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## Building Collapse in Rivers State, Nigeria: The Role of the Contractor

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### Abstract:

It is evident that building collapse is a global experience but quite a worrisome issue in Rivers State, Nigeria, especially in the last 7 years. This paper seeks to determine the building collapse causation factors in Rivers State, in order to mitigate building collapse occurrences. The role of the building contractor was the main focus of the study. Questionnaire survey was conducted to evaluate causation factors and by using weighted mean and ranking, topmost causes of building collapse was established. The study further appraised the effect/ implication of building collapse. By considering 5 major groups, construction problem was found to be the topmost factor followed by client's influence on contractor. An aggregated assessment of all the groups revealed the top three building collapse causing factors as poor concrete practices and technology, changing the purpose of the building and substandard material use. The top three primary effects of building collapse were damage to life, damage to other properties and damage to contractor's reputation. Recommendation was made to building clients, the building contractors and the State government on measures of mitigating building collapse occurrences.

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**Key Words:** Building, Building Collapse, Role of Contractor, Causes of Building Collapse, Rivers State

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### 1. INTRODUCTION

A building is a civil engineering structure that is intended to provide functional and comfortable enclosure for accommodation, storage, religious worship, industrial productions, entertainments, educational and health activities, and others of such human necessities. Buildings are structures which serve as shelters for man and his belongings and must be well conceived, designed and built to gain the expected environmental comfort (Odeyemi, 2012). It is the centre for most human activities and has various professional fields that are involved in its construction and servicing. It is an inevitable requirement that it is well built, stable and has a long lifespan without posing health, security and fatal risks. When a part or the whole of a building becomes defective in structural stability usually with visible signs, a building is said to have failed. Failure, though of various patterns and degrees, is a dangerous signal for the building users.

Building collapse on the other hand is the structural disconnection of a part of the building from the rest of the building or the whole building from its composite structural position. It is a state of total failure, with the structure actually given way and most members caving-in, crumbled, and unstable as originally intended (Ede, 2010). Several factors lead to the failure or collapse of buildings that may be due to human negligence and errors, professional incompetence, low quality materials and natural disasters. Ayeni and Adedeji (2015) opine that poor structural design, inadequate skilled workmen, lack of quality material and quality management deficiency are some factors that cause building collapse in Nigeria. Nigeria recently has experienced various building collapse that claimed lives and damaged properties of cost worth millions of Naira, and though building collapse is notable in various parts of the world, the Nigeria situation is alarming and calls for a quick intervention (Odeyemi et.al, 2019). Thirty-seven year building collapse records in Nigeria reveal that majority of the affected structures were privately owned (above 80%) and above 50% were generally residential buildings built by local contractors (Tanko et.al, 2013; Windapo, 2012; Ayodeji, 2011).

Rivers State is a state in South-South Nigeria that is termed the treasure base of Nigeria because of its appreciable contribution to the economic growth of the nation based on its high petroleum endowment. Thus the state attracts influx of people from other parts of the country and the world. Its commercial and industrial status is such that there are various building infrastructures and building developmental projects that are on in various parts of the state. However, the last 7 years has recorded building collapse in Rivers state that is worth cautioning. Table 1 is a vivid indication of notable building collapse situations in the last 7 years.

**Table 1. Building Collapse Occurrences in Rivers State in the Last Seven Years**

Date	Location	Structure	Possible Causation	Collapse	Casualties
March, 2017	NYSC road, Alakahia, Port Harcour	3-storey building	Foundation failure	/Poor workmanship	No casualty
Nov., 2018	Woji Road GRA Phase 2, Port Harcourt	7 storey Building under construction	Foundation failure		Over 20 lives lost & Several injured
July, 2019	Immanuel High School Rumubiakani Port Harcourt	4-story building	Foundation failure		No reported casualty
April, 2021	Diobu, Ikoku, Azikiwe Axis.	1 storey building	Structural failure		1 casualty
Sept., 2021	Woji town, Port Harcourt	Bungalow	Erosion/Foundation failure		1 dead, 2 injuries
June, 2022	Bende Street, PH Township	Part of 3 storey Building	Old age		No casualty
Feb., 2023	Mbodo, Aluu, Ikwerre	2 storey Building	Use of substandard materials.		3 deaths

Source: The Guardian, April 16, 2017; Okah (2022); The Chronicles, Feb. 5, 2023;

This study was geared towards investigating the causes of building collapse in Rivers State with regards to the building contractor's role. Such endeavour is poised to come up with ideas that will limit or eradicate the current worrisome rate of occurrences. The following objectives were pursued:

1. To examine the causes of building collapse in Rivers State from the contractors end.
2. To evaluate the effect of building collapse cases in Rivers State.
3. To propose ways of adequately mitigating building collapse occurrences in Rivers State.

