

The Requisite to Avoid Risk of Probable Building Collapse in Nigeria

Nnadi Ejiofor

Quantity Surveying Department, Enugu State University of Science and Technology, Agbani, Nigeria

Email address:

ezekiel.nnadi@esut.edu.ng

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Abstract: Construction activities in Nigeria have made the industry a focal risk point. This is because several building collapses which has resulted into huge losses of properties and human lives are yet to be curtailed. Some authors have written on this issue but it was observed that the spontaneous collapse of buildings in different locations has not yet triggered expected regulatory review in Nigeria. There are several reported and unreported total and partial collapse of buildings in major Nigerian cities like Lagos, Abuja, Onitsha, Kano and Port Harcourt, etc. Despite the availability of reliable building codes widely used in design; construction industry in Nigeria is still failing to meet acceptable standards; thus, resulting into risk of structural defects and subsequent building collapse. To find lasting solutions to tackling the challenges, this paper examines risk factors responsible for building collapse and its impact on Nigerian economy. Questionnaire and interview were used as instruments of data collection. The data gotten were analysis using tools like spearman's ranking and T-test. The findings revealed that usage of unapproved materials; defective design and engagement of quacks as major construction operators are the top ranked factors with an overall mean of 4.12, 3.96 and 3.87 respectively. T-test also reveals that at 95% confidence level, all the assessed factors were significant, as a significant p-value of 5 was derived for all the assessed factors. Loss of materials and capital investments, Psychological trauma and creating damaged image to the country and loss of lives of RII of 0.87, 0.85 and 0.83 were highest rankings respectively as identified impact of building collapse in Nigeria. It was concluded that all the identified factors are all significant and their impact are significant on the live of the people, the economy and the country's image. Mitigation measures were proffered to curb its further re-occurrence or control.

Keywords: Building Collapse, Construction Industry, Design, Management, Risks

1. Introduction

In developing countries, poor quality control in building construction has led to spontaneous building collapse and, in the event of even moderate seismic activity, to major disaster. Thus, because of poor building practices, the hundreds of millions of people occupying millions of new structures built in the coming years in developing cities worldwide will be at risk to even moderate earthquakes [1]. Poor construction quality has been identified as a major cause of building collapse accidents worldwide. In Nigeria, at least 25 buildings have spontaneously collapsed since 2006; killing identified 229 deaths; several unidentified death people and injuring over 400 people (Table 1). Meanwhile, every project has fundamental objective which includes the delivery of work at agreed Cost, Time, and Performance to attain maximum sustainability. Every

construction project is positioned to be sustainable if it could override the risks militating against it objectives. Hence, it's a high risk for a building to collapse while under construction; riskier when it's been occupied and most when been refurbished or demolished. Building collapse imprint poor image of the industry; it wastes human and economic resources; establishes fear in the mind of the investor and occupants of buildings. Therefore, factor of risk resulting into the frequent and yet to be checkmated collapse of building in the Nigeria is aim to be identified including its impact and mitigating measures to nail the occurrence in this work.

1.1. Review of Related Literature

Building construction is about stability; but most clients put more interest in the aesthetic. As the architects are answerable to the design; quantity surveyors to the cost is

also how the engineers should be made answerable to building structural stability or failure. No matter how small a building is, there is a probability of failure. It is therefore riskier if engineers are not involved in the design and project's construction. The failure of a project starts with poor planning. The involvement of the right person at the right time would aid adequate planning and ensure successful project delivery and sustainability. Until the right justification is done on who designs, gives approval to the designs, builds, supervises and gives final approval upon construction; building collapse would be a reoccurring issue.

