

Strategies for Mitigating Building Collapse in Nigeria: Roles of Architects and Other Stakeholders in the Building Industry

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Abstract

Collapse of buildings is one of the several failures of building projects and results either in loss of lives, properties and in some cases both. Often times the professionals in the building industry made up of Architects, Engineers, Planners, Quantity Surveyors, Land Surveyors, Estate Surveyors, Town Planners, Builders and Project Manager trade blames on who should be held responsible for the failure. Many factors can be adduced to the continuous occurrences of building collapse which, include inadequate monitoring of construction sites by government officials as a result of the vast and fast pace of developments in many Nigerian urban centres; as well as the use of substandard materials, improper soil investigations, bad design and supervision, poor quality construction and poor funding by clients. Using the secondary source of data collection, the paper discusses the roles the architect could play both in practice and in architectural education in mitigating building collapse. Findings reveal that mitigation of building collapse can be achieved in Nigeria through collaborative efforts of all stakeholders involved and concludes that architectural education could serve a supportive role.

Keywords: Architects, Architectural Education, Building Collapse, Mitigation, Nigeria

1. Introduction

The involvement and input of professionals in the building industry from the design to the construction of the buildings; including the supervision at every stage is vital if standards are to be maintained. As observed by Windapo and Rotimi (2012) the absence of these, results into failed projects and poor functional performance; as buildings that meet desired performance requirements add value to national asset stock. However, in some cases, these standards are not adhered to and services of non-qualified professionals are employed thereby constituting problems of building collapse.

Tomori (2010) noted that every aspect of building planning process from the architectural designs through to the mechanical, electrical, structural engineering, construction and maintenance require proper supervision and quality input by professionals and stakeholders in the building industry . Nevertheless, in some cases, building projects are not executed in accordance with the set down rules and consequently results in collapse.

Ayodeji (2011) and Adedeji (2013) define building collapse as 'a state of complete failure when the structure has given way and most members caved-in or buckled'. Similarly, Olagunju et al. (2013) perceives building collapse as a total or partial failure of one or more components of a building leading to the inability of a building to perform its principal function of stability, safety and comfort. In line with these, building collapse can affect the totality of the building or can partially affect some parts of the building and in this regard, safety and stability must be of utmost concern. Furthermore, Ede (2010) argues that every structural system is expected to be designed with safety in mind so as to avoid loss of lives, properties and damages to the environment.

Globally, building collapse may either be due to natural disasters resulting from earthquakes, hurricanes, floods, landslides, volcanic eruption, rising sea levels, storm surges; or man-made factors, also known as human errors as a result of poor design and construction before, during and or after construction (Natural Environment Research Council, 2005; Amadi et al. 2012). However, this paper dwells on collapse due to human errors caused by poor building professional practices resulting in the loss of human lives, properties and in some cases both in Nigeria. These, in most cases are accompanied by unforgettable memories by affected victims.

Ayuba et al. (2012) noted that the structures, materials and components of any building are very important and must not only meet standard but also aesthetics; short of these could result in building collapse. Conversely, Nwokoye (2012) stated that buildings are designed to support both live loads i.e. weights of people, objects, pressure of wind and rain; as well as dead loads of the building and should not deform excessively. The inability to calculate these loads appropriately and accurately may lead to its failure and eventual collapse. Like in other countries, Nigeria is experiencing cases of building collapse ranging from one storey buildings to multi storey buildings in the different geopolitical zones that make up Nigeria; of which quite a number of factors are responsible. This paper therefore discusses the roles of architects and other stakeholders (clients, consultants, contractors and government agents) both in practice and in architectural education in order to mitigate building collapse in Nigeria.

2. Factors Responsible For Continuous Occurrences of Building Collapse in Nigeria

Several causes of building collapse in Nigeria can be attributed to human errors; ranging from absence of soil

