapidated Structure	
62.	Two Storey Building	Oyo , State	March 1994	Structural Defect	4 died, 11 injured
63.	Three Storey Uncompleted Office Block	Airport Road, Oshodi Lagos	1994	poor materials	Not reported
64.	Hotel Building	Okesuna Road, Lagos Island	1994	structural defects	Not reported
65.	Three Storey Uncompleted Building	Idumagbo Area, Lagos Island	1994	structural defects	Not reported
66.	Estate Building	Ajah, Etiosa Lagos	1994	structural defects	Not reported
67.	Three Storey Building	Airport Road, Oshodi Lagos	1994	structural defects	Not reported
68.	One Storey Building	Kwara State	August	Structural Defect/Poor	2 died, 6

			1994	Workmanship	injured
69.	Two Storey Building	Oyo State	August 1994	Structural Defect/ Substandard Materials	10 died, 74 injured
70.	One Storey Building	Ondo State	August 1994	Structural Defects	1 died, several injured
71.	A Mosque Building under Construction	Abeokuta Ogun State	1995	Structural failure/use of incompetent Supervision	2 died
72.	Storey Building (under construction)	Central Lagos	October 5, 1995	Poor workmanship/ structural failure	10 died
73.	Three Storey Church Building	Lagos	October 30, 1995	Structural failure	6 died
74.	School Building	Alagbado Area, Ibadan Oyo State	October 1995	Poor workmanship	Nil
75.	3-Storey Building	Oke Igbala Area, Ibadan Oyo State	October 1995	Structural failure	6 died
76.	Four Storey Uncompleted Building	Ajao Estate, Lagos	1995	poor materials	Not reported
77.	Two Storey Uncompleted Building	Iponri, Lagos	1995	structural defects	Not reported
78.	Three Storey Building	Agege, Lagos	1995	structural defects	Not reported
79.	Five Storey Uncompleted Building	Ikorodu Road, Maryland	1995	poor material	Not reported
80.	Two Storey Building	Agege, Lagos	1995	structural defects	Not reported
81.	Three Storey Uncompleted Office Block	Maryland, Ikeja Lagos	1995	structural defects	Not reported
82.	Six Storey Uncompleted Building	Wale Ajose St, Mende, Lagos	1995	structural defects	Not reported
83.	Two Storey Building under construction but being used as church (Earlier approved as a bungalow)	Olowookere street, Mafoluku, Oshodi, Lagos	June 1996	Structural Weakness	7 died
84.	Storey Building under Construction	Lagos State	March 13, 1996	Structural failure	People only injured
85.	6-Storey Building under Construction (being used as Nursery/Primary School)	Lagos State	October, 1996	Use of quacks/Structural Failure	1 died
86.	2-Storey Building	Amu Street, Mushin, Lagos	June, 1997	Use of poor materials/structural failure	Nil
87.	Three Storey Building under Construction	Enugu, Enugu State.	June, 1997	Not reported	Not reported
88.	Mud Building	Ilorin, Kwara State	Sep 1997	Not reported	Not reported
89.	Duplex Building	Gwarinpa Area, FCT, Abuja	1998	Structural failure	2 died
90.	3-Storey Residential Building	Ibadan, Oyo State	1998	Faulty, Design/Poor workmanship	Several people
91.	4-Storey Church Building (under construction)	Akure, Ondo State	Oct. 1, 1998	Structural failure/Poor Supervision	8 died
92.	2-Storey Residential Building	Rd 3, Plot 10, Funbi Fagun Street, Abeokuta, Ogun State	Nov. 1998	Use of poor materials/structural failure	Nil
93.	Church Building Under Construction	Mafoluku, oshodi Lagos	1998	Structural failure	Not reported
94.	Three Storey Uncompleted	Igbobi, Somolu Lagos	1998	Structural failure	Not reported

