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BUILDING FAILURE AND COLLAPSE: A FRAMEWORK FOR TACKLING ITS SCOURGE IN NIGERIA

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ABSTRACT

The issue of building collapse has been a source of concern, not only to the general public but particularly, to construction professionals whose image and integrity are at stake. In an attempt to tackle this menace, this study engaged six different professionals in the construction industry within Lagos State, Nigeria by means of questionnaire administration. In all, 142 questionnaires were distributed to architects, engineers, builders, estate surveyors and valuers, town planners and quantity surveyors and 102 questionnaires were retrieved amounting to response rate of approximately 72%. The retrieved questionnaires were analyzed using descriptive statistics and weighted mean. Thereafter, analysis pinpointed the contractors and builders as the major culprits for majority of building collapse occurrence in the study area since they were the suppliers and producers within the building manufacture process. Again, the design team and high cost of building materials were identified as part of the factors accountable for building collapse. In recommendation, the need for builders/contractors and construction professionals in not compromising the quality of building materials was brought to the fore while adequate supervision cum regular inspection of professionally supervised construction projects was deemed necessary.

Key words: Building Collapse, Building Failure, Building Materials, Workmanship, Lagos State, Nigeria.

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1. INTRODUCTION

The disturbing phenomenon of building collapse is one that many Nigerians now take for granted due to its frequent occurrence (Fagbenle and Oluwunmi, 2010). The recent collapse of

a four storey building near Jabi Park, Abuja on the 18th of August, 2018 brings the total number of collapsed building to more than 30 cases of such occurrence in the past 15 years (Ayeyemi, 2018). According to Adepegba and Akinkuotu (2018), the traumatic incidence occurred, killing two persons and trapping eighteen others, after the addition of an extra floor, to a previously abandoned, fifteen-year-old, three storied building. The occurrence of building collapse especially within the last few decades has reached a crescendo and is fast becoming disgraceful and embarrassing, making it unacceptable to the concerned stakeholders and government of the country.

The issue has become so rampant that, there is no state including Federal Capital Territory, in the country that has not had its fair share of collapsed buildings (Adepegba and Akinkuotu, 2018). The situation has thus become an embarrassment not only to the various state governments who have the responsibility of ensuring the safety of both lives and property but also, the Nigerian citizenry who consume or are consumed by these faulty products. The reason for the worry emanates from the fact that whatever has the capability to terminate innocent and precious human lives prematurely should of necessity, be of concern to the professionals concerned as well as the government. That was why Oluwatuyi (2007) viewed the incidence of building collapse as a dent on the image of all professionals connected with the building industry. More worrisome on this issue is the fact that there appears to be no proffered lasting solution in sight, as there has been a regular occurrence overtime. Furthermore, failed structures, yet to collapse, exhibit features of an eminent collapse and if necessary measures are not put in place. The same threat may be the fate of some building projects still at the drawing board stage. It is against this background that this study sets out to examine the issue surrounding building collapse in Lagos metropolis.

2. LITERATURE REVIEW

Previous works reviewed and discussed under the scope of this present study belonged to the scope of building collapse and incidences of building collapse in Nigeria. These were as discussed within sections 2.1 and 2.2.

2.1. Building Collapse Concept

The construction of any building can be divided into two major parts: the substructure (foundation) and superstructure (comprising the walls, floor, beams, columns, roof, building services and external works) and a defect in the construction of any of part of these two could result in considerable failure of the building climaxing in a collapse. Collapse ensues when a structure partially or wholly fails and suddenly gives way fostering the structure's inability to fulfill its ultimate purpose. Arilesere (2002) notes that building collapse is a dire case of building failure as it connotes a total or partial crash of a super-structure either during construction or during use. Literature has validated the causes of failed and collapsed buildings to many factors some of which are the use of substandard or inferior building materials {Ayedun, Durodola and Akinjare (2012); Awolesi and Ayedun (2012); Oloyede, Omoogun and Akinjare (2010)}, over loading and chemical actions {Akande, Debo-Saiye, Akinjobi, Alao and Akinrogunde (2016)}, defective structural design {Onanuga (2017); Adebowale, Gambo, Ankeli and Daniel (2016); Chinwokwu (2000)} and inappropriate alteration or modification of existent building(s) to cater for uses other than its original intent.