tests, structural designs by quacks, uncoordinated activities between professional bodies, non-adherence to specifications, poor and bad construction practices, use of substandard materials, lack of proper supervision, illegal conversion of buildings, poor monitoring of work force, foundation failures, bad designs (Oloyede et al., 2010; Nkwokoye, 2012; Ayuba et al., 2012; Tomori, 2010; Olagunju et al., 2013; Danladi, 2012); all borne out of man's negligence and differing opinion on professionals to blame (Oloyede et al., 2010). Building collapse could result from defects from design, approval and construction stage. However, buildings could still fail even when they are in use. Non-performance on the part of the design team (architect, quantity surveyor, civil/structural engineer) could lead to collapse of buildings (Aluko and Adedeji, 2010). Although, like the developed countries, government and professional bodies in Nigeria have in place specific rules and regulations to maintain required and acceptable standards as regards building projects; however, due to weak accountability and political will as noted by Oloyede et al.(2010), these rules are not enforced nor properly monitored and consequently results in omission of performance; as such, the menace is growing in alarming rate in many cities in Nigeria. Thus, the consequences of non-performance are incalculable losses, not only in that of human lives and injuries, but also in loss of materials and investments not recoverable by the client as opined by Olagunju (2013) and Adenuga (2012). Furthermore, it gives room for several questions as to whom the blame of the collapse should be directed. Also, professional bodies such as Architects Registration Council of Nigeria (ARCON), Council of Registration of Engineering in Nigeria (COREN) and government bodies as stated by Fakere et al. (2012) are quick to set up panel of inquiry to determine the cause. This really call for concern, as all professionals (architects, engineers, builders, quantity surveyors) in the building industry are supposed to and should work together from the inception stage of a building project to the completion stage and through the defect liability period before the final handing over. Short of this collaboration, and corporation, mitigation of building collapse will be a mirage.

2.1 Pictorial Analyses of Building Collapse in the Six Geopolitical Zones in Nigeria

Building collapse cuts across all the geo-political zones in Nigeria; with the South-east made up of Anambra, Enugu, Ebonyi, Imo and Abia states; South-south made up of Edo, Delta, Bayelsa, Cross-River and Akwa-Ibom States; South-west made up of Lagos, Ogun, Oyo, Osun, Ondo and Ekiti States; North-central made up of Kwara, Kogi, Plateau, Nasarrawa, Benue, Niger States and F.C.T-Abuja; North-east made up of Taraba, Adamawa, Borno, Yobe, Bauchi and Gombe States; and North-west made up of Sokoto, Zamfara, Kebbi, Kaduna, Kano and Jigawa States (Ayeni, 2012) as shown in figure 1. Figures 2 to 11 shows the pictorial analyses of cases of building collapse in the six geopolitical zones in Nigeria



Figure 1: Six Geo Political Zones
Source: Adejumo (2013)

South-south



Figure 2: Collapse of a Hospital Reconstruction in Benin City
Source: <http://news.naij.com/812.html>

Figure 2 shows multi storey hospital building said to be 109 years old and being upgraded and reconstructed as part of infrastructural renewal in Benin City. Collapse occurred in June, 2012 and was caused by collision of crane with a freshly constructed beam on June 5, 2012 trapping workers under rubbles.



Figure 3: Collapse of Two storeys Building in Port Harcourt

Source: <http://www.vanguardngr.com/2013/08/building-collapses-in-port-harcourt/>

Collapse of a two storey building shown in Figure 3 was due to poor concrete mixing for decking and pillars; and the use of wrong sizes of reinforcement rods occurred on the 6th of August, 2013 at Akpajo on old refinery road, Elelenwo, Porthacourt. South-east



Figure 4: Collapse of Multi Storey Building in Umuahia, Abia, State, Nigeria

Source: <http://news2.onlinenigeria.com/latest-addition/284761-building-collapses-in-umuahia-abia-killing-seven.html>

Collapse occurred on the 16th of May 2013 as shown in Figure 4; at Agbama Housing Estate Umuahia, Abia State. Cause of collapse unknown, however casualties were recorded. North-east



Figure 5: Collapse of Multi Storey Exam Hall in Taraba.

Source: <http://ireports-ng.com/2013/04/25/three-secondary-schools-students-killed-200-injured-as-exam-hall-building-collapses-in-taraba/>

Collapse occurred on the first floor of a storey building located at Mararaba, in Donga Local Government Area in Taraba on the 25th of April 2013 as shown in Figure 5; killing three students and several injured North-west



Figure 6: Collapse of One Storey Building in Kano.

Source: <http://www.channelstv.com/home/2012/07/26/one-year-old-baby-killed-by-collapsed-building/>
Collapse caused by structural failure on 26th of July 2012, at Niger Road Sabongari, Kano leaving one dead and several injured.



Figure 7: Collapse of Multi Storey Building in Kaduna.