	Building				
95.	Three Storey Uncompleted Building	Idumota Area, Lagos Island	1999	Structural failure	Not reported
96.	Eleganza building	Ikota, Ajah, Lagos	1999	Structural failure	Not reported
97.	2-Storey Building	Idusagbe Lane, Lagos Island	1999	Structural failure	Not reported
98.	3-Storey Building	Oke– Igbala, Mushin Lagos	1999	Structural failure	Not reported
99.	Church Building	Olowookere, Oshodi, Lagos	1999	Structural failure	Not reported
100.	3-Storey Residential Building	Ojuelegba, Western Avenue, Surulere, Lagos State	1999	Carelessness/use of poor materials	4 died
101.	1-Storey Residential	AdeolaOdeku Street, Victoria Island, Lagos	1999	Rainstorm	Not reported
102.	3-Storey Residential Building	Charity Road, Oko-Oba, Lagos	June 1999	Structural failure	Nil
103.	3-Storey Residential Building	Iju-Isaga, Lagos	August, 1999	Structural Faulty/Rainstorm	35 died
104.	One – Storey Hospital Building	Nigerian Air force, Aero Medical Center, Kaduna	August, 1999	Not reported	Not reported
105.	3-Storey Residential	Four-square Gospel Church Abuja	October, 1999	Faulty design/ Implementation	Not reported
106.	1-Storey Residential Building	Obawole street, Iju, Agege, Lagos	October, 1999	Structural failure	Nil
107.	2-Storey Residential Building	Dawodu street, Ifo, Ogun State	October, 1999	Rainstorm	20 died
108.	Residential Storey Building	Idi-Oro, Mushin, Lagos	2000	Faulty Design/Carelessness	Not reported
109.	Church Building	3/13 Thomas drive, Bariga Lagos	2000	pressure on uncompleted structure, structural defects	120 injured and 3 died
110.	Residential Storey Building	Oke-Bola Ado Ekiti	2000	Poor workmanship, substandard materials & rainstorm	Nil
111.	Estate Building	Ajah, Along Lekki Road, Lagos	April, 2000	Structural Failure	Nil
112.	Residential Storey Building	Ogbagi Steet Ikare Akoko Ondo State	2000	Foundation Problem	Nil
113.	Residential Building under Reconstruction	14, Semi Sarumi Street, Itire Lagos	2000	deterioration of existing building; improper design	1 died
114.	School Wall Fence	State High School, Alimosho, Lagos	2000	weak and un–braced wall	3 students injured, 1 died
115.	4-Strorey Building	56a Adeniji Adele Street, Lagos Island	2000	contravention of planning approval	Nil
116.	4-Storey Building	10– 12, Suene Street, Surulere Lagos	2000	structural defects	2 died
117.	Primary School Building	Atunrase street, Surulerelagos	2000	structural defects	Not reported
118.	3-storey uncompleted building	Igbosere street, Lagos Island	2001	structural defects	Not reported

119.	4-storey uncompleted building	Idusagbe lane, lagos Island	2001	structural defects	Not reported
120.	2-Storey Mosque Building	21, Buhari Street Mushin, Lagos	April 2001	Unauthorized Conversion of former Bungalow to 2-Storey Building	7 died
121.	1-Storey Residential Building (under construction)	Iwoye-Ijesa, Osun State	2001	Structural failure/ use of quacks for supervision	7 died
122.	Residential Building	OdoIkoyiAkure, Ondo State	2001	Foundation Problem	Nil
123.	2-Storey Building	Agege Road, Lagos	2002	Structural Defect	Not reported
124.	3-Storey Building	Allen Avenue, Ikeja Lagos	2002	Structural Defect	Not reported
125.	2-Storey Building	Isiaka Street, Off Agege Road, Lagos	2002	Structural Defect	Not reported
126.	3-Storey Building	10 Jones street, Ebute Metta west Lagos	2002	Dilapidation. structural defects	Not reported
127.	2-Storey Building	49, Olonode Street, Yaba, Lagos	2002	structural defects	Not reported
128.	2-Storey Building	Stadium road, Akure	2003	No structural members	Nil
129.	2-Storey Building	8 Onyearugbulem market, Akure	2003	Poor workmanship & under-reinforcement of the cantilevering end	Nil
130.	2-Storey Building	Ojuelegba, Akure	2003	Poor workmanship & under-reinforcement	Nil
131.	1-Storey Building	50 Willoughby street Ebute Meta Lagos	2003	Structural Defect	8 injured
132.	4-Storey Uncompleted Building	Adeniji Adele Road, Lagos	2003	Structural Defect	Not reported
133.	3-Storey Uncompleted Building	Ojuelegba Road, Lagos	2003	Construction Defects	Not reported
134.	Uncompleted 3-storey building	Bereka Lane, Lagos	2003	Structural Defect	Not reported
135.	3-Storey Building	Pedro street, near Idumagbo Avenue, Lagos	2003	impact of an explosion from the nearby building	Not reported
136.	3-Storey Building	28 idumagbo avenue, Lagos Island	2003	explosion from storage of pyrotechnic devices used in fire works	30 people died, 60 injured
137.	Two-Storey School Building	Port Harcourt, River State	2003	Not reported	Not reported
138.	3-Storey Building	22, Markurdi street, ebuteMetta, Lagos	2004	structural defects	Not reported
139.	2-Storey Uncompleted Building	Ilasamaja Mushin, Lagos	2004	poor materials	Not reported
140.	2-Storey Structure	10, Elias Street Lagos	2004	Rainstorm, dilapidation, lack of maintenance	8 died
141.	2-Storey Building	Anthony Way, lagos	2005	structural defects	Not reported
142.	3-storey uncompleted Building	Adenijiadele, Lagos Island	2005	structural defects	Not reported
143.	3-Storey Building	6, Princess Street, Lagos Island	2005	Poor construction materials	Not reported
144.	2-Storey Building	40, Market street, Shomolu, Lagos	2005	structural defects	Not reported
145.	2-storey Uncompleted Building	Mende, Maryland, ikeja Lagos	2005	structural defects	Not reported

