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Causes of Building Collapse in Anambra State: Analytical Approach

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Abstract: This research has investigated the causes of building collapse in Anambra State over a period of 10 years. To meet the research goal, raw materials were gathered from original sources, including online printed publications from various local newspapers that provided firsthand experiences of building collapses. Data were collected, evaluated, and used in the research to provide insights into the causes of building collapses in Anambra State. Heavy rains, poor quality materials, hurried work, impropriety, various illegalities, fire incidents, structural compromise, project completion delays, floods, shoddy foundations, absence of building approval, absence of monitoring agents from relevant authorities, and a few other unreported factors were identified as the main causes. It is believed that the government and other parties involved in the construction sector should implement workable solutions and enforce rigorous compliance with stiffer penalties on offenders; building collapse problems will be a thing of the past not only in the chosen area but in Nigeria at large.

1. Introduction

Solid The frequency of building collapses has raised concerns in people's hearts, and not without numerous questions that need answers. What has become of the effectiveness of the construction codes implemented in Nigeria and the productivity of building industry experts? Are the questions that one cannot help but ask. If losing property can be bearable, what about losing lives? How are the relatives of those who perished in the building collapse faring? These are the most noteworthy questions raised as building collapse has now become a major cause of death in Nigeria, affecting mostly Abuja, Lagos, and Anambra State (Nigeriagrasrootnews, 2022, Obiotika, 2023).

It is documented that Nigeria had 541 building collapse incidents over the 48-year period from October 1974 to November 2022. With 322 instances, Lagos State tops the table, followed by Anambra (20), Oyo (19), and Abuja (18), among other states (Sahara News, 2023). Numerous researchers have investigated and recorded the stories of various building disasters in Nigeria, such as the September 12, 2014, Synagogue Church guesthouse building that collapsed in Lagos, which killed at least 116 people, including 84 visitors from South Africa (Mathebula and Smallwood, 2017, Owolabi, Aderounmu and Ogbonna, 2021), the 4-storey building that collapsed in September 2010 at 28 Tinubu Street, Vitoria Island, Lagos, with four fatalities (Windapo and Rotimi, 2012), the 5-storey building

that collapsed in June 2011 at number Aderibigbe Street, Maryland, Lagos (Helwig, Hong and Hsiao-wecksler, 2012), the 3-storey building that collapsed in October 2018 at Okpuno, Otolo, in Nnewi, Anambra (Owolabi, Aderounmu and Ogbonna, 2021), another 3-storey building that collapsed in October 2018 at Ifite Awka, Anambra State (Owolabi, Aderounmu and Ogbonna, 2021), the Reigners Bible Church building collapsed in December 2016 in Akwa Ibom State with 100 fatalities (Mathebula and Smallwood, 2017), The 4-storey building that collapsed in March 2015 at 6 Mogaji Street, Idumota, Lagos, and a twin 4-storey duplex that collapsed in November 2013 at Victoria Island, Lagos, with four casualties (Michael A, Oyewale I and O.A, 2018), and many others.

It has been observed that no research record has looked into the problem of building collapse bedeviling Anambra State analytically and comprehensively on large scale to provide an account of this event. This research investigated the causes of building collapse in Anambra State with the aim of highlighting tangible solutions towards solving the menace.

2. Methodology

2.1 Sourcing and preparation of data

To achieve the aim of the research, raw materials were collected through primary sources from online printed publications of some local newspapers that gave the first-hand accounts of cases of building collapse. Data were assembled, analyzed, and used for the research to provide insights into the causes of building collapse in Anambra State and proffer solutions from the engineering perspective.

2.2 Area of Study

The research area is Anambra State, which is the southeast region's financial and economic hub. Nigeria has thirty-six states, including Anambra State. It is situated in the southeast of the nation, between latitudes 5° 32' and 6° 45' N and longitudes 6° 43' and 7° 22' E, respectively. The state is diverse in terms of geography, population distribution, and regional development, covering an estimated 4,865 sq km, or 486,500 hectares, of territory. With 21 local government units (Figure 1) and roughly 177 localities, it was formed in 1991 from the former Anambra State, which has since been divided into the states of Anambra, Enugu, and Ebonyi.