Source: <http://www.vanguardngr.com/2013/07/kaduna-building-collapse-pathetic-tale-of-woman-who-lost-three-children/>
Collapse occurred on July 11, 2013, along Hadejia road Kaduna as shown in Figure 7 and was caused by overburdened by an extra-floor, which burden (loads) it was not designed to carry leaving several dead and trapped.
North-central



Figure 8: Collapse of Three Storey Building in Abuja

Source: <http://saharareporters.com/news-page/breaking-news-three-storey-building-collapses-abuja>
Collapsed occurred in Naval Quarters in Gwarinpa, Abuja on the 28th of January, 2012 as shown in Figure 8. It left several dead and construction workers injured and trapped



Figure 9: Collapse of Two Storey Building in Dutse, Abuja, Nigeria

Source: <http://allafrica.com/stories/201208090170.html>
Figure 9 shows an uncompleted two storey building collapse occurred on the 8th of August, 2012 in Dutse in Bwari Area Council, killing three people and injured nine others. Cause of collapse unknown.

South-west



Figure 10: Collapse of Twin four Storey Building in Lagos

Source: <http://www.sbs.com.au/news/article/2013/11/05/four-dead-nigeria-building-collapse>

Collapse of a twin four storey duplex shown in Figure 10 occurred on the 3rd of November, 2013 in Victoria Island leaving four dead and twenty-five injured; cause of collapse unknown.



Figure 11: Collapse of Church Building in Ibadan

Source:

<https://ejaife.wordpress.com/2012/06/01/5-killed-2-injured-as-church-building-collapses-in-ibadan/>

Collapse occurred in Sagbe Aba- Alfa, Ojoo, Ibadan, Oyo State on the 1st of June 2012; leaving five dead and two injured; building caved in as a result of heavy rain (Figure 11).

3. Study Area and Methodology

The study was carried out in Nigeria, West Africa and was essentially qualitative in nature; adopting the secondary sources of data collection through the review of relevant literature, past research works, using the internet, journals, texts and magazines relating to building collapse in Nigeria as well as pictorial evidences from the six geopolitical zones that make up Nigeria. The cities investigated within six geopolitical zones include South-east (Umuahia-Abia); South-south (Benin City, Port Harcourt South-west (Ibadan, Lagos); North-central (Abuja); North-east (Taraba) and North-west (Kano, Kaduna). The sampling method was Purposive and chosen for convenience and analysed through pictorial evidences as shown in figure 1 to figure 11.

4. Discussions and Findings

4.1 The Role of Architects in Mitigating building collapse in Nigeria

Going by the pictorial evidences of building collapse in all the geopolitical zones as previously shown in figures 1 to 10, it reveals that building collapse cuts across the major cities in the six geopolitical zones in Nigeria and has recorded incessant incidences some of whose causes are known and some unknown. As opined by Danladi (2012), Lagos, the commercial capital of Nigeria has always recorded the highest number of building collapse closely followed by Abuja, the Federal Capital Territory attributing it to the high rate of urbanization and construction taking place in these cities.

In mitigating building collapse in Nigeria, the architect, being a key player in the building industry, has duties of coordinating all operations of the allied professions; making sure all specifications are followed and in line with the design and satisfaction of the client. Hence, Ayuba et al. (2012) in line with the above opines that the architect as the master planner must ensure that competent professionals are recommended to the client.

The design of buildings does not only involve the design and aesthetics, but must be functional, safe and economical to suit the need and purpose of which it is intended (Famepyramid, 2013); as such, the architect must ensure that the right materials are specified both for the interior and exterior of the building. Also, site visits during construction must be ensured in order to ensure standard and quality are adhered to.

So many people (quacks) dishonestly parade themselves as architects, designing and supervising buildings and eventual construction as noted by (Tanko et al. 2013); these obviously has contributed to the increase in the number of building collapse in Nigeria and should be discouraged by ensuring that perpetrators are dealt with by the professional bodies and law enforcement agents; ensuring that only registered professionals

are allowed to practice.

Another main factor which contributes to building collapse earlier mentioned is the lack of adequate soil investigation. The Professionals should ensure proper site investigations and proper analysis carried out before the commencement of any design; as such, subsoil, topography, weather conditions of the site must be checked.

Furthermore, contractors that are inexperienced could contribute to produce substandard jobs and incessant building collapse in the country. In view of this, architects should ensure that competent contractors are duly selected for the execution of any building projects.

Also, many buildings are arbitrarily converted from its original design, without considering the structural capability of the existing structure. Architects should discourage the alterations of building plans after approval and after the structural drawings are completed. All alterations must be done at the design stages. There are cases where one storey buildings are changed to two storeys by the client and unqualified contractors without seeking the advice from the architect and other professionals. Due approval must be obtained from the Local Planning Authority before alteration is effected on any existing building.