The degree of building failure can be related to the degree of deviation of the building from its "as built" state which in most cases represents the acceptable standard within the neighbourhood, locality, state or country [2]. This deviation from the assertion above can be caused by several factors such as the greed of the contractors as well as poor supervision from the consultants or both. The significance of building collapse is the resultant effect of termination or hindrance to target construction process. This assertion was concurred with by [3] that; 'collapse of building either total or partial collapse of some of its components leads to the failure of building to perform its intended function of protection, safety or stability'. The quality control methods used in the construction industry often do not produce reliable data. Previous research by the author revealed lack of data on most construction activities in the country, most especially private owned project. Approvals are given to building designs by the capital development authorities without financial documentation (knowing cost value) of the proposed building. There are lot of structures in Nigeria major cities like Ibadan, Lagos, Enugu, Kano, Onitsha and Kaduna that are built so poorly; thereby are at risk of possible collapsed if nothing is urgently done to curb that. There should be an immediate established collaboration between the federal government and the Nigeria construction professionals to recertify major high rise buildings across the major cities to reduce the risk of more collapse.

Nigeria has stepped up quality of reinforcement in the market but is yet to overcome the issue of low-quality concrete which is among the key causes of building collapse in the country. Most concrete mixing especially in most

private owned projects are carried out manually without supervision. This act produces poor mixing ratio and weak concrete. On the part of public projects, even though part of total quality management (TQM) established to ensure quality production of concrete is by taken its sample and crushing same within 7days, 14 days and 28 days' intervals but this is rarely implemented. The test could pass while the concrete remains poor. Experience reveals that most specimens for test are taken after been duly informed; hence, the contractor prepares well and good sample mixture is taken in the presence of consultants after which they revert to their old and odd way of doing things. This differs from the developed countries where most concrete are mixed and delivered by ready-mix suppliers using automated dispensing stations and drum-mixer trucks (pumping machine). Mixing are poorly done and with inappropriate aggregates and water in most Nigerian construction sites thereby causing weak concreting. This necessitated the assertion that; 'engineering properties of the commonly used construction materials especially for concreting in Nigeria grossly fall below the minimum standard [4]. He added that "despite the shortfall, unqualified skills are employed to handle construction projects at various levels leading to poor quality control."

There have been no fewer than 20 high profile building collapses in the country, each with casualties and scars that are too obvious to be forgotten. The appalling part is that these happening kept occurring and spreading to all the nooks and crannies of the country. Uyo may be the most recent, but certainly not the last except decisive steps were taken for the needed changes [5]. Stemming from his prediction; Oko town in Anambra state recorded two incidents of building collapse in 2016. In one of the cases, no fewer than seven people lost their lives when a three-storeyed building collapsed at Nwagu village [6]. A collapse of four-storeyed residential building under construction in Lagos on 25th July, 2017 is another masterstroke. A total estimated worth of selected collapsed building in table 1 is N5,047,699,169.50 (Five billion, Forty-Seven million, Six hundred and Ninety-Nine thousand, One hundred and Sixty-Nine naira, Fifty Kobo Only). This is a huge loss to the contribution of the industry to the gross domestic product (GDP) of the country.

Table 1. Some identified capital collapse cases in Nigeria.

Incidence	Nature of project	Years	Location
Collapse of synagogue church guest house under construction	Six-storey guest house	September 12, 2014	Ikotun, lagos
Residential building under construction	5-storey building	March 8, 2016	Lekki Gardens Horizon 1
Residential building (3yrs of occupation)	Block of 36 flats of four-storey building	July 18, 2006	Ebute-Metta, Lagos
Residential building under construction	Four- storey building	August 2010	Garki, FCT
educational building (3yrs of occupation)	Two- storey building	September 2013	Bukuru, Jos
Residential building (under occupation)	A three- storey building	July, 2013	Ebute-Metta, Lagos
Residential building under construction		May 2013	Umuahia, Abia state
Bank of industry	A 21- storey building	March 2006	Lagos island
Residential building (under occupation)	A three- storey building	July, 2013	Kaduna
Residential building (under occupation)	A two- storey building	April 27, 2017	Lekki, Lagos
Residential building (under occupation)	A three- storey building	May 29, 2017	Lagos island
Residential building (under construction)	A four-storey building	June 13, 2017	Oko, Anambra State
Residential building (under construction)	A Four-storey building	July 25, 2017	3, Massey Street, Lagos Island

Table 1. Continued.

