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Perception Survey of Poor Construction Supervision and Building Failures in Six Major Cities in Nigeria

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Author's contribution

*Author MOA designed, carried out the research, performed the statistical analysis, wrote, read
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ABSTRACT

The paper is a perception survey of poor construction supervision and building failures in six major cities in Nigeria. This was informed by several reported cases of building failure and collapse with its concomitant losses of life and properties. While the paper examined relationship between poor construction supervision and unsustainable building construction practices with regard to incessant building failures in six major cities in Nigeria between September 2012 and August 2013, it assumes sustainable construction principles, efficient and effective supervision and other factors will stem the tide. The paper adopted descriptive research design using 397 stratified randomly and area clustered selected registered members of Nigerian Institute of Building (NIOB) from the six major cities in Nigeria for questionnaire administration. The sample size was determined using Yamane's formula for sample size determination at 5% level of significance. Data collected were analyzed using descriptive and inferential statistics. Results from the data analysis indicated that significant relationship exists between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures)/building failures in Nigeria; thus recommended effective monitoring of building projects by government agencies, establishment of building inspectorate, stiffer penalties for non-compliance with approved building plans and provision of low interest mortgage loans.

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1. INTRODUCTION

The incidence of building failures associated with poor construction supervision has become a major issue of concern in Nigeria's major cities. It has become a regular phenomenon for residential and commercial buildings to collapse like a pack of cards. Some of these buildings crumble under construction while many others give way while being occupied, resulting in many lives being lost and properties worth billions of naira destroyed. For example, 57 people were buried due to building collapse at Ebute Meta, Lagos on 18th July, 2006 [1] and another unfinished three-storey building on 12th June, in Enugu killing 20 people [2]. In Lagos, a four-storey residential building caved-in suddenly in July, 2006 killing 37 people and leaving 50 survivors to be pulled out of the rubble [2]. This has attracted the public blaming poor construction supervision by the relevant government agencies as the root cause.

Cases of building collapse are not limited to Nigeria, in April 24, 2013; an eight storey factory building which collapsed in Dhaka, Bangladesh, killing over a thousand people was also blamed on poor construction supervision/ systemic corruption in the building industry. While it may be true that building failures related to poor construction supervision is a global occurrence, the frequencies of their occurrence and the magnitude of losses in terms of lives and properties is a major source of concern to everyone world over.

It is unfortunate that over the years not much has been done by government to arrest the ugly trend of building failures particularly in Nigeria despite setting up of committees of inquiries to examine the remote and immediate causes. Nor, the culprits hardly prosecuted and professional negligence adduced reprimanded, while victims and their families were not cared for. It is against this background that it becomes pertinent to embark on a perception survey of poor construction supervision and building failures from registered members of Nigerian Institute of building (NIOB) in six major cities of Nigeria.

1.1 Statement of the Problem

It is common to hear incidents of building failure/collapse in major Nigerian cities like Lagos, Port Harcourt, Abuja, Enugu, Kaduna and Ibadan. According to Windapo and Rotimi [3], from a total of 91 cases of building failures/collapse in Nigeria between 1974-2010; 51.6% occurred in Lagos, 18.7% in the South Western states, 8.8% in Abuja—the Federal capital city, 6.5% in the South-South states, 5.5% in the South Eastern states, 4.4% in both the North Western and North Central states and 0% in the North Eastern states. They contended that these incidents are poor construction supervision related. Bamisile [4] asserted that many public and privately owned buildings in Nigeria lack maintenance thus resulting in deplorable conditions of structural fabrics and ultimate structural collapse. Olorunoje [5] noted that failure/collapse of building can be traced to the type of materials used and quality of workmanship. In Nigeria, it is generally believed that poor construction supervision, corruption, weak building legislation, poor structural design, faulty construction, use of low quality materials, hasty construction, shallow foundation and poor workmanship are the common causes of most building failures. A number of cases occur during and after the construction phase of the project.

Again, the consequence of building collapse has been colossal. In 44.4% of the reported incidents, between one and five lives were lost, while in 9.3% of the incidents over 21 lives were lost, with a high prevalence in South West Nigeria particularly Lagos city [3]. This might be due to the higher concentration of construction activities in Lagos because of its status as the commercial nerve center of Nigeria.

1.2 Research Objectives

The objectives of the research are as follows:

1. To determine the relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in Nigeria.
2. To evaluate the extent of the relationship between poor construction supervision and increased rate of building failures in Nigeria.

1.3 Research Questions

From the above research objectives, the following research questions were formulated:

1. Does any significant relationship exist between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in Nigeria?
2. Does any significant relationship exist between poor construction supervision and increased rate of building failures in Nigeria?