2.2. Incidences of Building Collapse in Nigeria

According to records, there have been several instances of building failure and collapse in Nigeria. Chinwokwu (2000) listed 42 cases of building collapse across the country within the period of 1980 and 1999. The incidents of building collapse are found to cut across building

categories such as private, corporate and public developers. Chinwokwu (1999) reported that out of the twenty-five reported cases of building collapse between 1980 and 1999 in Lagos State, 76%, 12% and 12% of the cases belonged to private, corporate and public developers respectively. This was an indication that private building developments were more prone to building collapse than corporate and public/government buildings.

The issue of both structural / building failure and collapse cuts across both developed and developing countries of the world but the phenomenon is found to be more rampant and devastating in the developing countries including Nigeria (Reuters, 2018; Whitfield, 2018; Sharman 2017). These occurrences not only waste human effort and investments, but also, results in loss of life. Olateju (1993) confirmed that a total of 174 deaths have been recorded in Nigeria within the period of 1971 and 1990 resulting from structural failures while Chinwokwu (1999) reported the loss of 126 lives as a result of building collapse over the period of 1980 and 1999 in Lagos State. Details regarding the date of occurrence, location and number of deaths / casualties involved in building collapse cases, as stipulated by the various Nigerian dailies, are as contain in Table 1.

Table 1 Details of Some Notable Collapsed Buildings in Nigeria and Their Suspected Causes

S/N	Building Location	Type of Building	Date	Suspected Causes	Remarks (Life Lost)
1	Mokola, Ibadan, Oyo State	Multi-Storey building under construction	Oct. 1974	Over Loading	27
2	Barnawa Housing Estate, Kaduna, Kaduna State	Residential Building	Aug. 1977	Faulty Design	28
3	Govt Secondary School, Markafi, Kaduna State	School Building	July 1977	Lack of maintenance	7
4	Barnawa Housing Estate, Kaduna, Kaduna State	3 No. Residential Buildings	1980	Faulty Design	6
5	Iponri, Lagos State	Uncompleted 4 Storey Building	May 18th, 1995	Carelessness	13
6	Ojuelegba Road, Lagos State	Residential Building	May, 1985	Rainstorm	
7	Lagos Island, Lagos State	Uncompleted	18th July 1985	Excessive Loading	9 (all of the same family)
8	Gboko, Benue State	Residential Building	Sept 1985	Weak Structure	1
9	Allen Avenue, Lagos State	Residential Building	1985	Structural Defect	
10	Adeniji Adele, Lagos State	Residential Building	1985	Structural Defect	2
11	Oshogbo, Osun State	Mosque	May 1986	Faulty Design	2
12	Ona Street, Enugu, Enugu State	Residential Building	1986	Not made public	2
13	Isiala, Imo State	High Court Building	1986	Ceiling Collapse	No casualty
14	Agege, Lados State	2-Storey Building under construction	May 9th 1987	Faulty Design/construction	No casualty
15	Idusagba Lane, Idumota, Lagos	Residential Building	Sept 14th 1987	No structural design	17