Incidence	No of Victims	Property worth	Reasons cited for collapse
Collapse of synagogue church guest house under construction	116 death; 100 injured	456,510,800	Church & contractor's fault; strange aircraft flown over the building (under investigation)
Residential building under construction	34 death; several injured	343,360,000	The building owner/developer
Residential building (3yrs of occupation)	28death; 50 injured	415,798,000	The contractor
Residential building under construction	23 deaths; 7injured	273,220,000	The contractor
educational building (3yrs of occupation)	10 deaths; 20 injured	182,934,800	Structural defects (designers & contractors)
Residential building (under occupation)	7death; few others injured	214,544,000	The owner & occupant
Residential building under construction	7death; few others injured		Structural defects (designers & contractors)
Bank of industry	2 deaths; 23 injured	1,774,990,000	Natural (heavy wind & rain)
Residential building (under occupation)	Several deaths; many others injured	198,645,500	Owner (maintenance)
Residential building (under occupation)	2 death; 1 injured	230,868,000	Contractor
Residential building (under occupation)	2death; scores injured	297,564,200	Construction
Residential building (under construction)	3death; 1person injured	338,140,215	Usage of substandard materials (contractor)
Residential building (under construction)	5 death; 13 persons injured	321,123,654.50	Addition of extra storey floor on the existing

Sources: punch newspaper, 11th march 2016: vanguard 28 April, 2017; vanguard 29 May, 2017; sensonewsonline.com, Punch 15th June, 2017, Vanguard 25th July, 2017, and approximate estimation using Quantity Surveyors' guide.

1.2. Identified Factors Responsible for Building Collapse in Nigeria

There are several factors responsible for building collapse in Nigeria. Some of these were discussed below. All these factors should be taken seriously and cautiously to ensure the mitigating of such occurrence in Nigerian construction industry.

Poor design and planning: The failure and eventual collapse of a building starts with the designs and planning towards its realization. The structural engineers are expected to carry out site investigation, soil test and probable future weather change before designing. There is need for necessary calculation to determine wind load etc. Some clients commence project without proper plan for funding. The weather effect on the ongoing project makes it weaker and unable to carry many loads when the reconstruction commences. Faulty designs bring about faulty construction.

Weak foundations: Foundation carries the superimposed loads, wind loads, dead loads and mobile loads and transfers same to the ground below for stability of the structure. Solid foundation sustains a building while weak or poorly constructed foundation mar construction activities. The substructure of a building project is valued at 25-35% of the total estimated cost depending on the ground nature. Construction of foundation in some swampy locations like Niger Delta area or a weak and erosion prone area in Nanka in Anambra cost more. Hence, a reasonable amount and time for supervision should be put in to ensure a viable foundation. Failure to do this would affect the expected performance of the project.

Usage of substandard materials: Corruption, greed and poor supervision has made it possible for substandard materials to be used for construction activities in Nigeria. Dirty water, 'muddy' sand, adulterated cement; substandard reinforcement are among identified major materials used in Nigeria building industry. Some contractors knowingly use the incorrect materials to cut costs. The standard organization or Nigeria (SON) and other regulatory professionals' bodies like COREN are expected to do more than office monitoring

but have an onsite assessment at will to determine standard of materials in use. The Quantity Surveyors too should ensure right materials usage before raising valuation for contractors.

Human error: This is a critical aspect of delivery where expert supervision is essential. Mixture of concrete and other works are like garbage in; garbage out. Hence, adequate monitoring by professionals not only saves cost but it saves time and enhances stability. Workers should not just be allowed to decide what they have inadequate knowledge of. Even when workers are given the right materials to make the concrete, they mix them incorrectly [7]. He further accuses developers of cutting costs by employing unskilled workers who are cheaper than trained builders. Earlier research carried out in 2004 on the reason building collapse in Uganda shows that the workers misunderstood the mixing ratios of concrete. It suggested that people used wheelbarrows instead of measuring gauges to measure cement. This lead to the collapse of the five-storey BBJ new hotel under construction and 11 people died [7]. Other common human errors include negligence, omissions, wrong placing and ignorance.