146.	Commercial Building	Port Harcourt, Rivers State	2005	Not reported	Not reported
147.	4-Storey Building	53, Cemetery Road, Amukoko, Lagos	2006	structural defects	Not reported
148.	3-Storey Building	Ijora, Ajegunle Lagos	2006	structural defects	Not reported
149.	2-Storey Building	1, Murtala Muhammed Airport Road Oshodi, Lagos	2006	structural defects	Not reported
150.	3-Storey Building	42, Ibadan Street, Ebuta meta, Lagos	2006	structural defects	Not reported
151.	Bank of Industry building	Broad street lagos island, Lagos	March, 2006	Weakened structure resulting from fire outbreak/ heavy wind and rain	2 died, 23 injured
152.	Three Storey School Building	Ikpoba-Okha Local Govt., Edo State.	April, 2006	Not reported	2 died
153.	3-storey building with penthouse	71, Ibadan Street, Ebute Metta West Lagos	July 18,2006	Faulty construction	28 died
154.	one-storey building, under construction	Benjamin Opara Street, Port-Harcourt, River State	2006	Not specified	Not reported
155.	Three Storey buildings	Surulere , Lagos	2006	Not specified	28 people died, 50 injured
156.	Three Floor Building Housing Office and Church	Abuja	June 2006	Not reported	Nil
157.	2-Storey Building	118, Ojuelegba Road, Surulere Lagos	2007	structural defects	Not reported
158.	2-Storey Building	8 Ashaka Street, Abule-nlaEbuteMetta Lagos	2007	structural defects	Not reported
159.	3-Storey Building	71 Agoro Street, Lagos	2007	structural defects	Not reported
160.	4-Storey Building	32B Egerton Lane, Oke Arin, Lagos	2007	structural defects	Not reported
161.	3-Storey Building	38, Idumagbo Avenue, Island	2007	structural defects	Not reported
162.	3-Storey Building	48, Adams Street, Lagos	2007	structural defects	Not reported
163.	2-Storey Building	Lasu-iba road, opposite Rosellas, Lagos	2007	structural defects	Not reported
164.	Multi-Storey Building	Kano	2007	Faulty design/structural failure	Several People died
165.	A Building being used as Nursery/Primary School	Olomi Area Ibadan, Oyo State	March 25, 2008	Use of poor materials Carelessness	13 pupils
166.	5-Storey Shopping Complex Building under construction	Wuse Area, Abuja	August 02, 2008	Structural failure incompetency/bad workmanship .	2 people injured and 100 people trapped.
167.	2-Storey Residential Building under construction	Asero Area, Abeokuta Ogun State	August 30, 2008	Contravening the given planning Approval, use of substandard materials incompetency, etc.	2 died
168.	Residential Building	Apongbon Lagos	2008	Structural defect	3 died
169.	Residential Building	Alade Street Lagos	2008	Structural defect	3 died 5 injured
170.	6-Storey LAUTECH Teaching Hospital Complex	Ogbomoso, Oyo State	Feb 19, 2009	Use of substandard materials, poor	5 died