Research questions formulated were: What are the factors that cause building collapse in Rivers State? What are the effects of building collapse in Rivers State in the last seven years? What are the measures to be taken to adequately combat building collapse in Rivers State?

## 2. LITERATURE REVIEW

### 2.1 Theoretical Literature

Failure and ultimate collapse of anything including building structures are detrimental. A proper understanding of the building process, its components, the technical team, designs, plants and equipment, labour work force, materials, fittings, etc. that are involved in the development of a building, is quite necessary to take an apprehensive position about building collapse. The collapse of buildings is definitely caused by factors within the sphere of such activities as just highlighted.

#### Client's Problems

The client has responsibilities that can influence building collapse if not handled positively. Adherence to government statutory requirements about building developments should not be taken lightly by the client since such government approvals are usually handled by his team before the contract to build is awarded. Further areas of concern from the client's end are: changing the intended purpose of the building without updating the structural design and other requirements; for selfish or ill profound reasons, suddenly replacing qualified contractor with a compromising less qualified one; imposing selected labour force that may be family members, friends or acquaintances on contractor; absence of proper site and soil investigation; and no provision for contractor for site safety and security.

Ukpata (2006) opined that building collapse rate in the country is traceable to unsafe actions of parties involved in the building process beginning from the client to professional consultants, the contractors and building users. The client makes serious changes and variations sometimes at an advanced construction stage in collaboration with the contractor without seeking professional consultants' advice, perhaps for financial profit and other gains (Aremu, et al., 2019).

#### Problems of professional consultants

The professional consultants in building developments are Architects, Quantity surveyors, land surveyors, urban planners, structural engineers, geotechnical engineers, electrical engineers, mechanical engineers, sound and acoustic engineers. While some may have no or insignificant roles

in building collapse causations, others like architects and engineers are prominently influential. Faulty designs have proved to be notable causes of building collapse. Dimuna (2010) asserts that the lack of competence of architects, structural engineers and builders are responsible for the recurring building collapse incidences in Nigeria.

### **Contractor's Problems**

The contractor is the constructor or builder of the building structure. He is the producer of the designed infrastructure and his level of qualification, experience, emotional and psychological balance, registration with professional body and updating on current practices/innovations/methods, matters so much in mitigating the occurrence of building collapse. Adebayo (2000) postulates that efficiency in achieving valuable workmanship in the construction of building, skill and experience is important. In construction projects most defects are due to human error from poor workmanship performance during construction (Othman and Mydin, 2014).

### **Materials Problems**

Building materials are a major influence of building stability if the material meets standard quality, and on the other hand a strong contributor to building collapses, if the quality is substandard. Areas of concern are poor material selection, substandard material use, not testing materials, over exposure of materials to harsh weather condition and poor material storage. Most times materials are used without thorough checks and tests to ascertain compliance to expected standards (Othman and Mydin, 2014).

### **Construction Problems**

The construction process with its numerous interlocking activities, material usage and the builder's expertise is a major influence of building collapse if handled carelessly. Notable problems are: poor concrete practices and technology, poor construction methods and supervision, overloading of structure with heavy materials, tools or equipment at upper floors during construction. Oloyede et al. (2010) and Hassan et al. (2016) are of the view that faulty construction methodology which results from unqualified personnel engagement is a major cause of building failure and collapse.

### **Problems of Natural and Military Disaster**

Beyond human responsibilities natural disasters can cause building collapse. Such cases are: flooding, turbulent winds and storms like tsunamis and tornadoes, military attacks, fire, earthquakes and landslides. Modern day technology has however, endeavoured to design and build structures that appreciably limit building collapse due to some natural disasters. Madu (2005) identified building failure and collapse causations as natural occurrences such as flood, earthquakes, tornadoes, etc.