Carriage of heavier load: A building collapses when the load is beyond the strength of the building [7]. It is just like asking a baby to carry a heavy box: "The baby will not be able to withhold the strain." Addition of load during construction puts heavier load on the foundation. This is even if the foundations and the materials are strong enough for what they were originally built for. Hence, if a building was designed for two-storey shops and later turned into three-storey shops the building may strain under the weight due to the additional floor. This was a fact revealed by guardian newspaper on the collapse of residential apartment block on March 8, 2016 at Lekki, in Lagos killing 34 people. This came two years after a church accommodation for the Synagogue collapsed, also, authorities said, because it had more floors than it could hold. In that case, more than 100 people lost their lives.

Lack or poor soil investigation: All points of construction; the strength of the building should be tested [7]. There are many physical reasons a building can collapse He identified corruption as the real reason buildings collapse in Nigeria.

Buttress to this assertion is that consultancy has not been duly patronized in the recent times. This led to inability to determine suitability of the terrain and soil's bearing capacity, which influences foundation soil risk.

Promotion of quackery: The involvement of quacks has done much harm to the industry. The round pegs are put in the square hole; thereby exposing the industry to more risks. The trained builders are abandoned while medical doctors, lawyers, politicians, religious leaders, business men and all sort of people dominate the construction environment. "You find bricklayers and even technicians calling themselves engineers". This was collaborated that, 'In Nigeria, it is common that most contracts are first awarded to businessmen who front for politicians. The practice is that the businessman gets the contract and sells it to incompetent contractors known to them without following the normal contract procedures and without investigating the competency of the contractor. The result is shoddy performance which can lead to building collapse [2].

Poor supervision: Every stage of construction requires expertise supervision and monitoring to reduce risk. Foundation as discussed above is the most important section of the building. So also, is the column carrying slabs etc. the roof too must not be too heavy to enhance sustenance of the supporting elements. An opinion was given that every part of work stage is extremely important in the life of the structure as a mistake in any stage can have a far-reaching effect in the whole building process [7]

Natural occurrence: Heavy downpour for a longer period can affect mainly a fresh poured concrete thereby weakened its strength. Wind effect and thunderstorm was reported in March 2006 as the cause of collapse of 21 storey building belonging to Bank of industry in Lagos Island which resulted into the death of 2 persons and injured 23 others. Flood, earthquakes, earth movement and heavy wind are other forms of natural occurrence that could result into a building collapse. Some of such cases of building collapse in Nigeria caused by natural disasters have been reported by [8]. The previous finding revealed that the prevalent cause of building collapse is structural failure, followed by poor supervision and workmanship, the use of sub-standard materials, carelessness which could be linked to lack of competency in building techniques and supervision skills, and faulty design respectively. Other causes include rainstorms/natural causes, excessive loading and conversion and disregard for approved drawings. This data suggests that many building collapses are traceable to human activity (or inactivity) [9].

1.3. Impact of Building Collapse in Nigeria

It can be rightly said that any pursuit of human endeavor has its cost, but the cost being paid in the Nigerian building industry cannot be justified. Each building collapse carries along with it tremendous effects that cannot be easily forgotten by any of its victims. The consequences are usually in the form of economic and social implications. These include loss of human lives, injuries, economic waste in

terms of loss of properties, investments, jobs, incomes, loss of trust, dignity and exasperation of crises among the stake holders and environmental disaster.

The quantification of the complete effects of any collapse is extremely difficult as there are so many factors involved, and these include emotional and subjective factors. Apart from the number of deaths that can often be truly identified, the rest of the effects are surrounded by so many uncertainties which make the analysis only approximate. Leaving aside the grossly quantifiable economic sums, the stress, trauma and shocks may have some far-reaching effects upon the building owner and/or employees, occupants, and others involved in one way or the other with the structure. The negative impact of such failures on the social-economic development of our economy is obvious. As many precious lives are lost, the nation loses the contribution that could have come from these victims towards the socio-economic growth of the nation. More so, this increasing rate of death from building collapse in Nigeria runs against the United Nations MDGs programs aimed at reducing the mortality rate and improving safety and life expectancy of the world population.