	under construction			workmanship/supervision	
171.	A wall fence	Aghaji crescent, GRA, Enugu	Aug 10, 2009	No proper drainage	1 died
172.	Uncompleted Building	Oke Padre Street, Ita-morin, Abeokuta	October 18, 2009	Use of substandard materials, hasty construction	3 died, 11 injured
173.	Building under Construction	Isopakodowo Street Cairo, Oshodi, Lagos	April 26, 2010	Use of Substandard building materials	4 died, 12 injured
174.	Uncompleted Storey building	Adenike Street off New market, Oniru Estate, VI Lagos	June 02, 2010	Use of Substandard building materials, Non-compliance o house-owners and developers with approved building plan and weak structure	1 died, 2 injured
175.	Uncompleted 4-Storey Building	2 Okolie Street, off Gimbiya Street in Abuja.	August 11, 2010	Substandard materials and disregard for building regulations	23 died, 11 injured
176.	Uncompleted Three-Storey Building	Ikole Street, Area 11, Abuja	August 2010	Not reported	5 died, 40 Trapped
177.	4 Storey Building	24 Alli Street off Tinubu Street, V. I Lagos	Sept,28, 2010	Structural Defects/overloading	3 died
178.	Two-Storey Market Plaza	Oshodi, Lagos	2010	Not specified	4 died
179.	Abandoned church under demolition	Anguwandosa,, Kaduna	December 2011	Wrong demolition method	5 died
180.	Uncompleted building	Gimbiya Street, Area 11 Garki Abuja	2011	overloading	5 died
181.		Kano	2011	Rain storm	6 died
182.	Three Storey Naval Building	Abuja	2012	Substandard materials, poor workmanship and Unsupervised demolition	2 died 1 injured
183.	Three Storey Blocks of Flat Building	16 Nnobi str. Enugu	2012	Structural	Not reported
184.	uncompleted One-storey Residential Building	Awka, Anambra State, Nigeria	2012	Defective material	Not reported
185.	Uncompleted three-storey Blocks of Flat Building	Owerri, Imo State, Nigeria	2012	flooding	Not reported
186.	Four-storey Building under construction	Agbama Estate, Unuahia, Umuahia, Abia State, Nigeria	2012	Non-adherence to building Regulation that permits only 2 floors in the area.	Undisclosed number of squatters on the ground floor perished
187.	Four-storey Building Commercial Building	Abanye Str. Onitsha, Anambra State Nigeria	2012	Heavy Rainfall flooding	Not reported
188.	3 storey building	Oloto Street Ebute Meta Lagos	July 2013	Not ascertained	7 died
189.	Three-Storey Building	Kaduna	July 11, 2013	Dilapidation	4 died
190.	Two - Storey School Building	Bukuru, Jos Plateau State	September, 2013,	Structural Defects/illegal conversion	30 died
191.	Multi Storey Quest House	Ikotun area, Lagos	Sept 12, 2014	Structural failure/design/detailing error	116 died, 100 injured
192.	3-Storey Building	Ebute Meta,	July, 2015	Weak Structure	Nil

		Lagos			
193.	Residential Building	Dolphin Estate, Ikoyi, Lagos	July, 2015	Gas Explosion	3 injured
194.	Five Storey Building under construction	Lekki phase 1, Lagos	March 09, 2016	Structural failure	34 died
195.	4-Storey Shopping Plaza	Itoku Market, Abeokuta, Ogun State	May, 2016	Under investigation	1 died
196.	Church building under construction	Uyo, Akwa-Ibom State	2016	Hasty construction	60 died
197.	Residential building	Police Baracks, Ikeja Lagos	2016	Structural failure/ lack of maintenance	2 died
198.	A storey building under construction	Apo Mechanic Village, Abuja	2017	Substandard materials	6 injured
199.	Four storey building	3 Massey Street Lagos Island lagos	2017	overloading	6 died
200.	Three storey mixed-building	9 Dada Alaja Steet, Oke-Arin, Idumota, Lagos	2017	Structural failure/Illegal repair	2 died, 14 injured
201.	three-storey building	6, Richard Abimbola Street, Ilasa area of Lagos	2017	Not specified	3 died, 19 injured
202.	Church building under construction	Ija-Ugho area, Arogbo Ijaw, Ondo State	2018	Substandard materials	6 died, 4 injured
203.	Four Storey Building under Construction	Jabi Abuja	2018	Investigations on-going	2 died, 18 injured
204.	Hotel Development Under Construction	Porthacourt Rivers State.	2018	Investigations on-going	6 died 35 injured