### **Town planning Authorities' Problems**

Government statutory laws and regulations concerning building developments are under the authority of the town planning department. Thorough checks of building designs, their purpose, advice to clients, permits or approvals and monitoring of construction activities are issues that must not be compromised by the authorities otherwise building collapse may be eminent. Sometimes without approvals defective drawings are used either by error, ineffectiveness, or corruption of officers of the approving authorities (Chendo and Obi, 2015).

## **2.2 Empirical Literature**

Opare (2007) carried out a study using inventories, interviews and questionnaire, and analyzed through descriptive statistics. The study revealed that topmost causes of building failures and collapse are poor workmanship, cheap and inferior materials usage, faulty interpretation of working drawings and supervision inadequacy. Okah (2022) conducted a study using self structured questionnaire and descriptive analysis with 4-point Likert's scale. The result showed that foundation/ structural failure, poor equipment and substandard materials among others are key causes of building failures and collapse. Wordu and Kanu (2021) investigated residential building collapse in Nigeria using questionnaire and analyzed through descriptive method, the Pearson's Product Moment Correlation, and t-test hypothesis analysis. Results showed that the major cause of the incessant buildings collapse in Port Harcourt metropolis, Nigeria was influx of quacks in the building construction industry.

Ayodeji (2011) investigated building collapse causes and consequence in Nigeria using historical data of 33 years and the data analysed using descriptive statistics, Pearson moment correlation coefficient, and linear regression. The result showed poor quality of material as the major cause of building collapse with most occurrences of private building which indigenous contractors executed. To investigate the phenomenon of building collapse in Nigeria, Hamma-adama and Kouider (2017) collected primary data through a questionnaire survey from clients, contractors, and professional construction consultants and analyzed the data using simple statistics. The result showed that there is an alarming frequency rate of building collapse in Nigeria with moderately major impact from low quality reinforcement, structural steel and cement use for foundations and other structural elements, are the primary causes of building collapse in Nigeria.

Adenuga (2012) had a study that adopted a survey technique with questionnaires mainly for the professionals in the building industry and collected data analyzed using descriptive statistics, one and paired sample t tests. "The building industry is full of quacks and inexperienced contractors" is the major finding of the study. Ebehikhalu and Dawam (2014) in their study examined the incidences of building collapse in Nigeria using field investigation and site inspection method of data collection and analysis by relevant qualitative and quantitative means. Structural defect, poor supervision/workmanship, substandard materials use, faulty structural design or absence of it, are the prominent causes of building collapse.

### 2.3 Summary of Literature Review

The various facts of literature reviewed on building collapse can be summarized as follows in table 2, conditioned for the design of the study questionnaire and empirical analysis of this study. The emphasis here is on the role of the building contractor to building collapse in Rivers state, Nigeria, an innovative approach that fills the gap of literature.

**Table 2: Summary of Literature on Building Collapse on the part of the Contractor**

<b>Building Collapse Causing Factors</b>		
1.	<b>Client's influence on contractor</b>	Changing the purpose of the building, Replacing qualified contractor, Imposing selected labour force on contractor, Engaging Contractor to construct without statutory building approvals, Illegal statutory approvals, No provision of site safety and security, Absence of proper site and soil investigation. <b>(7 Sub factors)</b>
2.	<b>Problems of Contractor's Qualification and Experience</b>	Low academic/ professional qualification, poor working experience, Not registered with professional body, Contractor not updating on current practices/innovations/methods. <b>(4 Sub factors)</b>
3.	<b>Construction Problems</b>	Poor concrete practices and technology, Poor construction methods and supervision, Overloading of structure. <b>(3 Sub factors)</b>
4.	<b>Material Problems</b>	Poor material selection, substandard material use, No material testing, Over exposure of materials to harsh weather condition, Poor material storage. <b>(5 Sub factors)</b>
5.	<b>Problems of Selfish gains</b>	Cutting corners for financial gains, Corruption, no incentives for workers that boosts their morale <b>(3 Sub factors)</b>
<b>Effects/implications of Building Collapse</b>		
Damage to life, damage to other properties, loss of money, Damage to contractor's reputation, legal penalty, delay/postponement of use of building, cost of clearing debris and compensation		

**Source:** Author's compilation

## 3. METHODOLOGY

Descriptive survey design was employed in this study. The target population for the research work was indigenous construction contractors in the building industry in Rivers State who are particularly based in the state capital, Port Harcourt. To administer a close ended, self-structured questionnaire, a random sample size of sixty (60) professionals was chosen. The questionnaire was poised to investigate the causes and effect of building collapse. Five main groups of building collapse causations were identified from literature for seeking respondents' opinions. 5 point Likert scale was used to measure the subjective opinions. Fifty two (52) were returned out of the Sixty (60) questionnaires that were administered. Statistical descriptive tools such as frequency, weighted mean and percentage were employed in analyzing the data.