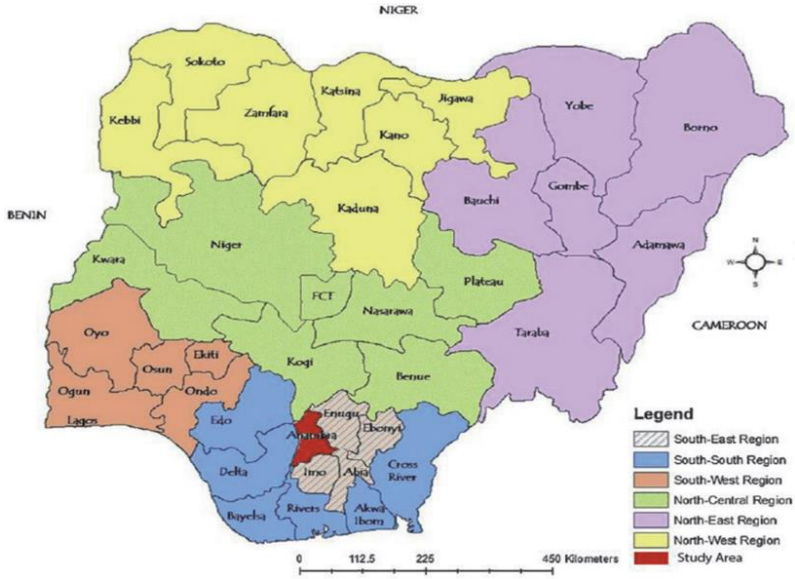

Figure 1. Map of Nigeria showing Anambra State. (Source: Department of Environment Management, Chukwuemeka Odumegwu Ojukwu University, 2021) (Akanwa *et al.*, 2022).

About 440 kilometers from Abuja, the federal capital, is the state capital, Awka, an emerging metropolis. Awka, the state capital, is an emerging metropolis situated roughly 440 km from Abuja, the federal capital situated in central Nigeria, and 65 km from Enugu, the former regional capital situated in eastern Nigeria. National Population Commission (2010) reports that the state's population increased from 2,796,475 in 1991 to 4,182,032 in 2006 and 4,461,942 in 2011(Awopeju, Otti and Eduputa, 2014).

Table 1. List of reported cases of collapsed buildings in Anambra state between 2013 and 2023

Type of building	Location	Cause of collapse	Causality	Year	Purpose served	Ref.
3-storey building under construction	Nnewi North, Anambra	Poor foundation, concrete mixture, quality of materials and wearing cost capacity as well as non-conformity to standards, non-approval from relevant regulatory authorities	3 died, others injured	September, 2023	Not reported	(Obianeri, 2023)
Not reported, old building	Anambra North, Anambra	Flood	1 died	October, 2022	Not reported	(Elekwa and Oota, 2022)
5-storey building under construction	Idemili South, Anambra	Substandard materials, no approval, no agency monitoring	Many trapped	April, 2023	Not reported	(Ugwu, 2023)
2-storey building under construction	Ekwusigo, Anambra	Unprofessional practices	2 died	September, 2022	Not reported	(Joe Chukindi, 2022)
Not reported, old building	Ogbaru, Anambra	Flood	Many trapped	October, 2022	Institutional	(Izunna Okafor, 2022)
2-storey building under construction	Awka South, Anambra	Under construction for the past ten years, the right equipment was not used for the demolition	None died	July, 2021	Not reported	(Editor, 2021)
2-storey building under construction	Aguta, Anambra	Compromised structural integrity	Four persons trapped	July, 2021	Not reported	(Chukindi, 2021)
1-storey building	Idemili North, Anambra	Not reported	1 died, 1 injured	September, 2020	Not reported	(Joe Chukindi, 2020)