1.4 Research Hypotheses

In view of the above research questions, the following null hypotheses were formulated:

- 1H₀: There is no significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures).
- 2H₀: There is no significant relationship between poor construction supervision and increased rate of building failures.

1.5 Literature Review

1.5.1 Building collapse and poor construction

Many cases of poor construction supervision related building failures have been reported in Nigeria. Folagbade [6] and Chinwokwu [7] enumerated forty-two (42) cases of poor construction supervision related building failures occurring between 1980 and 1999 in Nigeria while Makinde [8] listed fifty-four (54) cases occurring between January 2000 and June 2007 alone. Poor construction supervision related building failures has also been observed to cut across different categories of buildings – private, corporate or public. Folagbade [6] observed from a total of twenty-five (25) reported cases of poor construction supervision related building failures between 1980 and 1999 in Lagos State, 76% were private buildings, 12% were corporate buildings while government or public buildings also accounted for 12% of the building failures.

Windapo and Rotimi [3] observed in Table 1 that 39.7% of the poor construction supervision related Building failures in Nigeria from 1974 to 2010, were residential buildings, 14.3% were buildings used for business/professional (commercial) purposes, 12.7% were for assembly (churches and mosques) and 8%, 6.3% and 4.7% were for institutional (hospitals), Mercantile buildings (shopping complexes) and mixed occupancy respectively. There were no reported cases of poor construction supervision related Building failures in factories or industrial, high hazard, storage and utility buildings. This suggests that residential buildings were more susceptible to poor construction supervision in Nigeria. The reason may not be unconnected with the hasty and care free manner in which private clients handle their building projects with or without government approval. Fagbenle and Oluwunmi [9] observed that, out of 25 contractors in each of the six geographical regions of Nigeria, 68.6% evaded approval plans and 75% of them had also evaded approval plans before commencement of their construction work.

Table 1. Reported Cases of poor construction supervision related Building failures in Nigeria based on Geographical Location (1974 – 2010)

Geographical Location	Frequency	Percentage (%)
Lagos	47	51.6%
South- Western states	17	18.7%
Abuja	8	8.8%
South-South states	6	6.6%
South Eastern states	5	5.5%
North Western states	4	4.4%
North Central states	4	4.4%
North Eastern states	Nil	0.0%
Total	91	100%

Source: Windapo and Rotimi (2012).

Oyewande [10] discovered that 50% of poor construction supervision related building failures in Nigeria is attributed to design faults, 40% to construction fault and 10% to product failures. According to Chinwokwu [7] and Windapo [11], about 37% of these failures are believed to be caused by carelessness and greed on the part of construction professionals and 22% are traceable to design faults [12]. Uzokwe [13] submitted that the cause of poor construction supervision related building failures is almost always unique to the particular building in question. However, he advanced some general symptoms of poor construction supervision to include the use of poor quality blocks and concrete, poor compaction and consolidation of foundation soil and weak soil.

Poor construction supervision related building failures is no respecter of size of structure. Amusan [14] reported that Barnawa flat disaster in 1977 was a three-storey building. A public building (Secondary School) which collapsed in March 1988 at Ibadan was a two-storey structure. The collapsed show-room for cars in Lagos in 1987 was just a storey building while that of the Primary School in Iloabuchi, Port-Harcourt in July 1991 was a bungalow. Folagbade [6] also reported that the Abuja multi-storey building which collapsed in March, 1993 and another at Ojuelegba in 1999 were both as a result of poor construction supervision.

Another reported case of poor construction supervision related building failure was the collapse of a Nursery/Primary School fence at Olomi area in Ibadan, in March, 2008, in

which thirteen (13) pupils of the School died. The death of over 50 students of Saque Comprehensive College, Port Harcourt in 1990, associated with the owner's attempt to construct additional floors on structurally unsafe walling was also attributed to poor construction supervision. Similar trends of poor construction supervision related building failures were also observed in the collapse of a Mosque building in Mushin, Lagos in 2001 and a multi-storey commercial/residential building in Ebute-Meta. Some of these cases are as a result of ignorance on the part of developers and unauthorized conversion of buildings. According to Falobi [15], the common causes of building failures in Nigeria, have been traced to poor construction practices (bad design; faulty construction; foundation failure; extraordinary loads, use of unqualified contractors and poor project monitoring and above all, lack of enforcement of building codes by the relevant town planning officials). Case studies by Ogunsemi [16] and Folagbade [17] show that poor construction practices: poor structural design, use of substandard building materials, non-compliance with approved building design, poor workmanship, and lack of qualified and appropriate professionals to ensure quality construction, and cost control, among others are the major causes of building failures in Nigeria. In addition, Akinpelu [18] categorized poor construction practices arising from: environmental changes, natural and man-made hazards as the major causes of building failures in Nigeria. Richard [19] opined that poor construction practices arising from basic design faults and construction defects could result in structural failure.