## 4. DATA ANALYSIS

Questionnaires were distributed and collected between January 2023 and April 2023, and all completed and returned questionnaire were arranged in tabular form and analyzed to derive the weighted mean and subsequent ranking of the variables.

#### 4.1 Respondents' Demographic Variables Analysis

Respondents' demographic characteristics reveal that 83.9 % of respondents are within the ages of 30-40 and above. Academic qualification of contractors revealed 82% within HND to PhD degree holders. Contractors registered with relevant professional bodies were 86% and respondents' working experience ranging from 5-20 years and above was 91%. Assessing the quality of demographic characteristics indicates that maturity in age, years of working experience and academic qualification are reasonably high. In pursuance of the objectives of this study, respondents assessed the causes of building collapse using the Likert's scale of 1-5: **1** = never occurred, **2** = seldom occurred, **3** = neutral, **4** = frequently occurred and **5** = very frequently occurred.

#### 4.2 Analysis of Surveyed Data and Discussion

In order to showcase the major causes of building collapse respondents' opinions were tabulated and analyzed by means of weighted means and their effect evaluated. Using the Likert scale of 1-5, tables 3-8 depicts the results of the analysis of data. The table clearly shows the weighted means and their ranking. Table 3 presents the findings of **Client's influence on contractor** as a problem that causes building collapse and according to respondents' opinion the top three factors are: *Changing the purpose of the building*, *Absence of proper site and soil investigation* and *Engaging Contractor to construct without statutory building approvals*, in descending order. Client's influence on contractor may usually be heightened by the dubious role played by some client's representatives.

**Table 3: Client's influence on contractor**

S/N	Details of Causes	Weighted mean	Ranking
i	Changing the purpose of the building,	4.13	1 <sup>st</sup>
ii	Absence of proper site and soil investigation	3.91	2 <sup>nd</sup>
iii	Illegal statutory approvals	2.91	5 <sup>th</sup>
iv	Imposing selected labour force on contractor	2.71	7 <sup>th</sup>
v	Replacing qualified contractor	2.88	6 <sup>th</sup>
vi	Engaging Contractor to construct without statutory building approvals	3.81	3 <sup>rd</sup>
vii	No provision of site safety and security	2.93	4 <sup>th</sup>
<b>Average weighted mean = 3.33</b>			

Source: Respondents' Opinion, analyzed and ranked by Author

The 2<sup>nd</sup> category is **Problems of Contractor's Qualification and Experience** in table 4 and the top three factors are: *Poor working experience*, *Low academic/ professional qualification* and *Contractor not updating on current practices/innovations/methods* (from 1<sup>st</sup> to 3<sup>rd</sup>). The 3<sup>rd</sup> group is **Construction Problems** showcased in table 5 with the highest three factors as: *Poor concrete practices and technology*, *Wrong Construction method* and *Poor supervision and Overloading of structure* (from 1<sup>st</sup> to 3<sup>rd</sup>).

**Table 4: Problems of Contractor's Qualification and Experience**

S/N	Details of Causes	Weighted mean	Ranking
i	Poor working experience	3.89	1 <sup>st</sup>
ii	Low academic/ professional qualification	3.80	2 <sup>nd</sup>
iii	Not registered with professional body	2.68	4 <sup>th</sup>
iv	Contractor not updating on current practices/innovations/methods	2.82	3 <sup>rd</sup>
<b>Average weighted mean = 3.28</b>			

Source: Respondents' Opinion, analyzed and ranked by Author

**Table 5: Construction Problems**

S/N	Details of Causes	Weighted mean	Ranking
i	Wrong Construction method and Poor supervision	3.95	2 <sup>nd</sup>
ii	Overloading of structure	3.87	3 <sup>rd</sup>
iii	Poor concrete practices and technology	4.25	1 <sup>st</sup>
<b>Average weighted mean = 4.02</b>			

Source: Respondents' Opinion, analyzed and ranked by Author

The 4<sup>th</sup> group is **Material Problems** shown in table 6 with three uppermost factors as: *substandard material use, no material testing and poor material storage* in descending order. Issues of construction materials should be a major concern of the contractor in two senses depending on the type of contract. Where the client is in charge of purchasing materials, the contractor ought to carry out physical and other checks to ascertain quality levels before agreeing to use the materials; and where the contractor has the onus of purchasing the building materials, he should avoid corrupt sharp practices and go for the best. If the client forces low quality materials on the contractor or the contractor purchases and uses low quality materials, the influence on building failure and collapse will be inevitable.

