

Building Collapse in Nigeria and its Consequences on the Architect's Role as the Leader of The Building Team

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Abstract

The mishap of building collapse does not sound strange again in many sub-Saharan cities especially Nigeria due to the frequency of its occurrence, and architects are most vulnerable to blame because of their leadership position in building delivery. Evidence in literature has suggested a critical appraisal of built environment professionals' role to tackle the menace. However, the consequence of the role of architects as prime consultants hasn't been adequately investigated. Using a systematic review of literature for reported cases of building collapse in Nigeria between 2009 and 2019, the paper examines the causes of building collapse and enumerated specific areas members of the architecture profession in the building industry are implicated. The result reveals that the major causes of building collapse are the use of substandard materials, structural defects, and the use of incompetent personnel indicating a lapse in leadership and supervisory function. Although from direct observation, the study highlights deontology as the bane of building collapse in Nigeria and recommends among others that: Standard Organization of Nigeria (SON) should ensure that only certified building materials are allowed in the market; soil tests, environmental impact analysis, and structural analysis should be mandatory as well as proper supervision of construction works by competent professionals with strict law enforcement.

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1.0 Introduction

Among other requirements of a building, the structure is stable and the functionality of its intended use throughout its lifespan. Buildings are structures designed to support live loads such as weights of people, objects, rain, wind pressure, snow, in addition to their self-loads called dead loads, and failure in this aspect result to collapse. However, the incidence of building collapse is fast becoming a universal problem of which very little has been done to curb its occurrence, especially in developing countries. In Nigeria, it poses a serious challenge to the profession of architecture and other allied professionals and stakeholders in the building industry, including governments, private developers, landlords, and users (Chendo and Obi, 2015). Notably, cities in Nigeria like Abuja, Lagos, Port-Harcourt, Ibadan, Enugu, and Kaduna, to mention but a few, are witnessing a building collapse at alarming rates with many cases of collapsed buildings recorded in the recent past. Examples of collapsed buildings include; Ibadan multi-storey building in Mokota, Ibadan (Oyo State) 1974 (Olagunju et al., 2013), Mosque building, Osogbo, (Osun State), (1986), Saque Comprehensive Primary and Secondary School, Port Harcourt, (Rivers State), which resulted in the death of over 50 pupils in June 1990. Others include uncompleted two-storey building, Isinkan, Akure, (Ondo State) (1998); two-storey residential building, Funbi Fagun street, Abeokuta, (Ogun State) (1998); Nigeria Industrial Development Building (NIDB), Lagos (2006); a two-storey market plaza in Oshodi, Lagos (2010) (Olagunju et al., 2013). Prominent among the terrifying incidences of building collapse in

Nigeria is the July 2006 collapse in Surulere, (Lagos State) where three buildings caved in, causing pandemonium among residents killing no fewer than 28 lives and leaving 50 others severely injured (Baje, 2019). Also in Lagos, about 37 people lost their lives in four-storey building mishap at Ebute Meta in 2006 (Baje, 2019). Another tragic collapse occurred in September 2014, where over 116 worshipers were killed in a six-storey building under construction which collapsed in the premises of the Synagogue Church of All Nations (SCOAN) in Lagos State (Nan, 2019). In another account in 2011, in Gimbiya Street, Area 11 Garki, Abuja, an uncompleted building collapsed killing five people including a pregnant woman, with over 40 squatters trapped in the house. It is also on record that no less than five worshippers died following the collapse of St. Anthony Catholic Church Cathedral in Oduma, Aninri Local Government Area of Enugu State (Olubi and Adewolu, 2018).

The review of the literature and anecdotal evidence revealed that between 1974 and 2019, which is 45 years, Nigeria have recorded over 221 cases of building collapse across its major towns and cities leading to the loss of many lives with several degrees of injuries recorded (Okeke et al., 2019). In fact, over the last four years, Yaqub (2019) alluded that Nigeria has recorded over 56 cases of building collapse and more still counting. Oyedele, (2018) further said that no state in Nigeria, out of the 36 states and the Federal Capital Territory (FCT), has been exempted from the event of building collapse in the last ten (10) years. In some years, building collapse occurred in more than ten (10) different

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locations in Nigeria with casualties; according to Omenihu et al., (2016) from 1971 to 2016, a total of 1455 lives were lost in reported 175 occurrences of building collapse in Nigeria. It is therefore expedient that causes, implications, and mitigation steps of the nuisance be carefully examined.

Evidence in the literature suggests that while building collapse has been linked to inferno, acts of terrorism, global changes in the environment, and seismic activities in many western countries (World Bank, 2015), in countries of sub-Saharan Africa, most cases of building collapse have been attributed mainly to human factors such as design errors and negligence, and lack of institutional mechanisms and capacity to prevent the collapse of buildings. Other factors identified include Lack of geotechnics investigation, construction defects, quackery (Tanko et al., 2013; Agwu, 2014), and poor construction supervision linked to lack of physical development and building regulations enforcement.

Building collapse can be partial for example, Nigerian Industrial Development Bank (NIDB) Building on Broad Street, Lagos State in 2008, or complete, like the Lekki Garden building collapse in 2016. The site of building collapse is disheartened and very pathetic (see Figures 1-5 below), because most often it is associated with loss of life, investment, time, equipment, and waste of building materials. It also affects the reputation of the construction industry in the area of occurrence. The Nigeria Construction and Infrastructure Summit Group estimate that the nation loses between 2.03tn and 3.05tn naira annually to infrastructure deficit due to building failure (Okeke et al., 2020) as the rate of building collapse recorded is overwhelming. Below are scenes of building collapse sites.