Not reported	Idemili North, Anambra	Structurally compromised	2 died	October, 2020	Not reported	(Editor, 2020)
Not reported, under construction	Onitsha South, Anambra	Lintel attachment to an existing structure, illegality	1 died	April, 2020	Not reported	(Agency Report, 2020)
Not reported, old building	Onitsha South, Anambra	The plaza was partially burnt in October 2019 during a fire incident at the market	None trapped	December, 2019	Commercial	(Ifeanyi Okonkwo, 2019)
3-storey building,	Onitsha North, Anambra	Heavy downpour	None trapped	September, 2019	Not reported	(Chukindi, 2019)
4-storey building under construction	Idemili North, Anambra	The building earlier had a foundation for two-storey building, but, later, the owner allegedly decided to add two extra floors to it, which affected the foundation as it could not carry the weight of extra floors	None trapped	July, 2018	Not reported	(Agbodo, 2018)
2-storey building under construction	Nnewi North, Anambra	Not reported	None trapped	September, 2021	Not reported	(Staff, 2021)
2-storey building under construction	Anambra East, Anambra	use of substandard materials, unprofessional practices	6 trapped	January, 2018	Not reported	(Elekwa, 2018)
Not reported, under construction	Nnewi North, Anambra	Not reported	11 trapped	October, 2018	Not reported	(Okafor, 2018)
4-storey building under construction	Orumba North, Anambra	Heavy rain, substandard materials	3 died	June, 2017	Not reported	(Okafor, 2017)
Twin 3-storey under construction	Idemili North, Anambra	Not reported	None trapped	March, 2017	Commercial	(Admin, 2017)
2-storey building under construction	Idemili North, Anambra	Substandard building materials	3 died, 3 injured	July, 2016	Not reported	(Staff, 2016)

3-storey building under construction	Orumba North, Anambra	Heavy rain	7 trapped	May, 2016	Commercial	(Ujumadu, 2016)
3-storey building under construction	Anaocha, Anambra	Not reported	1 died, 20 injured	September, 2014	Not reported	(Ujumadu, 2014)
4-storey building under construction	Onitsha South, Anambra	Heavy rain	3 died	September, 2013	Not reported	(The Nation, 2013)
3-storey building under construction	Onitsha North, Anambra	Not reported	2 died, 3 injured	May, 2019	Not reported	(Okunloye , 2019)
3-storey building under construction	Awka South, Anambra	Heavy rainfall, substandard materials, the speed with which they pursued the construction was horrible, unprofessional practices	Not reported	September, 2015	Not reported	(Nation, 2015)

3. Results and Discussion

A close look at Table 1 shows several factors that contributed to building collapses in Anambra State, including poor foundation, concrete mixture, quality of materials, and wearing cost capacity, as well as non-conformity to standards, non-approval from relevant regulatory authorities, and no agency monitoring to enforce strict compliance with building regulations. Others are flooding, heavy rainfall, unprofessional practices, compromised structural integrity, aged buildings, delay in completion of buildings under construction, illegality both in building conversion and other sharp practices, fire incidents, and a great rush to complete a building under construction in an unprofessional way. According to the incidences sampled in Table 1, it was observed that actions usually taken by the Anambra State Government once there is a building collapse menace can be summarized as follows:

1. Government's foremost action once there is incidence of building is usually to rush to the site to save lives.
2. Collect samples from debris where the cause of collapse is not obvious to conduct laboratory test for determination of the actual cause of collapse.
3. Check if the building was approved before construction and to see if building regulations were sticked to during the construction.
4. Demolish the remaining portion of the building where there is partial collapse and remove debris where there is complete collapse.
5. Confiscate property where approval was not sort from appropriate authorities before commencement of building.