**Table 6: Material Problems**

S/N	Details of Causes	Weighted mean	Ranking
i	Over exposure of materials to harsh weather condition	2.64	4 <sup>th</sup>
ii	Poor material storage	2.73	3 <sup>rd</sup>
iii	No material testing	3.84	2 <sup>nd</sup>
iv	Poor material selection	2.57	5 <sup>th</sup>
v	Substandard material use	4.01	1 <sup>st</sup>
Average weighted mean = 3.16			

**Source:** Respondents' Opinion, analyzed and ranked by Author

The 5<sup>th</sup> group is **Problems of Selfish Gains** depicted in table 7 with the top three factors being: *Corruption, Cutting corners for financial gains and No incentives for workers that boosts their morale* in descending order.

**Table 7: Problems of Selfish Gains**

S/N	Details of Causes	Weighted mean	Ranking
i	No incentives for workers that boosts their morale	2.49	3 <sup>rd</sup>
ii	Cutting corners for financial gains	2.61	2 <sup>nd</sup>
iii	Corruption	2.80	1 <sup>st</sup>
Average weighted mean = 2.63			

**Source:** Respondents' Opinion, analyzed and ranked by Author

Table 8 below is a summary table showing the five groups of building collapse causation in Rivers State, their average weighted means and their ranking. In descending order of ranking they are: *construction problems, client's influence on contractor and problems of contractor's qualification and experience*. Table 8 is depicted in Figure 1 in a pie chart form.

**Table 8: A summary of the ranking of five groups of causes of Building Collapse**

S/N	Causes of Accidents	Average Weighted Mean	% Appraisal of Groups	Ranking
1	Construction Problems	4.02	24.5	1 <sup>st</sup>
2	Client's influence on contractor	3.33	20.3	2 <sup>nd</sup>
3	Problems of Contractor's Qualification and Experience	3.28	20.0	3 <sup>rd</sup>
4	Material problems	3.16	19.2	4 <sup>th</sup>
5	Problems of Selfish Gains	2.63	16.0	5 <sup>th</sup>