1.4. Mitigating Measures to Building Collapse

There are some identified approaches to curbing building collapse in Nigeria. The end users must imbibe risk and maintenance culture to improve building's span and value. Necessary advice should be sought from expert in terms of environmental changes and impact. Certified structural engineers' skill should be utilized whenever the initial form of a building is being altered; most importantly in multistory buildings. Furthermore, the professionals must be fully engaged in designs, costing and construction. For instance, structural engineers should ensure the design after soil investigation; produce calculation sheet before design and being involved till completion. The Architect should design after visiting the site and work at closer range with the structural engineers to determine the foundation level and building height. The Quantity Surveyors on their part should prepared bill of quantity devoid of minimal errors and avoid working on drawings without engineers' certification.

Nigerians can 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 test for multistory buildings as opined by [4]. He also emphasized the need to formulate national codes, build on tested engineering properties of available building materials in Nigeria.

Summarily, every project should have an engineer's supervision to avoid further risks. It also behooves on the country's construction industry to ensure that all stakeholders are synergized to work for the growth of the industry. Other identified risks in the country are that of not knowing the total worth of the industry's contribution to the economy. For instance, the worth of the collapsed buildings in table 1 was calculated from the experience of the researcher. Data bank should be established for all the projects to be executed

before commencement. This allows for calculating the value of the monetary worth of the building to ascertain the industry's contribution to the GDP, in case of insurance, unforeseen and for other purposes.

2. Methodology

Research design can be described as an outline, arrangement of conditions, or a blueprint for collection, measurement and analysis of data, in a manner that combines relevance to the purpose of the research with economy in procedure [10]. It was described as an action plan for getting from here to there [11]. Here connotes the initial set of questions for which answers are sort, and there connotes the set of conclusions about the questions. The methodologies used in this study include comprehensive review of literature and adoption of a descriptive cross-sectional survey design. A comprehensive literature review was conducted through relevant books, academic research journals, workshops and dissertations, and online database. The study was designed to proffer a mitigating measure to incessant building collapse being witnessed in Nigeria.

2.1. Study Population

The population of the study consisted of 80 registered construction firms in Enugu, Lagos and Abuja which are the key regional cities in Nigeria with huge construction activities. 170 professionals in practicing consultancy's firms that are duly registered with their respective regulatory bodies such as; The Council for the Regulation of Engineering in Nigeria (COREN), Quantity Surveyors Registration Board of Nigeria (QSRBN); etc. form the respondents.

2.2. Questionnaire Design

The questionnaire employed had two sections. The first section of the questionnaire dealt with the respondent's general information. While the second section of the questionnaire required the respondent to rate various risk management practices and procedures to ascertain the level

of their consciousness and awareness using five-point Likert scale viz-a-viz: strongly disagree = 1; disagree = 2; neutral = 3; agree = 4 and strongly agree = 5. Likert scale rating system has been successfully utilized by several researchers in their studies, among which are [12]. The validity of the instrument was carried out by two experts in the field. Reliability of the instrument was established by applying split-half method. Cross tabulation and chi-square was adopted to test the data and a degree of agreement was obtained. Whereby tests were carried out to find out the strength of association between the variables using Phi and Cramer's V.

2.3. Sampling Technique

Sampling technique is a process of selecting a few contacts or objects from a total population to represent the entire population. Given the wide distribution of construction activities going on in Nigeria and their heterogeneous nature, the purposive or judgment sampling method was adopted in this study. Patton argues that purposeful sampling is a technique widely used in research for the identification and selection of information-rich cases for the most effective use of limited resource.