	State				
16	Ikorodu Road, Lagos State	Commercial Building	Sept 9th 1987	Structural defect/storm	4
17	Calabar, Cross River State	Residential Building	Oct 9th 1987	Structural Defect	3
18	Akinwunmi Street, Mende Village, Lagos State	6-Storey Hostel Building	Oct 1989	Faulty design	No loss of life
19	Port-Harcourt, Rivers State	School Building	June 15th 1990	No structural Design	55
20	Agege, Lagos State	Church Building	Nov 1st 1995	Faulty Design	15
21	Adeola Odeku Street, V.I; Lagos State	1-Storey Building	1999	Storm (Nature)	
22	Ojuelegba Area, Western Avenue; Lagos State	3-Storey Residential Building	1999	Carelessness	4
23	Idi-Oro, Mushin, Lagos State	Residential Building	2000	Structural Defect	Not known
24	Ajah, Along Lekki Road, Lagos State	Residential Building	April, 2000	Report of investigation not released to the public	Not Known
24	St Dennis Catholic Church, Bariga; Lagos State	Residential Building	2000	Structural Failure	3
25	Buhari Street, Mushin, Lagos State	Mosque Building	2001	Structural Defect	7 deaths, several injured
26	Igbosere Street, Lagos State	Uncompleted 3-Storey Building	2001	Structural Defect	Not known
27	Otigba Street, Off Pebble Street, Ikeja, Lagos State	Residential Building	2002	Structural Defect	10 deaths, 31 injured
28	Mosadolohun Street, Iba, Lagos State	3-Storey Residential Building	2002	Structural failure	15 deaths, several injured
29	Fredrick Faseun Street, Okota, Isolo	Residential Building	2002	Structural failure	15 deaths, several injured
30	Broad Street, Marina-Lagos	NIDB Building	May 2006	Fire Incidence	1
30	Okepopo Street, Lagos Island	3-Storey Residential Building	Feb 14th 2008	Structural Defect	Not Available
31	24, Alli St; Victoria Island, Lagos	4-Storey Building	Sept., 28th 2010	Overloading/Structural Defect	3 deaths + Several injures
32	Odowo St; Osodi, Lagos	Building under-construction	April, 26th 2010	4 deaths + 12 injured persons	Sub-standard materials for construction
33	16, Nnobi Street, Enugu, Enugu State	3-Storey Block of Flats	2012	Not Available	Structural Failure
34	Awka, Anambra State	1-Storey Uncompleted Residential	2012	Not Known	Substandard materials

		Building			
35	Agbama Residential estate, Umuahia, Abia state	4-Storey Block of Residential Flats	2012	Not Known	Failure to adhere to building regulations
36	Abanye Street, Onitsha, Anambra State	4-Storey Commercial Building	2013	Not Available	Flooding
37	Egbe-Ikotun Area, Lagos State	6-Storey Church Guest House	2014	100 injured + 100 dead persons	Structural failure
38	Ebute Metta Area, Lagos State	3-Storey Building	2015	Nil	Defect Structure
39	Dolphin Estate, Ikoyi Area of Lagos State	Residential Building	2015	3-Injured	Gas Explosion
40	Lekki Phase 1, off Lagos-Epe Expressway, Lagos State	Uncompleted 5-Storey Building	2016	34 deaths	Non-compliance with the approved building regulations and plan
41	Itoku Market, Abeokuta, Ogun State	4-Storey Shopping Plaza under construction	2016	1 death	Not made public
42	Jabi District, Abuja	4-Storey Building	18th August, 2018	4 death + 18 trapped	Not Immediately Known

Sources: Ayedun, et al (2012), Olateju (1991), Chendo and Obi (2015) & Oloke, et al (2017)

2.3. Professed Causes of Building Collapse in Nigeria

Table 1 summarised the reported cases of some notable building collapses in Nigeria and their suspected causes. As contained in the reported cases, the causes of building collapse in Nigeria generally include professional negligence, poor quality of specification and enforcement of building regulations, quality of clients and their tastes, building design, structural defects, among other numerous reasons.

Akeju (1984) identified the engagement of incompetent professionals in the planning and design of building projects to be one of the causes of building collapse in the country while Chinwokwu (2000) also claimed that building designers very often, neglect specification writing. In the same vein, Olateju (1993) noted the neglect of quality control in the construction industry has being responsible for many defective and ugly looking buildings and the rise in the number of collapsed buildings in the Nigeria in the recent past. Ayedun, Durodola, Oni, Oluwatobi and Ikotun (2018) further identified flooding to be one of the issues constituting nuisance to most residential buildings especially those not built with quality materials while Ogunde, Isaac, Nduka, Ayedun and Ogunde (2018) recommended the introduction of integrated building automated systems in curtailing the challenges being faced by residential building construction in Nigeria.