Source: Respondents' Opinion, analyzed and ranked by Author

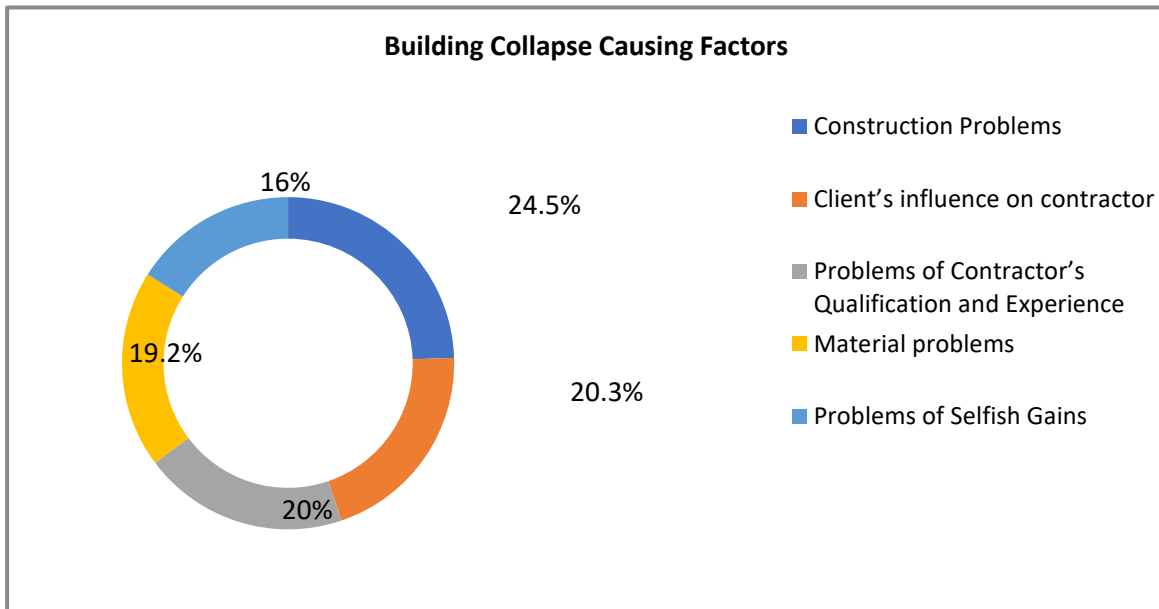


Fig 1: Ranked Main Groups of Building Collapse Causing Factors in %

On overall weighting this is how the respondents' opinions stood in descending order of importance of the first 10 factors that cause building collapse. They are: Poor concrete practices and technology, changing the purpose of the building, substandard material use, wrong Construction method and Poor supervision, absence of proper site and soil investigation, poor working experience, overloading of structure, no material testing, engaging Contractor to construct without statutory building approvals, low academic/ professional qualification. Table 9 showcases the **effect of building collapse occurrences** in Rivers State, Nigeria in the last 7 years based on respondents' opinion. In the last 7 years the effect of building collapse has the three topmost effects as: *Damage to life, Damage to other properties and Damage to contractor's reputation.*

Table 9: Effects/Implications of Building Collapse in the last 7 Years

S/N	Causes of Building Collapse	Average Weighted Mean	Ranking
1	Damage to life	4.1	1 <sup>st</sup>
2	Damage to other properties	3.9	2 <sup>nd</sup>
3	Damage to contractor's reputation	3.6	3 <sup>rd</sup>
4	Loss of money	3.2	4 <sup>th</sup>
5	Cost of clearing debris and compensation	3.0	5 <sup>th</sup>
6	Delay/postponement of use of building	2.9	6 <sup>th</sup>
7	Legal penalty	2.7	7 <sup>th</sup>

Source: Respondents' Opinion, analyzed and ranked by Author

## 5. CONCLUSION AND RECOMMENDATION

In this study the set out aim and objectives have been adequately achieved. Five groups of building collapse causation factors with relevant sub-factors were culled from literature, questionnaire respondents' opinion obtained and statistically analyzed. By the ranking result of this study the following is the status of each of the building collapse causing factors making the five groups, in descending order: *construction problems, client's influence on contractor, problems of contractor's qualification and experience, material problems and problems of selfish gains.* This study's finding of construction problems as the topmost cause of building collapse from the contractor's end is very striking. It suggests that at construction stage the contractor can be apt in addressing any factor that can pose problem for the structure and perhaps lead to building collapse. A well qualified, experienced and conscientious contractor can stop negative issues at construction stage that can lead to building collapse.

Considering the sub- factors of the five groups aggregately, the data analysis revealed the ten topmost causes of building collapse in Rivers State, Nigeria, in descending order as: (i) Poor concrete practices and technology, (ii) Changing the purpose of the building, (iii) Substandard material use, (iv) Wrong Construction method and Poor supervision, (v) Absence of proper site and soil investigation, (vi) Poor working experience, (vii)

Overloading of structure, (viii) No material testing, (ix) Engaging Contractor to construct without statutory building approvals, (x) Low academic/professional qualification. The three topmost effect of building collapse was found to be (in descending order): *Damage to life, Damage to other properties and Damage to contractor's reputation.*

To mitigate building collapse in Rivers State, the following recommendation is put forward:

1. Building clients should be more quality and safety conscious rather than being more interested in financial cuts as they do business with their contractors. By this, they are encouraged to monitor the practices of their representatives to the contractor in order to check dubiousness. If this suggestion is adhered to, there will be no need for unnecessary client's influence on the contractor.
2. Building clients should be respectful of government statutory laws and ensure that they adhere to them strictly with regards to their building development.
3. All building contractors should be resilient to all forms of influences whether human or financial that is likely to influence building collapse. Further, the contractor should be more conscious towards every technical practice that will enhance stability and longevity of building infrastructures.
4. The Rivers State government should be more awakened to the enforcement of statutory laws of building construction and be quite disciplinary in monitoring the corrupt practices of their officers in the town planning department.

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