Figure 1. Two -Storey Building that collapsed in Lagos, Nigeria (2019)
Source: Olasunkanmi, (2019)



Figure 2. Collapse of Two -Storey Building in Delta State, Nigeria (2015)
Source: Chido, (2015)



Figure 3. School Building Collapse in Lagos, Nigeria 2019
Source; Rayyan, (2019)



Figure 4. A Collapsed Building caused by Earthquake in Taiwan 2018
Source: the Associated Press, (2018)



Figure 5. Collapse of multistorey building in Agbama, Umuahia, Nigeria (table 1, No. 25)
Source: Babalola, (2015)

In building design and construction, architects establish realities, which once erected are not altered easily (Okeke et al., 2019). Consequently, the degree of pressure on the architect to deliver the projects from the moment he accepts commission has intensified in recent years due to the prevalent climate of the building industry. This has arisen due to greater complexity and scale of projects; more client-generated conditions of engagement with onerous implications for the architect, the emergence of hybrid and untested contract conditions, shifts in practice ethics which tend to confuse the traditional roles and responsibilities within the building team (RIBA, 2004). Based on the overwhelming ill effects of building collapse, scholarship in literature has suggested critical appraisal of built-environment professionals' role to tackle the frequent incidences. However, the consequences of the architect's role as the prime consultant have not been adequately explored. The study presumed that the

professional architect by right must exercise the “duty of care” he owes to all his design projects and the study aims to identify the major causes of building collapse in Nigeria and its implication to the architect’s involvement as the leader of the project team. The specific objectives perused are:

- To identify the major causes of building collapses in Nigerian cities;
- To investigate the implication of building collapse to the Architects and other members of the building team;
- To suggest possible solutions to tackle the problems and issues that are likely to guide the architect and his team in addressing the problems.
- The study encountered a limitation of porosity of data on recent cases of building collapse as most incidence is no longer reported and or rarely investigated.

1.1 Context of Study

Nigeria is a West African country and has a diverse geography, with climates ranging from arid to humid equatorial (Okeke et al., 2020). On the global scale, Nigeria is the most populous black nation with its most diverse feature being its people. She occupies an area of 923,768 sq km, extending 1,127 km East-West and 1,046 km North-South (National Bureau of Statistics, 2010), with a population of over 198 million (National Population Commission, 2019). It lies between latitudes 4°N and 14°N, North Greenwich Mean Time (GMT) and longitudes 3°E and 14°E East of Greenwich Mean Time (GMT) in the southeastern edge of the West African region with the Atlantic Ocean, Sahara Desert and Cameroon Mountains, which form the southern, northern and eastern boundaries respectively. (See Figure below)

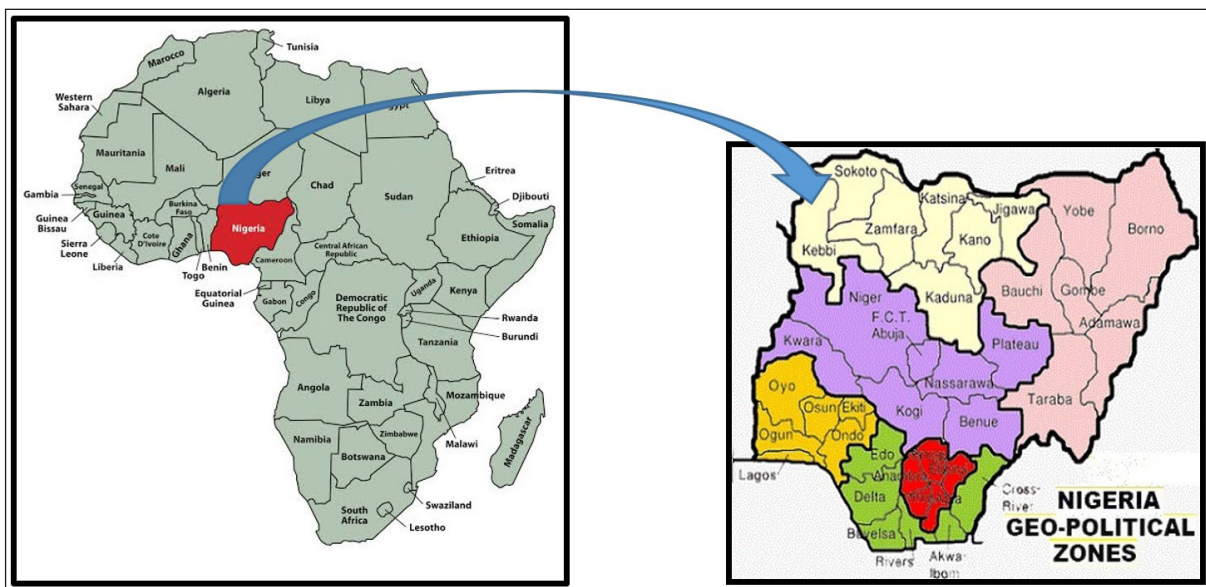


Figure 6. Map of Africa showing Nigeria and map of Nigeria showing 36 States that make up the 6 Geopolitical Zones
Source: Nigerian population commission, (2018)

1.2 Conceptual framework

The technique and architecture of buildings all over the world depend on the climatic boundary conditions, the culture, and the availability of raw materials within the locality (Okeke et al., 2019). Buildings provide shelter with protection from both natural and man-made elements (Okeke et al., 2021), and must be well conceptualized, designed, and erected to gain the desired comfort from the environment (Odeyemi, 2012). According to Ayinuola and Olalusi (2004), failure can be cosmetic when a building experiences an addition or subtraction of substances that affect its physical outlook, or structural when both physical outlook and structural stability have been affected. In line with the above concepts, Olagunju et al., (2013) defined building collapse as a total or partial failure of one or more components of a building, leading to the inability of the building to perform its principal function of stability, comfort, protection, satisfaction, and safety. It follows then that the building is said to have failed or collapsed when one or more elements of the structure cannot perform its original function efficiently due to the malfunction of the constituent materials. Furthermore,

Omenihu et al., (2016) defined building collapse as the inability of a building component to withstand the loads it was designed for. Ede (2010) posits that collapse is a state of complete failure when the structure has factually given way and most of its members have carved in crumbled, and the building can no longer stand as originally built. Ayinuola and Olalusi, (2004) opined that failure is considered as occurring in a component when such component cannot perform its intended functions. In summary, the unplanned falling of a building is referred to as building collapse, while the planned falling of a building is referred to as demolition.