Figure 2. Sample images of building collapse caused by different variables, (a) poor foundation, concrete mixture, and quality of materials (Obianeri, 2023), (b) flood/heavy downpour (Elekwa and Oota, 2022), and (c) delay in completion of buildings under construction/aged building (Editor, 2021).

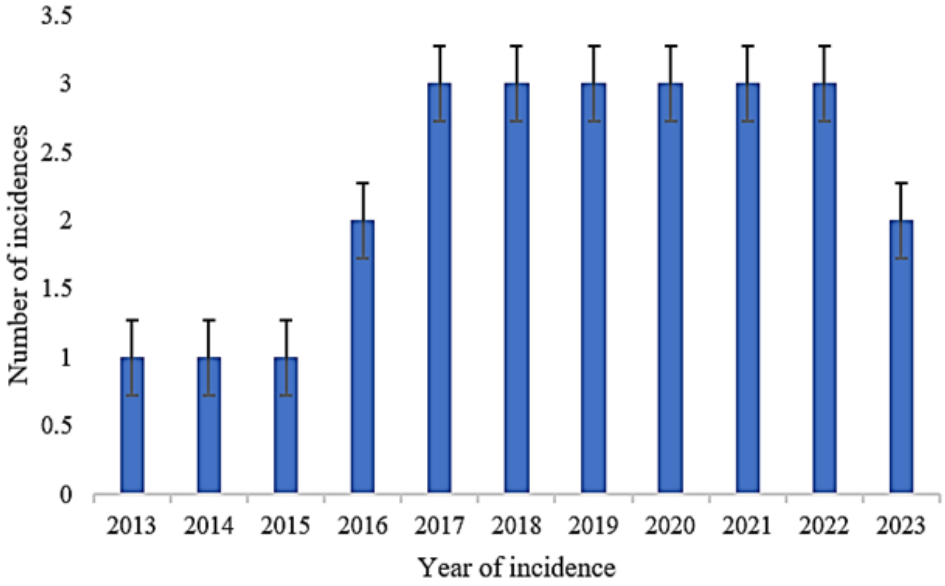

Figure 3. A plot of the number of incidences versus the year of incidence

Figure 3 presents plots of the rate of incidences and the year in which they occurred. It could be seen that from 2017 through 2022, there were a constant and equal number of cases. It could suffice to say that the current situation is more alarming than previous years, like 2013 through 2015, when there were fewer events of building collapse.

Figure 4 shows that Idemili North has the highest number of buildings that collapsed over the period evaluated, followed by Nnewi North and Onitsha South, which recorded the same number of incidences. Other places like Anaocha, Anambra East, Aguta, Anambra North, Ogbaru, Ekwusigo, and Idemili South witness an occurrence in each of them, respectively.