According to Folagbade [20], the inability of the engineer to: carry out proper site investigations, calculate design loads accurately, prevent the use of substandard building materials, have good design layout and understand structural analysis/design principles could lead to structural failure. The professionals that are usually accused of negligence in all cases of building failures in Nigeria include: the architect, civil/structural engineer, the contractor and town planning officials. The inability of the architect /structural engineer to use the right number/sizes of reinforcements often times lead to collapse of buildings. While the inability of the town planning authorities to ensure that architectural/structural designs and calculations conform to design principles before approvals are given can also lead to structural failure.

It is important to note that some officials of the town planning authority sometimes compromise their position and allow developers/landlords to recklessly contravene development control regulations. Added to this dimension is the very slow pace at which the town planning authorities enforce the building regulation. During construction, the consultants and the contractors must have competent persons on site to monitor work as it progresses, failure to do so, could lead to bad or poor workmanship, resulting in structural failure. Often, developers and landlords of collapsed buildings cut corners in the use of materials for construction. They deliberately deviate from what was approved for them and begin to contravene in the process of construction.

1.5.2 Construction practices and building collapse

Statutory building development practice in Nigeria is guided by laws and regulation through approved procedures administered by requisite government agencies and construction professionals. However, many developers had and continued to compromise the procedures leading to sub-standard practices in building production. Such include deficient structural drawing, alteration of approved drawings, building without development permit, approval of technically deficient drawings, illegal alteration of existing buildings substandard materials, poor workmanship and use of acidic and salty water.

1.5.2.1 Statutory building development procedure in Nigeria

The importance of Building Code cannot be overemphasized, for it sets the minimum standards on building pre- design, design, construction and post construction stages with a view to ensuring quality, safety and proficiency of the building industry. The Nigeria National Building Code [21] is the main piece of legislation that regulates the construction and safety of buildings in Nigeria. Its main aim is the achievement of a sustainable built environment in the Nigerian society. The statutory procedure for building development/construction in Nigeria as stipulated by the National Building Code is as stated in Table 2.

Though, sustainable construction measures are incorporated in the provisions of the National Building Code to a certain extent, it lacks publicity, effective enforcement agency, efficient supervision of construction works and research/technical development on new renewable building materials. There is no doubt that the promulgation of the National Building Code [21] is a very important development in the building industry in Nigeria. For many measures must be put in place, in order to make the National Building Code [21] workable. These include: creation of an enabling environment for its operation, enlightenment campaign, provision of all the necessary legal frameworks for its operation, etc. This explains the reason many experts have done a lot of work on various issues relating to the National Building Code. Researchers and practitioners (Ademoroti [22]; Bamisile [23]; Lamoreaux [24] and Ojambati [25]) have advocated on the need for laws to control building construction and professional code of conduct in the Nigerian building industry.

According to Snelling [26] building regulations are designed to secure the health, safety and convenience of people in or about buildings and of others who may be affected by buildings or matters connected with them. Anderson et al. [27] noted that building codes are needed in every society to take care of risks posed by lack of uniformity, victims of poor construction, lack of enforcement of other legislations and billions of annual loses, of which 24-40% could be avoided. This is particularly important in the case of Nigeria where human activities in the built environment are haphazardly carried out.

However, one very important issue that seems to be neglected is how the National Building Code can promote sustainability. This is especially important in view of the reciprocal impacts between human actions and the biophysical world. The question is increasingly being asked as to whether current rates of exploitation of resources can be sustained without serious implication for the future. Construction activities put a lot of pressure on the physical environment. All these have great implications on the environmental quality as well as the survival of man. This means that measures that improve the quality of human life while living within the carrying capacity of supporting eco-systems (sustainability) should be put in place.

Table 2. Statutory procedure for building development/construction in Nigeria

Procedure	Description of Procedure	Estimated Duration	Associated Costs
1	Obtain environmental impact assessment report- It usually takes 4 days for the town planner to issue the environmental impact assessment report.	7days	Between NGN 20,000 and NGN 50,000.
2	Obtain development permit from the local government Office - The development permit authorizes construction and is valid for 2 years. Several documents are required to obtain this permit, including all the property documents, clearances, and approvals required or obtained in the previous procedures. Legally, a pre-approval inspection is required. Other inspections include one by the Environmental Protection Agency, and another structural inspection carried out by the Local Town Planning Authority during construction.	42 days	NGN 494,216
3	Pay Development Levy to the Local Town Planning Authority - The Local Town Planning Authority charges a contribution levy (10% of the building permit cost) for the preparation and production of development plans, such as local, state, subject, and action plans; development guides; office maintenance; procurement and maintenance of vehicles; office equipment; and similar issues.	1 day	NGN 49,422
4	Pay Spatial Enhancement Contribution to the State Town Planning Authority in bank draft.	1 day	NGN 95,000
5	Obtain certificate of structural stability of foundation from an accredited construction testing company.	2 days	NGN 5,000
6	Obtain certificate of structural stability (first pouring of concrete).	2 days	NGN 5,000
7	Obtain certificate of structural stability (second pouring of concrete).	2 days	NGN 5,000
8	Obtain certificate of structural stability (third pouring of concrete).	2 days	NGN 5,000
9	Receive inspection during construction from State Government Task Force reporting to the Commissioners for Land and Urban Development.	1 day	No cost
10	Receive inspection during construction from Local Government Monitoring Team reporting to the LGA Office.	1 day	No cost

Table 2 continued.....