2.0 Literature Review

Evidence in the literature indicated that the rate of building collapse is increasing in many developing countries (Boateng, 2020), and owing to the regular occurrence of building collapse in Nigeria, research on this subject has been championed by mostly Nigerian Scholars (Okeke et al., 2020). Some elucidated factors that cause building collapse in Nigeria include poor structural design, use of unskilled workmen and use of substandard material, and lack of adequate management and supervision (Ayeni

and Adedeji, 2015; Hilary et al., 2018; Odeyemi, et al., 2019). Oloyede et al., (2010) attributed causes of building collapse to negligence in some vital areas in construction such as soil investigation, design for building loads, wind loads, earthquakes, uneven terrain, and use of substandard building materials, poor supervision, and overall poor workmanship. Ede, (2010a) identified other factors which he termed the “Nigerian factor” enumerating corruption, lawlessness, and the “jack of all trade” posture of Nigerian building professionals who take all forms of responsibility in the building process. Tanko et al., (2013) revealed that quackery is the cause of the most frequent building failure in Nigeria. However, the majority of investigations revealed the contrary; that sub-standard or poor quality of building materials is the main cause of building failure and collapse in Nigeria (see table 2). Ayinuola and Olalusi (2004), blame parties in the building industry, clients, architects, engineers, town planners in the local authorities, and contractors stating that they have contributed to building failures in various dimensions. Adebayo, (2006) noted that building collapse incidences can be controlled or minimized if the client is ready to pay for high-quality materials and expert professional services. In 2006, the Nigerian government regulatory body of engineers, Council of Registered Engineers in Nigeria (COREN) reported an outcome of an investigation panel for three cases of collapsed buildings in 2005. It was discovered that no registered engineer was involved. Ayedun et al., (2012) compiled findings on collapsed buildings in Lagos State between the years 2000 and 2010 (10years), out of the 54 collapsed buildings 37 (68.52%) failed and collapsed due to structural related issues. Oseghale et al., (2015) opined that weakening of reinforced concrete could occur from corrosion of the reinforcement due to carbonation and chloride ingress through cracking from overloading of the concrete structure and construction defects. The findings of Oseghale et al., (2015) and Folagbade (2001) revealed that poor structural design, use of substandard building materials, non-compliance with approved building design, poor workmanship, lack of qualified and experienced professionals to ensure quality construction are the major causes of building collapse in Nigeria. Ayinuola and Olalusi (2004), reasoned that building failures occurred due to inadequate knowledge of building structural performance and unexpected environmental phenomena. Fagbenle & Oluwunmi, (2010) blamed the high frequency of structural collapse on the low level of compliance with approved architectural and structural drawings before construction, ineffective monitoring by the concerned government agencies, and the low level of awareness of the existing building regulations by clients and contractors. This submission was buttressed by Mrabure and Awhefeada, (2020) and stressed that there is a need to enforce the provision of these laws. Windapo, (2006) stated that over the years, Lagos residents have witnessed consistent building collapse leading to fatalities, litigations, and regulatory actions, pains, injuries, delayed schedules, bad reputations, and loss of properties. Most collapsed buildings were found to be constructed with low-quality building materials, while incompetent craftsmen rather than professionals

were engaged. Also, the existing building codes, meant to guide builders were rendered ineffective because of a lack of political will to enforce the same by the Town Planning Authorities. On the other hand, most investigations, as well as research on the causes of building failure, tended to focus on Architects, Engineers, Surveyors, and Builders; hence several architectural and design elements are seen to be mentioned in many articles and linked to failure causes. However, many have no connection with building stability or otherwise; the building can only collapse when one or more of its essential components failed and these components are part of the structural frame. The time-tested method is not always followed on many projects. There is no control over the building process in Nigeria. An empirical ascertainment of the causes of building collapse in Nigeria was carried out by Ayedun et al., (2012). The study identified the use of substandard building materials, poor workmanship by contractors, use of an incompetent contractor, faulty construction methodology, heavy downpour, non-compliance with specification/standards by developers/contractors, inadequate/lack of supervision/inspection/monitoring, structural defects, defective structural design, illegal conversion /alteration/additions to existing structures and dilapidating structures as the major causes of building collapse in Lagos State, Nigeria. Again, the research of Hamma-adama et al., (2020) from academic literature identified three leverage points as differential settlement, structural failure, and structural issues, all connected to the field of civil engineering as the leading cause of frequent building collapse in Nigeria.