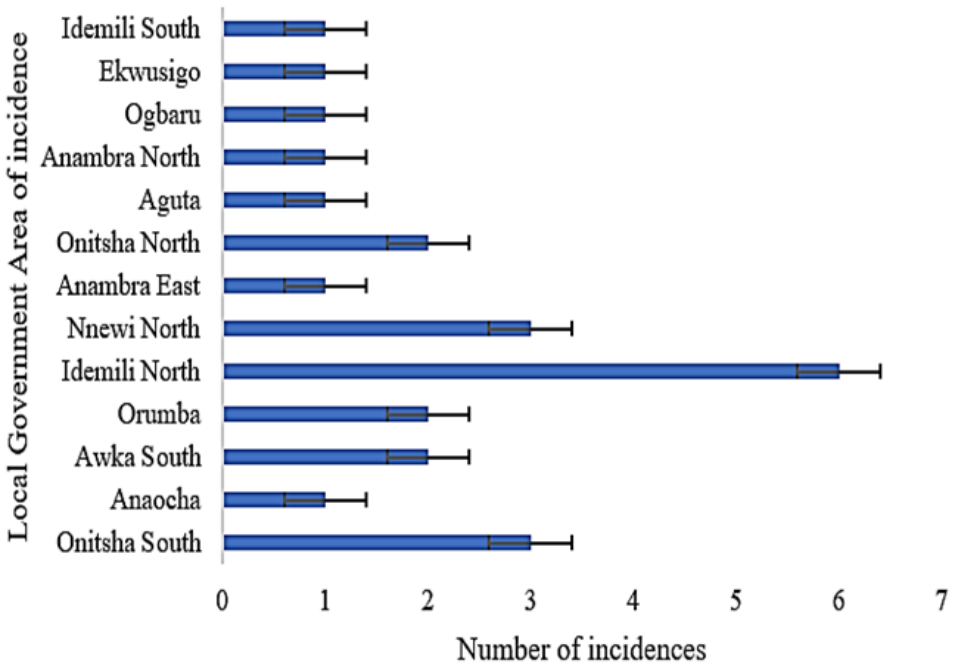

Figure 4. A plot of the number of incidences versus the Local Government Area of incidence

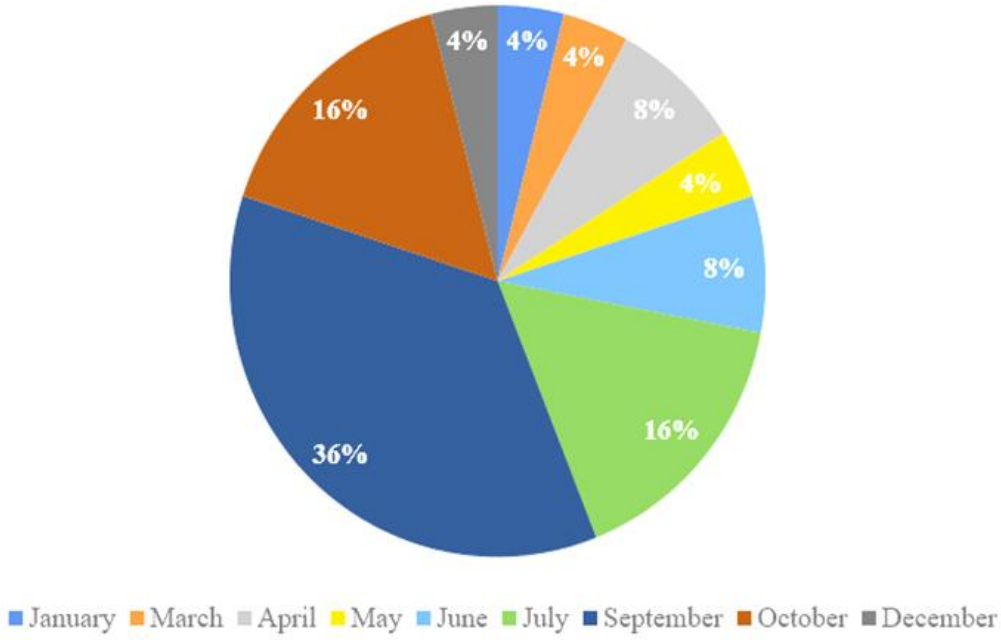

Figure 5. A plot of the month of incidence versus the percentage of incidences

The results in Figure 5 show that September, with 36%, is the month with the most occurrences of building failures. This is because the rainy season starts more seriously around May, and before it gets to September, the soil is well soaked, igniting the tendency for such events. March and July were months that had a reasonable number of buildings that collapsed. March is the earlier stage of the rainy season, which comes with more wind capable of pulling down building structures that are not strong.

Figure 6 shows that 2-storey, 3-storey, 4-storey and 5-storey buildings were affected most. And there was only a single case of a 1-storey building. This indicates that buildings with more than one floor are more likely to collapse; hence, contractors and builders need to be retrained on how to construct such buildings.