2.4. Sample Size and Selection

The primary data for this study were collected from 250 respondents including 80 registered construction firms in Enugu, Lagos and Abuja which are the key regional cities in Nigeria with huge construction activities. Multiple construction professionals in Nigeria were contacted using a questionnaire survey. A total of 170 questionnaires were purposively administered to 40 architects, 55 engineers, 65 quantity surveyors and 10 developers in person to get their response on research topic. Telephone call and short message system (SMS) reminders were used to follow up on the responses. Table 2 shows that 187 valid responses were received, constituting a response rate of 75% which was considered adequate for data analysis.

3. Results

3.1. Factors responsible for Collapse Building in Nigeria

Table 2. T-Test Summary of factors responsible for building collapse.

Factors	MIS	SD	RK	SIG.
Usage of uncertified materials	4.12	1.35	1	0.000
Defective design	3.96	1.30	2	0.000
Construction being carried out by quackery	3.87	1.27	3	0.000
Poor construction management	3.62	1.19	4	0.000
Non-involvement of relevant professionals (inadequate supervision)	3.58	1.17	5	0.000
Corruption	3.16	1.04	6	0.000

Footnote: MIS = Mean item score, SD = Standard deviation, RK = Ranking, SIG (p-value) = Significant

3.2. Impact of building collapse

Table 3. Impact of building collapse in Nigerian construction industry.

S/N	Identified Impacts	frequency of response					Σf	Σfx	Mean	RII	Rank
		1	2	3	4	5					
1	Psychological trauma	0	0	12	17	26	55	234	4.25	0.85	2nd
2	Withdrawal of practicing licenses	1	5	22	11	16	55	201	3.65	0.73	6th
3	Loss of new commissions and contracts	4	13	15	16	7	55	174	3.16	0.63	7th
4	Create damaged image to the country	0	0	16	16	23	55	227	4.13	0.83	3rd
5	Lack of trust in the industry	2	8	12	14	19	55	205	3.73	0.75	5th
6	Loss of materials and capital investments:	0	0	8	19	28	55	240	4.36	0.87	1st
7	Loss of lives	0	0	16	14	25	55	229	4.16	0.83	3rd

4. Discussion

4.1. Factors Responsible for Collapse Building in Nigeria

Result in table 2 shows the summary of t-test conducted with the ranking of each factors. The findings revealed that usage of unapproved materials; defective design and construction being executed by quacks are the top ranked factors with an overall mean of 4.12, 3.96 and 3.87 respectively. Following the hypothesis set ($H_a: U > U_0$ and $U_0 = \text{important}$). T-test also reveals that at 95% confidence level, all the assessed factors were significant, as a significant p-value of 5 was derived for all the assessed factors.

This result proves that each of the identified and assessed factors had caused one building collapse in one part of the country to the other. The curriculum vitae of most construction firms in Nigeria include qualified professionals that are not in their pay roll nor involved in their activities. Thus, the construction sites are largely controlled by the same 'unfit' contractors and not by the consultants. Nigeria industry is therefore under trajectory risk and the siege of quackery; promoted by poor policy and implementation.

4.2. Impact of Building Collapse

The rate of occurrence of collapse buildings in Nigeria is at alarming rate that made it difficult to predict the industry. Several factors resulting to this had been earlier discussed. Meanwhile, the occurrence has a direct and indirect impact on the industry and the entire Nigerians. It is vital therefore to evaluate the impact of building collapse in Nigeria; which was presented in table 3.

Table 3 shown the impact building collapse has on the people and the nation. Loss of materials and capital investments ranked first with RII of 0.87 which is very significant. Psychological trauma ranked second with RII 0.85 RII. Creating damaged image to the country and loss of lives were both ranked 3rd with RII of 0.83 each; which is also very significant. Loss of new commissions and contracts ranked least (7th) with RII of 0.63, which is still very significant.

The result implies that collapse of building in Nigeria has a huge effect on the economic growth of the people since its occurrence result in loss of materials and capital investment of the people.