In the study conducted by Qurix and Doshu (2020) aimed at exploring major causes of building collapse in Nigeria as perceived by building industry professionals, policymakers, and the public; it was discovered that the leading cause is the change of use without following professional protocols. Furthermore, it was reported that the Client’s undue interference, made at an advanced construction stage without consultants’ advice is a contributory factor to building collapse (Odunisi, 2019; Imafidon and Ogbu, 2020). Fakere et al., (2012), reviewed extensively, building collapse concerning the role of building materials during construction. It was discovered that building materials such as reinforcing steel, cement, sand, granite, sandcrete blocks, and concrete play a huge important role in either the collapse or stability of buildings in Nigeria. It was concluded that 10-25% of buildings that collapse in Nigeria are as a result of the use of poor quality building materials. Okeke et al., (2020) investigated the cause of building collapse in Nigeria and discovered that negligence on the part of a government agency has fueled the incessant building collapse in the country. Ayodeji (2011), in a study, termed sustainable construction practices revealed that the quality of materials and workmanship in the Nigerian building industry is not satisfactory and that the problem lies in the use of inappropriate materials supplied to the site, inadequate materials, and inefficient supervision of the site workers. Usman et al., (2010) revealed that building Collapse is an occurrence that has been frequent over the decades caused by many factors which have their great impact on lives and

properties of man, judging from reported cases of building collapse in Nigerian cities between 2000 till 2015. Ayedun et al., (2012) gave an account of some collapsed buildings in Lagos between the years 2000 and 2010 with their locations and suspected causes of their collapses (Table 2). Windapo and Rotimi, (2012) examine contemporary issues in building collapse and its implications for sustainable development in Nigeria and establish that the approach to construction by industry stakeholders does not match sustainable principles, and contributes to the general underperformance of buildings.

3.0 Research Methodology

The study investigated building collapse in Nigeria and its consequences on the Architect's role as the leader of the building team. It utilized Primary data based on anecdotal

pieces of evidence, authors' observations in the field of practice, and also secondary data from journals, conferences, and technical reports of previous works of other authors on the subject matter. A systematic review of related literature was adopted possibly to achieve the objectives set out in the study. Papers reviewed were identified via searchers on online databases such as Google Scholar and Science Direct among others. Reported causes of collapsed buildings in Nigeria between 2009 and 2019 were identified and using content analysis, descriptive statistics, and percentages, data collected were analyzed. Research results revealed that the majority of the cases were due to the use of substandard building materials and a few cases owing to natural occurrence. This invariably indicates that the leadership role of the architect in the building team is lax.

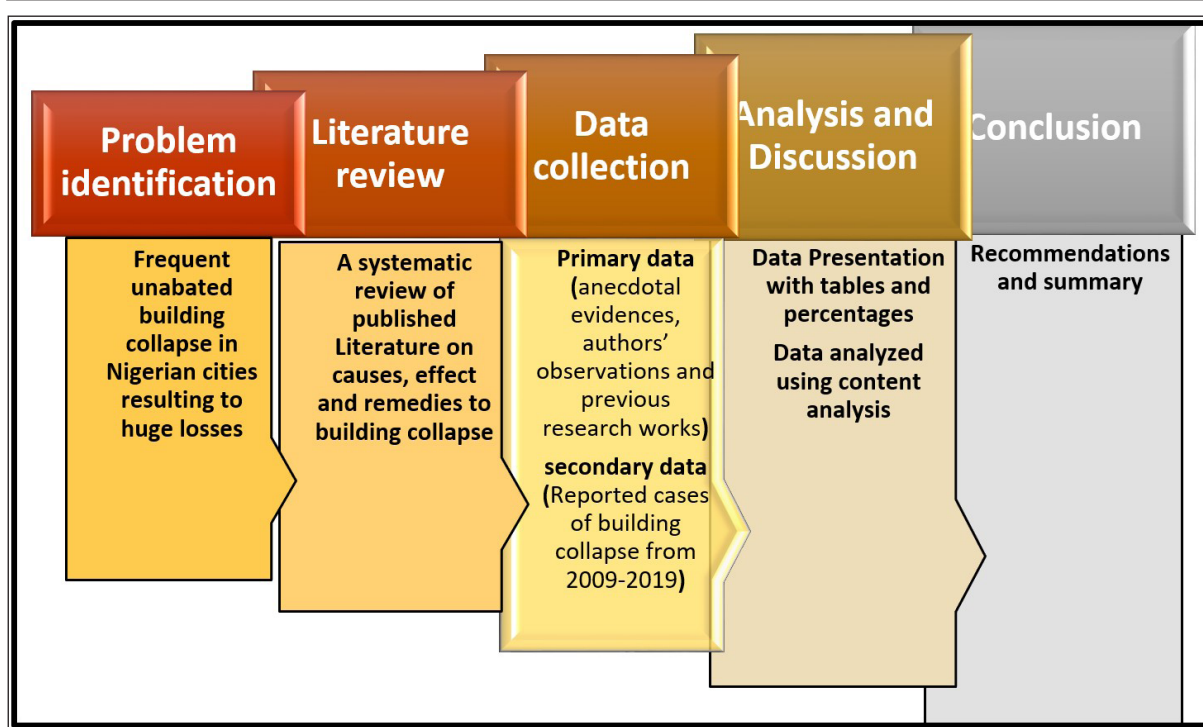


Figure 7. research methodology flow chart

4.0 Data Presentation, Analysis, and Discussions

Table 1. Records of building collapse in Nigeria from 2009 to 2019
Source; Source: Babalola (2015); Omenihu et al., (2016)

sn	Location	Date of collapse	Type of building	Causes of Collapse	Casualty
1	Ogbomosho Oyo state	February 2009	Six storey Lautech Teaching hospital under construction	Substandard material ¹ Poor supervision ³	5 died
2	Ogbomosho Oyo state	Mar-09	Four storey building under construction	Not reported ⁷	5 died
3	Lagos	Jun-09	Two storey building	Not reported ⁷	7
4	Aghaji crescent GRA Enugu	Aug-09	A fence wall	No proper drainage ³	1
5	Oke padre street Itamori Abeokuta	18th October 2009	Uncompleted residential building	Use of substandard materials ¹ Hasty construction ³	3 died 11 were injured
6	Garki Abuja	Nov-09	2-storey commercial building	Structural failure ² Substandard material ¹	-
7	Isopakodowo street, Cairo oshodi Lagos	26th April 2010	Residential building under construction	Use of substandard material ¹	4 died 12 were injured
8	Adenike Street off new market oniru estate VI Lagos	2nd June 2010	Uncompleted storey building	Use of substandard materials ¹	1 died 2 injured
9	Plot 702 Port-Harcourt crescent Garki 11 Abuja	Jul-10	6 suspended floors for commercial purposes with a basement	Substandard materials ¹ Use of unqualified professionals ³	-
10	2 Okolie street off Gimbiya street, Abuja	11th August 2010	Uncompleted four storey building	Substandard materials ¹ Disregard for building regulations ⁴	23 died 11 were injured
11	Tinubu street VI Lagos	28 th September 2010	4-Storey Building	Structural defect ²	3
12	No 9B Adenubi close ikeja Lagos State	13th March 2011	5- storey hotel under construction	Poor quality concrete ¹	2