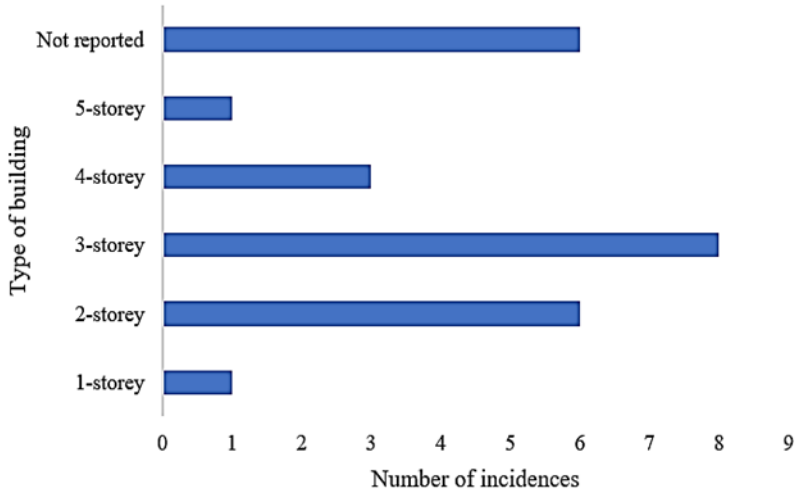

Figure 6. A plot of the type of building versus the number of incidences

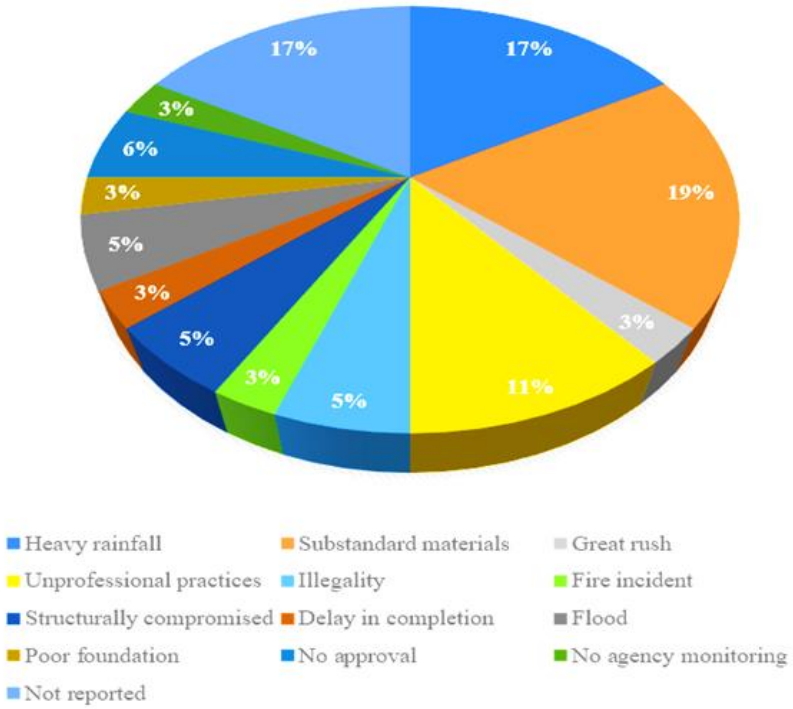

Figure 7. A plot of the causes of building collapse versus percentage of incidences

The analysis of the data in Figure 7 reveals that substandard material with 19%, heavy rainfall also recorded as 17%, and unprofessional practices, which are 11%, were the greatest causes of building failures. This implies that erecting buildings with substandard materials and engaging unprofessional individuals for such construction should be highly avoided and discouraged. Once this is done, other factors will have been absolutely eliminated or may have been drastically reduced.

3.1 Remedial measures taken to avert building collapse in Anambra State

According to the Anambra State government, in order to prevent building collapse, a procedure has been put in place to stop the construction of unapproved building plans. It is mentioned that the actions will make it possible for the state government to identify organizations that work with quacks to develop buildings without respecting the law. Additionally, they urged the public to never hesitate to report the names of Anambra State Physical Planning Board employees who support quacks for disciplinary action. They also cautioned developers who engage in dishonest behavior by utilizing

quacks for building development to backtrack, as they will be held fully accountable by the law (Modilim, 2021).