Ayedun, Durodola and Akinjare (2012) identified the use of sub-standard building materials, poor workmanship by contractors, use of incompetent contractors, faulty construction methodology, heavy downpour, non-compliance with specifications/standards by developers/contractors, inadequate/lack of supervision/inspection/monitoring and defective design/structure to be the major causes of building collapse in Lagos State nay Nigeria. Oloyede, Omoogun and Akinjare (2010) and Awolesi and Ayedun (2012) recognized the use of incompetent artisans, weak supervision of workmen on site and low quality building materials to be responsible for collapse of building in Nigeria.

3. RESEARCH METHODS

To achieve the aim of this study, questionnaires were administered on the major professionals (builders, architects, town planners, quantity surveyors and estate surveyors and valuers) involved in building construction in the Lagos State, Nigeria with a view to obtaining from them what they considered to be factors causing building collapse in Nigeria and how to curbing the menace. In all, 142 questionnaires were administered to these professionals, out of which 102 copies, which represent 70% of the administered questionnaires, were returned. The historical data on some of the collapsed buildings in the country were collated from newspapers and past studies. To buttress the study, the opinions of some highly professionals and academicians were sought on the subject of study. The data collated from the retrieved questionnaires were analyzed with the aid of simple descriptive and analytical statistical tools.

4. DATA ANALYSIS AND DISCUSSION

The analysed data were presented and discussed under the following sub-headings: characteristics/bio-data of respondents, opinion of the respondent professionals on the possible causes of building collapse, opinions of the respondent professionals on the possible latent or remote causes of building collapse and finally, respondents suggested solutions to the problem of building collapse.

4.1. Characteristics/Bio-Data of Respondents

The characteristics of the respondents which include their sex, age range, academic qualifications and professional affiliation are shown in Table 2:

Table 2 Respondents Bio-Data and Characteristics

Characteristics	Category	Frequency	Percentage (%)
Sex	Male	87	85.3
	Female	15	14.7
	Total	102	100
Age	21-30	8	7.8
	31-40	24	23.5
	41-50	33	32.4
	51 and Above	37	36.3
	Total	102	100
Academic Qualification	Higher National Diploma (HND)	45	44.1
	Bachelors' Degree (B.Sc)	49	48
	Masters Degree (M.Sc)	6	5.9
	Doctor of Philosophy (Ph.D)	2	2
	Total	102	100
Professional Affiliation	Builder	12	11.8
	Architect	27	26.5
	Town Planner	9	8.8
	Engineer	24	23.5
	Quantity Surveyor	19	18.6
	Estate Surveyor & Valuer	11	10.8
	Total	102	100
Professional Qualification	Student Member	10	9.8
	Pupil/Graduate Member	14	13.7
	Associates	56	54.9
	Fellows	22	21.6
	Total	102	100
Years in Practice	Less than 10 yrs	16	15.7
	11-20 yrs	21	20.6

	21-30 yrs	26	25.5
	31-40 yrs	30	29.4
	41 yrs & above	9	8.8
	Total	102	100

Table 2 depicts the characteristics of the respondents indicating that 85.3% and 14.7% were male and female respectively. With regard to age range, the respondents of above 51 years (36.3%) constituted the highest percentage and were closely followed by the age bracket of 41 and 50 years (32.4%). In term of academic qualification, respondents with B.Sc degrees constituted the highest proportion with 48%. This was followed by the category of HND holders constituting 44.1% of the respondents. However, in terms of professional representation, the Architects constituted the highest proportion with a 26.5% representation. This was followed by the Engineers (23.5%) while the Quantity Surveyors formed 18.6% of the total respondents. With regard to the professional qualifications of the respondents, respondents who were Associate members of their respective professional bodies constituted the highest with a 54.9% response rate.