13	Oba ile Housing Estate Akure	2011	The collapse of a hotel Building under construction	Substandard materials ¹	–
14	Mararaba (near Abuja)	The collapse	The collapse of a 2- storey Zenith Bank Plc	No Geotechnical investigation ⁶ , Undersized ¹ Large span slab, No specific floor thickness on drawing ⁶	2 died 11 were injured
15	No 6 Magaji close idumota Lagos	Jul-11	3-storey building	Not reported ⁷	18
16	Aderibigbe street, Maryland Lagos	Oct-11	A penthouse	Structural failure ²	2
17	No 3 Ademola Awosike Road Kubwa Extension III, Abuja	8th August 2012	The collapse of 2-storey building under construction	Poor quality material ¹ poor workmanship ³ , weak foundation ¹ , failure of structural element ²	3 died 9 injured
18	Gwarinpa Estate Abuja	28th January 2012	The collapse of two storey building	Structural Defect ¹ , Demolition operation ³	3
19	Apo Mechanic Village Abuja	13th June 2012	1-storey commercial building under construction	No qualified professional on-site, poor supervision ³ , use of poor quality material ¹	–
20	Hadeja Road by Ibrahim Taiwo Road Gombe	Jul-12	101 year old 3-storey commercial/residential	age, Lack of maintenance ⁶	1
21	Muri Okunola street Eti-Osa LGA of Victoria Island Lagos	4th November 2012	Collapsed building under construction	Structural failure ² Poor construction ³	3 dead 50 trapped
22	Jakande estate in Oke-Ake-Afa, Isolo Lagos	20th November 2012	Collapsed of a building (in use)	Structural Failure ² , Occupants ignored governments safety warning ⁴	3
23	!74 Corporation drive Dolphin Estate, Ikoyi Lagos	20th November 2012	Collapsed of a building	Structural Failure ²	–
24	Ojodu, Lagos	8th May 2013	2-storey Building under construction Illegal approval	Structural failure ²	1
25	Agbama, area, Umuahia	15th May 2013	Building under Construction	Not Reported ⁷	7
26	Ojodu, Lagos	May-13	Three storey building	Not reported ⁷	2
27	Agege motor road, Mushin Lagos	11 th June 2013	Three storey building	Unauthorized conversion. Use of quacks ³	1
28	Ishago road, Surulere Lagos	21 st July 2013	2-storey uncompleted building under construction	Non-compliance to regulatory authority warnings ⁴ Inferior Building materials ¹	4
29	Ebeute-meta, Lagos	11 th July 2013	Residential Building	Structural Defect ²	7
30	Maitama, Abuja	6th September 2013	Building Collapse	Not reported ⁷	3
31	Nyanya, Abuja	27th September 2013	Storey Building of Government secondary school	Not reported ⁷	8 injured
32	Lagos Island	25th September 2013	Three storey building fell on a bungalow	Not reported ⁷	2
33	Amassoma in Southern Ijaw LGA of Bayelsa State	5th October 2013	Lecture theatre building at the permanent site of the Niger Delta University	Use of substandard material ¹ No compliance with the standard procedures in the use of materials ⁴	-
34	Ologuneru in Ido LGA	May 3 rd , 2014	An uncompleted	Not reported ⁷	2
35	Akure, Ondo state	9th May 2014	A hostel building under construction	No geotechnical report Use of quacks ³	2
36	Agudama-Epie, near Yenagoa	19th May 2014	Uncompleted Church building	Heavy downpour ⁵	20 injured
37	Onitsha, Anambra state	2nd June 2014	An uncompleted four storey building	Structural failure ²	4
38	Pedro police station, somolu Lagos	30th June 2014	2-storey barrack building	Not reported ⁷	-
39	Ejigbo, Osun State	10th July 2014	School building complex few hours before commissioning	Not reported ⁷	2 injured
40	Bucknor estate, Jakande-Isherioshun Rd.Ejigbo/isolo Lagos State	30th July 2014	The collapse of three storey building	Structural failure ²	-
41	Osogbo, Osun State	19th August 2014	One storey building Heavy downpour		1 injured
42	Lagos	12th September 2014	The collapse of a warehouse at synagogue church	Demolition process ³	4
44	Benin	30th September 2014	The collapse of liberty power bible church	Structural defects ² Use of substandard material ¹	-
45	Ebute Meta Lagos	15th July 2015	3-storey Residential Building	Structural defects ²	4 rescued
46	Swamp street Odunfa Lagos island	21st October 2015	3-storey Residential Building	Structural defects ²	4 rescued
47	Lekki, Lagos	9th March 2016	Five storey Building Under	Heavy rainfall ⁵ foundation failure ²	34
48	Mile 12, Lagos	19th March 2016	Two storey building	Structural defects ²	1 dead 1 injured
49	Malet, Kwara State	2016	Three storey building	Not reported ⁷	–
50	Lagos Island	27th August 2017	Residential Building	Heavy downpour ⁵ Vibration ³	8
51	Zulu Gambari Road, Ilorin	18th August 2017	Four Storey Building	Not Reported ⁷	3 Injured
52	Abuja	18th August 2018	An abandoned Building	Old age, Illegal conversion ⁶	2 Dead 3Injured
53	Port-Harcourt	November 19th, 2018	7- Storey Building under construction	Not Reported ⁷	15 dead 31, rescued
54	Lagos	February 3rd, 2019	3-storey Building	Not reported ⁷	2 dead 1 injured
55	Ita-faji, Lagos Island	13th March 2019	3-storey building	Old age ⁶ Non-compliance to regulatory authority warnings ⁴ .	20 dead 41 Injured
56	Sogoye, Bode Area of Ibadan	15th March 2019	3- Storey building under construction	Concrete was not allowed to cure before continuing the construction ¹	–