Another role the architect needs to play in mitigating building collapse is to ensure that all drawings are duly approved by appropriate authorities before the commencement of the construction work. Architects should discourage clients building without all necessary approvals.

Also, professional bodies like Nigeria Institute of Architects (NIA), Nigeria Institute of Quantity Surveyors (NIQS), Nigeria Society of Engineers (NSE), have not been able to effectively monitor the activities of their members as most of their jobs have been taken over by the quacks. Designs made by the quacks are brought to the registered professionals to seal after a sum of money has changed hands without putting the integrity of the profession at heart. These have contributed to the persistent building failures.

Architects should have it in mind that his job does not end on the drawing board but to oversee the entire process through to the construction stage until the project is completed. In that way, the architect is able to advise the client and sees that the design is actualised.

Added to the activities of the architects in the mitigating collapse of buildings, other key players in the building industry like the clients, consultants, contractors and government agents are vital to solving this menace.

The Client

The appointment of the consultants is the sole responsibility of the client. Therefore, any mistake made in their appointment either in terms of competence or experience directly affects the output of construction. However, the selection of contractor is vital in the successful implementation of the construction. In the selection process, it is safer if the client follow the advice of the architect in the selection of contractors and other parties to be involved in the project. In some cases, a client neglects the recommendation of the consultants, thereby selecting quack or mediocre contractor to carry out the physical implementation of the project. If the availability of manpower and the equipment to execute a project of large magnitude is not considered by the client in the course of making his choice, the issue of failure, therefore, becomes inevitable.

It is worthy of note that the information required from the client in the course of initial stage of design is of paramount importance. The client's requirements [brief] should be sufficient and unambiguous to avoid failure in the process of construction.

The Consultants

The consultants are the professional advisers to the client. It is not impossible for each of the consultants to be connected in one way or the other to the collapse of buildings. Adherence to professional codes and ethics in the discharge of duties is vital in taming building collapse in Nigeria.

Building drawings that are prepared by an Architect who probably does not carry out proper site investigation, soil test, inadequate working drawings and details, wrong specifications, non-adherence to buildings bye laws, regulations and acts that obtain at the Federal, State or Local Government levels, neglect of building orientation and location with reference to weather conditions are sources of collapse of our building. Structural drawings without sufficient information on the design of beams, columns, deformation, shrinkage, structural engineering details calculation error overtly or covertly contributes to building failure (Aluko, and Adedeji, 2010). Hence, various professional are to ensure that their professional inputs are diligently and accurately carried out. In the same vein, construction, when in progress ought to be supervised and monitored so as to point out to the contractor areas of deficiency, which could be in terms of workmanship and materials. The aftermath of not doing the above is what anybody can think of. Other causes from consultants are outright negligence, greed and mismanagement.

The Contractors

The contractor is charged with the responsibility of physical erection of the building. He is expected to have in

his organization both skilled and unskilled labour. In fact, he must be versed in modern techniques as well as being in possession of modern construction plants and equipment. Besides, his knowledge of current construction materials must be high. However, investigation reveals that very many contractors in Nigeria lack the above qualities. What becomes clear is that mixture and placement of concrete, placement of formworks and use of building materials are done very badly. On many occasions, contractors accept a commission whose capabilities and expertise fall below the scope of work. The Architect and other professionals that serve the interest of the client on site are to ensure that the contractor possesses the minimum qualifications stated above in order to effectively perform on site. Adequate management of site, carefulness and adherence to specifications are salient factors that will ensure mitigation against collapse of buildings.

Government Agencies

Various government agencies have also contributed to the huge losses experienced in the building industry through building collapse. The inability of the Local Planning Authority to ensure that design conforms to design principles before approval has not helped matters in Nigeria. If building collapse would be curbed in Nigeria, the Planning Authority must wake up to their enshrined role of ensuring designs conform to building regulations before they are approved for execution. There are cases, where the Planning Authority in a particular Local Government lack expertise personnel (architects, engineers and planners) to ensure right decisions are taken before approval and during execution of buildings. This must be corrected.

Also, on the area of inspection of buildings during construction, regular routine inspections must be carried out to ensure compliance with given approval in all cases. The impacts of Standard Organization of Nigeria (SON), which is responsible for the development of standards that are local to Nigeria, have not been felt in the Nigerian building market. Their performance in the aspect of monitoring the qualities of building materials produced by the manufacturing firms to ensure uniformity/ conformity with established standards have not received any attestation.