Source: Oni (2010), Fakere et al (2012), Ebehikhalu & Dawam(2014), Micheal et al (2014) Ochendo & Obi 2015), Babalola (2015)

From the table above, summary of building collapse according to the state locations is shown in table below.

Table II: Location distribution of building collapse in Nigeria

SN	STATES	NUMBER OF OCCURENCE	%
1.	Abia	1	0.49%
2.	Akwa-Ibom	1	0.49%
3.	Anambra	4	1.96%
4.	Benue	1	0.49%
5.	Borno	1	0.49%
6.	Cross Rivers	1	0.49%
7.	Edo	2	0.98%
8.	Enugu	3	1.47%
9.	Ekiti	1	0.49%
10.	FCT	13	6.37%
11.	Imo	2	0.98%
12.	Kaduna	6	2.94%
13.	Kano	5	2.45%
14.	Kwara	2	0.98%
15.	Lagos	123	60.29%
16.	Ogun	7	3.43%
17.	Ondo	10	4.90%
18.	Osun	3	1.47%
19.	Oyo	10	4.90%
20.	Plateau	1	0.49%
21.	River	6	2.94%
22.	Sokoto	1	0.49%
	TOTAL	**204**	**100%**

Table III: Distribution of building collapse across the geopolitical zones in Nigeria

SN	ZONES	NUMBER OF OCCURENCE	%
1.	North - East	1	0.49%
2.	North - West	12	5.88%
3.	North Central	17	8.33%
4.	South - East	10	4.90%
5.	South - South	10	4.90%
6.	South - West	154	75.49%
	TOTAL	**204**	**100%**

Table IV: Analysis of causes of building collapse in Nigeria

Types of fault	No of occurrence	%
Excessive loading	6	2.63%
Structural failure/defects	118	51.75%
Poor/ substandard materials	29	12.28%
Poor workmanship	13	5.70%
Faulty design/ no design	11	4.83%
Carelessness	7	3.07%
Wrong demolition method	2	0.88%
Natural factors (rainstorm, wind, flooding etc.)	14	6.14%
Dilapidation	6	2.63%
Ignorance	1	0.44%
Poor / Incompetent supervision	8	3.51%
Contravention to planning approval	8	3.51%
Lack of maintenance	2	0.88%
Explosion	4	1.75%

5.0 Findings and Discussions

5.1 Findings

Table I shows in details the total recorded occurrences of building collapse in Nigeria between 1978 to 2018 which claimed over 931 irreplaceable lives. Over 583 people were injured and property worth millions of Naira wasted. The table also shows the reasons and causes of the collapse. Examination of locations of building collapse in Nigeria as shown in table II above revealed that building collapse in Nigeria is not evenly distributed across all states.. Twenty -One (21) states and Federal Capital Territory (Abuja) had experienced documented building collapse between the periods under research. The table revealed that 60.29% of the total building collapse cases in Nigeria occurred in Lagos only; which is the highest in history of the country. This is followed by, the Federal Capital Territory Abuja which recorded 6.37% of the total incidences. It is therefore worthy of note that the prevalence of the incidents of building collapse could be associated with concentration of construction activities and population of any location. Lagos and Abuja being the commercial centre and the federal capital territory of Nigeria respectively has witnessed tremendous construction activities till date. 4.90% occurred in Oyo and Ondo States each. Ogun State recorded 3.43% while 2.94% occurred in Kaduna and Rivers State. Kano State recorded 2.45% cases of building collapse while Anambra State had 1.96% share of the menace. Enugu and Osun State experienced 1.47% each. 0.98% occurred in Edo, Imo and Kwara States respectively. Abia, Akwa-Ibom, Benue, Borno, Cross Rivers, Ekiti, Plateau and Sokoto all experienced 0.49% of building collapse respectively. Table III examined the distribution of building collapse in Nigeria across the geo-political zones; South-West region recorded 75.49% the highest occurrences of building collapse in Nigeria; followed by North Central which recorded 8.33% occurrences. North-West recorded 5.88%, South-South and South-East region recorded 4.90%. Apart from the activities of Boko Haram insurgents in the North Eastern part of Nigeria in recent times which has rendered many people homeless, there has been just one recorded case of building collapse in the region. It was discovered from the above that occurrences of building collapse was more prevalent in the South West region and more frequent in Lagos State than any other parts of Nigeria.