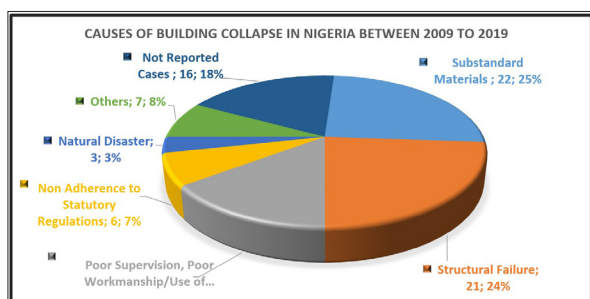
Table 2. Selected Collapsed Buildings in Lagos from 2000 to 2010

Source: Ayedun, et al., (2012)

S/N	Year	Location, of Building	Casualties	Suspected Cause of Collapse
1	2000	.Eleganza Building, Ikota Ajah	deaths,25 injured ,2	Structural failure ²
2	2000	St., Dennis, Catholic Church, Bariga	deaths 3	Structural failure ²
3	2000	Semi street, Surami, Itire,14	1death,1 injured	.Structural, slab deterioration ²
4	2000	Ogba,Road, Agege,14	N/A	Flooding ⁵
5	2001	Karunwi, Central Mosque, Mushin	deaths 7	.Structural defects ²
6	2002	storey building along Allen Avenue 3	N/A	Structural failure ²
7	2003	Buildings at 28 Idumagbo, street 2 (and10, Pedro street (same day	deaths, several injured 30	The explosion from fireworks materials ⁶
8	2004	Building, at Ilasamanja	N/A	Use, of substandard materials ¹
9	2004	Alias, street, Lagos Island ,10	N/A	Dilapidation/Lack, of Maintenance ³
10	2005	Princess Street, Lagos Island 6	N/A	Poor construction Materials ¹
12	2006	.6A, Milverton Close, Ikoyi	N/A	Dilapidation ⁶
13	2007	The building at Ebute Metta	.Several deaths	Unauthorized conversion/poor supervision ³ /use of substandard materials ¹
14	2010	Uncompleted storey building at Adenike .street, Oniru Estate, Victoria Island	dead,2 killed 1	Use of substandard materials ¹ Non .compliance with Approved Building Plan ⁴
15	2010	.storey building at,24, Ali Street 4 .Victoria Island	killed. Several injured 3	Structural overloading ²

4.1. Results

The occurrences of building collapse in Nigeria from 2009 to 2019 were investigated. This investigation was based on available published statistics of researchers evident in literature, because the national procedures/actions followed in investigating the cases of building collapse in Nigeria is setting up a panel for an investigation that is usually bureaucratic, time-consuming, politically influenced, and sometimes end up not yielding substantial findings. The locations, date of occurrence, the building types, the suspected causes of the collapse, and the casualty Figures were obtained and reported in Tables 1 & 2. The result presented in the graphical illustration below shows that the leading cause of building collapse within the period under investigation is the use of substandard materials while natural disasters account for the least cause compared to other developed cities.



Substandard Materials¹ – 22 =25%

Structural Failure² – 21 =23.9%

Poor Supervision, Poor Workmanship/Use of Quacks³- 13 =14.8%

Non Adherence to Statutory Regulations/Warnings and compliance with Approved Building Plan⁴ – 6 = 6.8%

Natural Disaster⁵ – 3 =3.4%

Others⁶ - 7 =7.9%

Not Reported Cases⁷ - 16 = 18.2%

Total cases identified =22(25%) +21(23.9%) +13(14.8%) +6(6.8%) +3(3.4%) +7(7.9%) +16(18.2%) = 88 (100%)

4.2 Analysis

A summary of the main causes of building collapse in Nigeria is presented below:

Substandard materials recorded the highest number of cases amounting to 25% and are considered as a major challenge facing the stakeholders of the building industry. It manifests in form of poor concrete mix, poor cemented block units, use of untested materials, and use of low-quality materials. This is followed by Structural Failure, 23.9% while Poor Supervision, Poor Workmanship/Use of Quacks collectively recorded 14.8%. Non Adherence to Statutory regulations and None Compliance with Approved Building plans to account for 6.8% of the whole cases. Natural disasters recorded the lowest 3.4 %. Other cases such as No Geotechnical investigation, no specific floor thickness on drawing, Old age/lack of maintenance, Explosion from fire, and Dilapidation recorded 7.9%. Generally, 18.2% belong to None Reported Cases. This study observed that building collapse is not common in bungalows, however, occurs more frequently in storey buildings and that it is an event that repeats itself every year. Under location, the trend highlights Lagos state with numerous reported occurrences probably due to nearness to the sea, high population with demand for housing, or huge casualties of happenings.

5.0 Discussions

The erection of a building or structure undergoes a building process of various stages from the pre-design stage to post-construction and occupancy. According to Fowode (2016), building projects start well before ground is broken. It is pertinent to think of building construction as a series of activities that result in the structure's actualization. Therefore, it requires the services of a team of experienced professionals in the building industry to avoid failure.