The use of committees in looking into cases of building collapse and coming up with recommendations, like the necessity of using registered engineers, making sure that developers and pertinent building regulatory bodies have direct communication at all crucial building stages, dissuading the use of defective structural drawings to get approvals, and encouraging supervision of construction projects to prevent building collapse, among others (Ejike Abana, 2019).

Again, to evaluate all the materials that will be utilized in the state for upcoming building projects, the state government has also established materials testing laboratory. This is to prevent more construction collapses in the state and to guarantee that only high-quality standard materials are employed (Okonkwo, 2014).

3.2 Why building collapses has persisted in Anambra State despite remedial measures (Jonathan and Okafor, 2019)

1. The government of Anambra State has been held accountable by the Nigerian Institute of Architects for the recent building failures in the state.
2. The government's lack of willpower to implement the recommendations of stakeholders and professionals in the building industry on how to prevent building collapse in the state despite the fact that the recommendations are well detailed and comprehensive.
3. Use of a faulty panel of inquiry by the state government to investigate collapsed buildings.
4. The government's attitude of rushing to set up panels on building collapses without implementing the recommendations of such committees is an effort in futility.
5. There was no implementation of the already published white paper report on building collapse published on October 13, 2014, and a lack of willingness to follow best international practices in building construction.

3.3 The national building code of Nigeria and its provisions

The Nigerian National Building Code outlines rules, regulations, specifications, and moral principles pertaining to the design, construction, and maintenance of buildings in Nigeria that need to be enforced in the practice of building construction in Nigeria. But unfortunately, the code is yet to have the full legal backing and support that it desires, though it is currently a bill before the Nigerian National Assembly (Akinyemi *et al.*, 2016). The construction regulations guiding the practice of construction in Nigeria presently are from Britain, in the form of British Standards and Codes of Practice (Akinyemi *et al.*, 2016). The National Building Code 2006 evolved due to variations in the existing conditions of our cities and environment (Akinyemi *et al.*, 2016). But till it gets the needed legal backing and full implementation, building collapse has continued to rack havoc.

Conclusion and Recommendations

The paper has successfully investigated and highlighted the perceived causes of building collapse in the state evaluated, as the results from the data analysis have shown. Preventive measures should be applied not only to Anambra State but beyond. The root causes were noticed to be heavy rainfall, substandard materials, unnecessary rush, unprofessional practices, illegality of different kinds, fire incidents, structural compromise, delay in completion of the project, floods, poor foundations, lack of building approval, lack of monitoring agents from constituted authorities, and some other factors not reported. The study recommends that feasible measures and strict compliance be taken by the

government and other stakeholders in building industry to prevent its reoccurrences. Other recommendations are that:

- Stricter sanctions should be applied on clients, developers, and consultants involved in any building collapse that results in casualties.
- The Ministry or other government organizations in charge of physical planning should encourage community members to use an informant strategy by reporting any unsafe building they believe poses a risk to the society.
- It is imperative that Standard Organization of Nigeria (SON) takes immediate action to fulfill her obligation of supplying high-quality building materials for development projects. Effective monitoring must be implemented by SON, and those who fail to produce building materials according to the correct criteria will face harsh penalties.
- Without obtaining the appropriate professional knowledge or training, no building industry professional should present themselves as a jack of all trades by taking on the responsibilities of other related professions.
- Instead of operating as rivals or competitors, all specialists in the building sector ought to collaborate as a team. Fighting building collapse will mostly depend on the cooperation of professionals in the building sector.
- It is equally important to advise professional architects against unethical building practices.
- The Nigerian National Building Code describes the laws, norms, guidelines, and ethical precepts that should be upheld in the country's building industry with regard to the planning, constructing, and upkeep of structures.

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Compliance with Ethical Standards: This article does not contain any studies involving human or animal subjects.

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