5.2 Discussions

It can be deduced that causes of building collapse in Nigeria as reported in Table IV above include structural failures or structural weakness, substandard materials, dilapidations, poor workmanship, illegal repair, overloading, faulty design, carelessness, natural factors (rainstorm, wind, flooding), contravention of planning approvals and lack of maintenance. This research further revealed that structural defects were responsible for the highest number of building collapse in Nigeria. Natural factors are responsible for only 6.14% of the total building collapse in Nigeria while 93.86% occurrences were as a result of human activities or in-activities.

The highest number of building collapse was recorded in Lagos where major developments in the region are concentrated. Lagos terrain is largely swampy most especially the Island where most of the land were reclaimed for building purposes many years ago without strict planning approval process which in one hand has been responsible for building collapse in the city. More so, it was found out from this research that building collapse is associated with infrastructural developments in Nigeria. Cities like Abuja, Port Harcourt, Ibadan, Kano, Kaduna and Akure where there are numbers of infrastructure facilities all recorded incidences of building collapse. Nigerian cities harbour all factors responsible for building collapse which hamper negatively on the sustainability and development of the Cities. This requires urgent intervention from the government and stakeholders to curb the menace and put Nigeria on the fast track of sustainable development.

6.0 Recommendations and Conclusion

i. It is important to incorporate sustainability into the every building project from the pre-design stage through adequate planning and appropriate site selections. Building designs must be flexible and durable enough to support future changes. Building materials must be sustainable and comply with standards.

ii. All stakeholders in the building industry must have a professional approach by following identified sustainable principles. Considering that the incidences of building collapse negate the principles of sustainable development, therefore, all stakeholders must consider the future in their current activities.

iii. Soil integrity test must be made compulsory for all building projects of any nature to ascertain the composition, strengths and characteristics of the soils before erecting building; this will help to know its suitability for any proposed building project and the type of building that can be built, on a given site.

iv. Comprehensive urban renewal scheme with quality control should be embarked upon by governments at all levels. Such scheme that would involve identification, marking and demolition of all distressed buildings in all urban cities in Nigeria. Lagos State government has started this scheme, policies should be put in place towards implementation of the scheme and other States of the federation should follow suit to ensure that the menace of collapse building in Nigeria is brought under check.

v. There must be political will on the part of Government to curb the menace of building collapse in Nigeria by enacting and enforcing laws. Building codes must be passed into law, implemented and enforced to ensure that standards are followed in terms of building materials for construction, qualifications of the Site Engineers and all other professionals entrusted with designing, constructing and monitoring building construction.

vi. Professional bodies in the built environment such as Architects Registration Councils of Nigeria (ARCON), Nigerian Institution of Estate Surveyors and Valuers (NIESV), Council for the Regulation of Engineering in Nigeria (COREN), Council of Registered Builders of Nigeria (COBON) in collaboration with relevant governmental agencies must carry out periodic and regular public awareness on the dangers involved in patronizing quacks for building designs, constructions, management, maintenance and supervisions. Building collapse and its effects will be reduced to the minimal when only professionals handle building projects.

vii. Whoever is responsible for building collapse in Nigeria must be made to face the full wrath of the law including imprisonment of clients, contractors, builders, planning approving officers, and construction engineers especially where loss of lives is involved to serve as a deterrent to unprofessional practises in Nigeria.

viii. Town Planning Authorities must be allowed to perform its functions without any political influence or interference, corruption must be discourage in its entirety among monitoring agencies and any erring staff must be punished and most importantly, honesty must be rewarded and celebrated.

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