5.1 Functions of Building Design Team: The land Surveyor

determines the shape, geographical orientation, and size of the site. The Architects' duties involve the design, coordination, and supervision of the building project. Structural engineers are in charge of structural design and supervision of structural specifications. The town planners ensure that the building codes and regulations such as setbacks, maximum heights of buildings, building lines, and plot coverage are incorporated in the building site. Quantity Surveyors estimate the probable amount that will complete the house and issue payment valuations at interims. The Estate Surveyors take control of the building for management after it has been completed. These professionals ensure that buildings are professionally built to avoid the incessant collapse in Nigeria although the efforts of these professionals in arresting the frequency of building collapse have not been effective and at minimal given the current trend of building failure within the country.

5.1.1 Identified Areas of Loopholes arising from the Building team

Client: Changes and variations at an advanced stage of construction; Changes to standard conditions of contract, specifications, regulations, and bye-laws. Interference in the contract roles and duties of contract Consultants and administrators; Giving the contract to inexperienced ill-equipped contractors

Contract consultants: (architects, engineers, surveyors, town planners, quantity surveyors) Errors and design inadequacies; Use of inexperienced and incompetent personnel and undefined delegation of responsibilities; Inadequate or incomplete information; Lack and or poor coordination of contract issues; Taking commission beyond the scope to minimize cost

Government Agencies: Approving drawings prepared by unregistered consultants through bribery and corruption; Selling retained drawings meant for other sites to prospective clients without considering the nature of the new site; weak monitoring and supervision of site work.

Contractors: Use of inexperienced and incompetent personnel and undefined delegation of responsibilities; Inadequate or incomplete information; Lack and or poor coordination of contract issues; Taking commission beyond scope and capacity of the firm

Sub-Contractors: Poor standards of workmanship; Conflicts with main contractors

5.2 Implications of the Architect's duties and responsibilities as the leader of the building team and co-coordinator of other allied professional input

Under this criteria, architect's managerial roles as spelled out in the standard form of building contracts (SFBC, 1996) include, site investigation, preparation of sketch plans, sketch design proposals, design details and working drawing, specifications, advice to the client, co-ordination of other consultants' services, issuing and preparation of variation, certificates, and overall supervision. Enormous responsibilities rest on the shoulders of the architect who among other players in any building project has a total

appetite to actualize and deliver his design drawings because a failed building project is regarded as the abortion of an architect's brainchild. Judging from the above, it is therefore of paramount importance that an architect imposes firm management disciplines on his activities through the establishment of a clear management structure and responsibility. From the result of the study, substandard materials recorded the highest number of cases with 25%. These findings, therefore, indicate the architect or his team and at large the architectural profession of laxity in their overall supervisory role and contract administration in building projects. The role of the Architect as a leader is also to refuse the use of none certified materials because according to the ethics of the profession, the prime consultant (architect) owes a duty of care and diligence to the building and the environment. Furthermore, observation and the author's personal experience in the building industry over the years and in conjunction with the research results have proved that deontology is an ethical issue boarding around corruption as the bane of building collapse in Nigeria. Laws and adequate frameworks exist, however lack of implementation and its enforcement fuels the unethical practice. This finding corroborates the result of Ede (2010), who discovered that the 'Nigerian factor' such as lawlessness, corruption, and the assumption that any Engineer in the construction industry can undertake all forms of responsibility in the building process. By deontology, we mean the normative ethical position that judges the morality of an action's adherence to rules or obligations rather than either the inherent goodness or the consequences of those actions. Stakeholders in the building and construction industry now result in 'cutting corners' for selfish reasons. If the weak framework of the Government and its agencies has allowed substandard building material to flood the market, the architect as a leader in the building team should not permit its use on construction sites or grant approval for such material on building projects. Potential areas of loopholes that should be guided by the architect as viewed by this study include:

- **Management of Project:** Management disciplines on the part of the architect entail his ability to manage his activities in project administration.
- This can be achieved through proper checks and responses arising from reports and drawings as they come or leave the office. Accepting commission within the scope and capability of the firm.
- **Management of Staff:** Delegation of roles of members of staff should be following levels of experience and competence to ensure adequate skilled supervision. Be always accessible to all the staff under his control. Some firms resort to employing the services of school leavers to manage big projects thereby acting as principal architects. Establish regular systems of project monitoring on a feedback basis including regular inspections (RIBA, 1998; 2004).
- **Dealing with other consultants:** Ensure that the consultants appointed by the client are adequate for the project and that the terms of appointment do

not override the leadership role of the architect. Do not delegate to other consultants' services that you are bound by contract to execute and for which in any event you are accountable. In the same vein, do not take up the services of other consultants even if you think you are capable because you will be liable to claims arising from such actions in the event of any collapse. Architects venturing into the design of structural drawings may result in a faulty design capable of causing collapse.

- **Dealing with project Site:** Check appropriate site information provided by the client
- Any departure from the original brief must be agreed upon with the client in writing
- **Planning Permission:** Architects should not allow any work to commence until planning permission is granted. Refusal on the ground of defective structural drawing may lead to building failure if the building has gone to the advanced stage.
- **Construction of building:** Check the accuracy of technical details before the commencement of works. The specification should be made in clear language in a standard format and must conform to the latest code and standards.
- **Building Contract:** Care must be taken when selecting contractors on behalf of the client. Be especially wary of contractors selected by the client
- **Commencement of works:** Contracts are often started with incomplete drawings, incomplete details, soil tests, foundations details due to pressure from the client. The problems that can follow this action can lead to building failure and bring serious trouble for the architect. Do not permit a contract to commence in advance of adequate information. Do not alter design or details or permit some without the client's written consent
- **Project Management:** If you are appointed project manager for a project of which you are not the architect, ensure that you do not interfere in architectural matters. Confine strictly with management duties.
- **Materials:** Structural defects caused by wrong concrete mix invariance to structural engineer's specification must be avoided. Substituting lower-quality materials should be avoided.
- **Inspection and Supervision:** There should be clarification between the two terminologies. Inspection means looking at something critically to ensure whether it meets prescribed criteria. For architects, it means a periodic inspection of the works in progress to establish whether it is being carried out generally following the contract in terms of progress and quality of work, that is, an inspection cannot guarantee detection of every defect. The best way an architect should carry out an inspection is

when unaccompanied by the contractor. Where work is in variance with the contract, an architect should issue an instruction to the contractor on how to deal with it.