4.2. Opinions of the Respondent Professionals on the Possible Immediate Causes of Building Collapse

Table 3 below shows the various suggested immediate causes of building collapse from the opinions of the professionals involving in the construction industry in Lagos State, Nigeria.

Table 3 Opinions of Professionals on the Possible Immediate Causes of Building Collapse

	Possible Causes	Frequency	Percentage (%)
1	Lack of Structural Design	17	16.7
2	Inadequate Reinforcement	19	18.6
3	Use of Sub-Standard Building Materials	24	23.5
4	Wrong/Illegal Conversion of Building	7	6.9
5	Poor Workmanship	8	7.8
6	Non-Compliance with Approved Design	13	12.7
7	Poor Maintenance	11	10.8
8	Contractual Arrangement	3	3
	Total	102	100

From the afore-mentioned analysis, as contained in the Table 3, the use of sub-standard building materials (23.5%) ranked highest in the rating of the factors causing building collapse. This was closely followed by the use of inadequate reinforcement (18.6%) and lack of structural design (16.7%) amongst the factors responsible for building collapse. Contractual arrangement was rated least among the causes of building collapse with a response rate of 3%.

4.3. Opinions of the Respondent Professionals on the Possible Latent or Remote Causes of Building Collapse

The latent or remote causes of building collapse as identified by the respondent professionals are represented in Table 4.

The respondents opined that high cost of building materials 30.4% constituted the major cause of building collapse which was closely followed by bribery and corruption as well as government policies with a response rate of 22.5% and 20.6% respectively. The act of cutting corners by contractors, developers and owners was found important by 16.7% of the respondents while poor supervision was perceived to be the least influential cause of building collapse.

Table 4 Opinion of the Respondent Professionals on the Possible Remote / Latent Causes of Building Collapse

Possible Remote/Latent Causes	Frequency	Percentage (%)
High cost building materials	31	30.4
Government policies	21	20.6
Bribery and corruption	23	22.5
Act of cutting corners by contractors, developers and owners	17	16.7
Poor supervision	10	9.8
Total	**102**	**100**

4.4. Respondents Suggested Solutions to the Problem of Building Collapse

Table 5 below contains respondents' suggested solutions to the issue of building collapse in Nigeria.

Table 5 Suggested Solutions to the Problem of Building Collapse

Suggested Solutions	Frequency	Percentage (%)
Strict enforcement of building regulation Laws	28	27.5
Inducing local production of building materials to reduce cost	23	22.5
Proper Building Maintenance	17	16.7
Proper Soil Testing/Investigation	15	14.7
Penalizing of Culprits (Builders, Contractors and Owners)	6	5.9
Withdrawing of practice license of professionals indicted any building collapse	13	12.7
Total	**102**	**100**

From Table 5, indications showed that 27.5% of respondents were of the opinion that the enforcement of building regulation laws in the country was the best solution to the menace of building collapse. 22.5% of the respondents opined that if the government induced local production of standardised building materials, the problem of building collapse would be abated while another 16.7% reasoned that proper maintenance of building would solve the problem. In addition, 14.7% of the respondents suggested proper soil testing/investigation prior to building construction would bring the menace to a halt while 12.7% resolved that the withdrawal of the practice license of any professional indicted in unprofessional acts resulting to building collapse was necessary.

5. CONCLUSION AND RECOMMENDATION

Findings from the study revealed non-compliance with building regulations and planning approval to be the main causes of building collapse going by the opinion of the respondent professionals within the construction industry. Interviews with some of the professionals revealed that some building owners and developers exceed the number of floors approved by the planning authority due to the prevailing corruption in the country. This occurs as the officials who are mandated by the government to enforce compliance often close their eyes to such unholy acts.

To curb such acts with the view of bringing a lasting solution to the problem of building collapse in the country, the enforcement of building laws, promoting (standardized) local production of building material to reduce cost and proper maintenance of building is hereby recommended.

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