5. Conclusion

The impact of the risk of collapse buildings in Nigeria is huge. Huge amount of financial outlay are lost at each occurrence. The capital lost results to low contribution to GDP and negate the economic growth of the country. Human lives that are unquantifiable are also lost in most of the identified cases. The identified factors such as usage of unapproved materials; defective design and construction being executed by quacks and so on are significant to causes of building collapse in Nigeria as ascertained from the T-test. The major disservice the rate of buildings' collapse is doing to the country is by making the industry a highly risk prone and being unpredictable. Loss of materials and capital investments, psychological trauma, damaging of the country's image are among the impact of building collapse on the economic growth of the people.

6. Recommendations

Proper planning, supervision and monitoring of construction activities should be institutionalized by policy makers to ensure that all buildings are constructed to design, specifications and planning regulations. Professionals in the building industry should maintain their integrity and professional ethics and work in accordance to standard practice procedures laid down by the standard form of building contracts.

There is need to organize periodic public awareness campaign through electronic and print media to sensitize the public on advantages of using professionals as the way of realizing safe buildings. Standard organization of Nigeria should be vigilant to ensure that building materials imported into the country conforms to standard requirements.

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 put the building in avoidable risk. It is the duty of the architect as most times the first contact to direct the client to engage other relevant professionals. This he achieves by 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 planning authority for "building permit". Expected document to be

added during building approval is the stamped bill of quantities by registered QS. The bill of quantities provides the financial information of the proposed work. It furnishes the government with the projects worth, tax purpose, loan acquisition, claims and for assessing the industry's contribution to GDP.

Soil investigation, material tests and environmental impact assessment (E.I.A) should be made compulsory for all institutional, industrial and commercial buildings. All building plans tendered by any developer for approval must comply with the Nigeria's new building code and local bye laws and regulations. Standard organization of Nigeria, (SON) should monitor the standard of blocks moulded in block industries and impose minimum standard in terms of sand-cement ratios. There is need to empower and restructure available materials testing laboratories in the country. The National Assembly should take contribution or submissions of relevant professional bodies in the industry and make speedy passage of the bill on National Building Code.

References

- [1] Fernandez R.F. (2014): Strategies to reduce the risk of building collapse in developing, PhD thesis Submitted to the department of Engineering and public policy, Carnegie Mellon University.
- [2] Chendo, I.G and Obi, N. I. (2015, citing Ikpo, 1998); Building Collapse in Nigeria: The Causes, Effects, Consequences and Remedies, International Journal of Civil Engineering, Construction and Estate Management Vol.3, No.4, pp.41-49.
- [3] Olagunju, R.E, Aremu, S.C and Ogundele, J (2013): Incessant Collapse of Buildings in Nigeria: An Architects view. Journal of Civil and Environmental Research. Vol. 3 No 4, 2013.
- [4] Afolayan J. (2014) Vanguard newspaper of October 7, 2014.
- [5] S. Shitanda, National Building Maintenance Policy (Ministry of Housing of the Republic of Kenya, Nairobi, Republic of Kenya, 2011).
- [6] Punch newspaper of 15th June, 2017.
- [7] Ede, A.N (2010): Building collapse in Nigeria: the trend of casualties the last decade (2000 -2010), International Journal of Civil & Environmental Engineering IJCEE-IJENS vol:10 no:06 32.
- [8] Arayela, O and Adam J.J (2001): Building Disasters and Failures in Nigeria. Causes and Remedies. Journal of the Association of Architectural Educators in Nigeria (ARCHES). Vol. 1 No. 6.
- [9] Abimbola O. Windapo and James O. Rotimi (2012): Contemporary Issues in Building Collapse and Its Implications for Sustainable Development, Buildings, vol. 2, pp 283-299.
- [10] Kothari C.R (2004): Research Methodology, methods and techniques, New Age International Publishers.
- [11] Yin, R. K. (2009): Case study research: Design and methods (4th Ed.). Thousand Oaks, CA: Sage.
- [12] Nnadi, E.O.E (2015): Risk Management for Sustainable Project Delivery in Nigerian Construction Industry; A PhD thesis submitted to the Civil Engineering Department, University of Nigeria, Nsukka.