4.2 The Roles of Architectural Education in Mitigating Building Collapse in Nigeria

The analyses above supports earlier researches by Tanko, Ilesanmi and Bala (2013, that quackery is a principal culprit in building failures in Nigeria, hence, building collapse is as a result of so many unregistered and unqualified 'graduates' practicing and carrying out jobs of architects without being checked. This therefore calls for the general enlightenment of students of architecture on the one hand and other allied professionals to aim at their chosen career to professional levels; and the general public on the other hand patronises qualified professionals to guard against eventual loss of properties and/or human lives in a bid to save cost.

Regulatory professional bodies, the Architects Registration Council (ARCON) and the Nigerian Institute of Architects also have roles to play by ensuring that most schools of architecture have accredited courses and ensure that the schools run courses duly certified in order to guard against breeding 'half baked' graduates who would eventually parade themselves as professionals.

Tertiary institutions must ensure that students who are admitted for architecture programmes are qualified for admission and meet the required standard grades set as prerequisites for admission into the schools of architecture, short of these will lead to breeding of quacks that are not able to measure up to the expected level of knowledge needed to be professionals.

Also, structural detailing should be emphasized and improved upon in the schools of architecture. Architects should be trained to visit sites more and regularly, than the normal one month visit currently stipulated by the Nigerian Institute of Architects

Furthermore, there should be procedures put in place for revising curricula in all architectural schools in Nigeria in order to impart adequate knowledge and skills in construction; to reflect findings from researches for students to be abreast with current technologies and developments in the industry.

From the preceding literature, some clients change the use of buildings during construction and in most cases over stretch the initial structural capability of the design, which eventually leads to collapse of the building either during or after construction. Students should be taught how to take proper brief from client, skills of giving useful advice as well as implication of alteration during construction. By that, the client is aware of all the implications and in turn adheres to professional advice.

As earlier stated, architecture is not all about aesthetics but also involve functional and safety; as such design studio should draw attention and elaborate on the structural implications of fanciful designs. Furthermore, students should be cognisance of the importance of structural stability and deeper knowledge taught at all levels. Although aesthetics and creativity are part of architectural training, however, structural stability and proper functions of the various parts involved are crucial and underpins its success. As such, students must have adequate knowledge of structures and construction at all levels of architectural education.

In addition, management aspects of architecture which are not currently being emphasised in schools should be checked and improved upon.

Architectural educators should discharge their duties to reflect quality and standard; as such, adequate knowledge and skills are expected of architectural educators. In this regard, training and retraining through capacity building is vital.

5. Recommendations and Conclusion

From the study, building collapse in Nigeria can be attributed to mainly human errors and are usually accompanied by various degrees of loss including human lives and properties. Although occurrences of building collapse cannot be completely eliminated, however, it can be mitigated through the cooperation and collaborative roles of architects, associated regulatory bodies of architectural profession such as the Nigerian Institute of Architects (NIA) and the Architects Registration Council of Nigeria (ARCON), allied professions and other relevant stakeholders in the industry. The architect in practice as well as an educator has the coordinating roles and responsibility in seeing that there is adherence, satisfactory performance, standard and quality of building construction.

In line with the above, duties and obligations of each member of the building team should be well defined and any professional failing to adhere to the rules and regulations governing building construction or projects and especially in changing the use of buildings without proper consultation should be made to face the consequences.

Furthermore, there is the need for schools of architecture in collaboration with the professional bodies such as the Nigerian Institute of Architects (NIA) and the Architects Registration Council of Nigeria (ARCON) to regularly organise conferences, workshops, seminars and training to update knowledge of staff and students in general on new knowledge and information on construction.

Also, government should set up monitoring forces to see that every building design which has passed through approval process is built as specified and approved; by making regular visits to construction sites with the view of assessing every stage of construction.

As discovered from the study, the use of quacks by clients is one main reason for building collapse in Nigeria, apart from the use of substandard materials, lack of soil test and the lack of proper supervision. The architect therefore has the choice of consultants and contractors should advice the clients in this regard and guard against clients imposing quacks in the execution of building projects; instead clients should rely on professionals' advice of the architect in order to maintain standard and quality.

In addition, there is the need for a collaboration between all professionals, that is, the architects, engineers, builders, town planners, quantity surveyors, estate valuers who need to work together to ensure that buildings designed and approved are actually built and also ensure that the right materials and proper supervisions are carried out.

In conclusion, the study has elaborated on the role the architect and architectural education need to play and has shed light on the collaborative need among the allied professions in order to mitigate building collapse in Nigeria.

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