Supervision means a continuous overviewing of progress. It implies that architects supervise the works of their employees. There is widespread misunderstanding of the term supervision and it should never be used in connection with the architect's leadership role during the building works (RIBA, 2004).

6.0 Recommendations

Based on the findings, the following are recommended:

Substandard Materials

- i. Standard organization of Nigeria, (SON) should monitor the standard of blocks molded-in block industries and impose minimum standards in terms of sand-cement ratios and scrutinize building materials that are supplied for use in Nigeria and ensure that only certified building materials are allowed in the market.
- ii. The standard organization of Nigeria should be vigilant to ensure that building materials imported into the country conform to standard requirements.
- iii. There is a need to empower and restructure materials testing laboratories in all Geo-political zones of the country.
- iv. Building professionals and contractors should ensure proper and efficient checking of materials brought to site and carry out tests such as cube test for concrete, tensile strength for steel bars, slump test for in-situ concrete in a building project following Engineer's specification.
- v. The design team in any building project should ensure that building materials supplied to the site by the domestic or nominated supplier are under the contract specification.
- vi. The national regulations regarding building materials are revised and consider the international standards to be adopted
- vii. Build on tested engineering properties of available local building materials in Nigeria.

Structural Failure

- i. There is a need to organize periodic public awareness campaign through electronic and print media to sensitize the public on the advantages of using professionals as a way of realizing safe buildings. Structural Engineers should be engaged in all building projects above two floors.
- ii. The building construction process involves professionalism in the planning, design, and execution of the project. Engineering consultants must be involved in the design and supervision of buildings
- iii. Imposing additional floors beyond original design provision should be avoided
- iv. Reduce the level of exposure of structures to risk by imbibing maintenance culture, seek advice from

experts when changing the form and use of buildings, and insist on material and soil tests for multistory buildings.

- v. Regulatory professional bodies such as the Engineering Regulatory and Monitoring (ERM) unit of COREN and their corresponding associations should on regular basis organize workshops for stakeholders in the building industry to update their knowledge and highlight the dangers and penalties associated with collapsed buildings.

Poor Supervision, Poor Workmanship/Use of Quacks

- i. All building professionals play key roles to actualize their respective obligations during building production, using the wrong professionals at any stage of the building process puts the building in danger
- ii. Construction should involve the collaboration of different professionals who have been registered by law practice the art of the building process.
- iii. Professionals in the building industry should maintain their integrity and professional ethics and work by standard practice procedures laid down by the standard form of building contracts SFBC and Joint Contract Tribunal JCT/80 especially when they play in the hands of ignorant clients
- iv. Only workers or building operatives with the appropriate training and experience should be allowed to engage in building works especially on the structural members.

Non Adherence to Statutory Regulations/Warnings and Compliance with Approved Building Plan

- i. It is the duty of the architect as the prime agent of the client to detect or rather direct the client to use the right professionals. This he achieves by at last ensuring that the Structural and Services drawings brought to his office are stamped and signed by professionals registered by their respective professional bodies before proceeding to plan authority for “building permit”.
- ii. Urban or Town development agencies at various levels of government (Commission, Board, and Authority) should enforce control of building works in their localities as laid down on Urban and Regional Planning Decree 88, of 1992 and as in section 13 of the National Building Code 2006.
- iii. Proper planning, supervision, and monitoring of construction activities should be institutionalized by policymakers to ensure that all buildings are constructed according to design, specifications, and planning regulations
- iv. All building plans tendered by any developer for approval must comply with the Nigerian new building code and local bye-laws and regulations.
- v. Soil Tests, Environmental Impact Analysis, and Structural Analysis need to be made mandatory for all institutional, industrial, and commercial buildings and submitted along with the building plans to Town Planning Authorities by all building developers.

Natural Disaster

- i. Building on flood plains or flood-prone areas should be avoided because flood weakens soil structure and foundation.
- ii Building on the hillside is likely to collapse due to erosion. Ensure that the soil surrounding the building is well protected with concrete or with stone pitching. All stakeholders in the construction industry should adhere strictly to the provisions of the building code.

7.0 Conclusion

The study investigated the frequent causes of building collapse in Nigeria and enumerated specific areas members of the architecture profession and other stakeholders in the building industry are implicated. The research results revealed that the majority of the cases were due to the use of substandard building materials and a few cases owing to natural occurrence. This invariably indicates that the leadership role of the architect in the building team is lax. The responsibility of the Architect as dictated by his professional ethics and his position as the coordinator of other allied professionals is always at stake when things are not followed according to standard procedures. This paper thinks that the building project delivery though is a collective responsibility of the stakeholders involved in the building process, the architect who stands out as the first target of blame during incidences of building collapse should ensure that his duties are discharged diligently as backed by relevant existing laws. The professional architect also should guide against deontology an ethical issue in construction. It recommends an overhaul of planning and implementation policies for building development regulations (e.g. building codes), with strict enforcement of laws, and that the Nigerian government, as a major construction stakeholder should initiate sustainable construction measures and ensure this as best practice for the construction industry.

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Conflict of interest:

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