11	Receive inspection during construction from Zonal Monitoring Team.	1 day	No cost
12	Request and receive inspection by fire department- This certificate is to be obtained at the local town planning authority before the building can be used. It is within the discretion of the authority to conduct an on-site inspection before issuing the certificate.	1 day	No cost
13	Obtain Certificate of Completion and fitness for habitation.		

Source: Nigeria National Building Code, 2010.

1.5.2.2 Effects of poor construction supervision and poor construction practices

•**Deficient Structural Drawing:** Buildings fail when structural drawings are based on false assumptions of soil strength or as a result of faulty structural details. Design defaults accounts for 50% of building failures in Nigeria [10].

•**Alteration of Approved Drawings:** During construction, many contractors either on the directive of the client or in a bid to cut corners and maximize profit, alter approved building plans without corresponding amendment to structural drawings to the detriment of the structure.

•**Building without Approved Building Drawings:** Building without approved drawings and in some cases no drawings at all, can result in the failure of a building, more so when the drawings were not vetted by qualified professionals or relevant authorities before construction. Without drawings, all constructions are based on guess work.

•**Approval of Technically Deficient Drawings:** Town Planning Authorities at times approve technically deficient drawings. This may be either due to ignorance on the part of the Town Planning Personnel or as a result of outright corruption on their part.

•**Illegal Alteration of Existing Buildings:** Clients at times on their own, alter existing structures (buildings) beyond and above the original design without any drawings or relevant Town Planning approval. In some instances existing bungalows have been converted to either a storey building or two to three-storey structures without any drawings and supervision by qualified personnel. The result can be anybody's guess.

•**Clients Penchant to Cut Corners:** Nigerian building clients (mostly individuals) have a penchant for cutting corners by not employing qualified personnel to produce the contract documents and supervise the building construction, as they want to spend minimum (not optimum) amount of money on the construction[28]. Even where qualified professionals are employed for design and supervision, most clients insist on having the final say on what goes on in the site to the detriment of proper execution of the contract.

•**Use of Substandard Materials:** Substandard materials especially reinforcement rods and cement can contribute immensely to failure of buildings. Hall [29] posited that use of low quality materials is one of the major causes of structural failure.

•**Inefficient Workmanship (Labour):** Inefficient and fraudulent labour input, can also contribute to failure of buildings [30]. When a contractor cannot read drawings or refuses to listen to the instruction of consultants, anything can happen. Oyewande [10] posited that faults on construction sites accounts for 40% of structural failure.

•**Use of Acidic and Salty Water:** Use of acidic and salty water, as sourced from oceans and seas in cities like Lagos and Port Harcourt can affect the strength of concrete.

2. MATERIALS AND METHODS

The scope of this research is limited to the selected registered members of Nigerian Institute of Building (architects, civil engineers, structural engineers, builders and town planners) in the six major cities in Nigeria: Abuja, Lagos, Ibadan, Kaduna, Port-Harcourt and Enugu. It is assumed that responses obtained from the sample respondents would be representative of the opinions of all members of Nigerian Institute of Building while the duration of study is between September 2012 and August 2013.

The study adopted cross sectional survey research design using stratified random and area cluster sampling method in eliciting the required primary data. The population of study consists of the entire 50,000 registered members of Nigerian Institute of Building (NIOB) presented in Table 3. A sample population of 397 respondents across cities clusters was determined using Yamane [31] formula for sample size determination at 5% level of significance while stratified random/area cluster sampling method was used for questionnaire administration (all collected and analyzed). The questionnaire was designed to four-point Likert type scale. The sample respondents were selected using shuffling of cards method (without replacement) in which each NIOB registered member's name was written on a small card and the name on the topmost card was selected each time, the cards were shuffled.

Data collected were analyzed using descriptive and inferential statistics. The questionnaire responses of the sample respondents were presented using tables while formulated hypotheses were tested using analysis of variance (ANOVA). A total of 397 copies of the questionnaire were administered.

Table 3. Distribution of Registered Members of Nigerian Institute of Building in Six Major Cities in Nigeria

Cities/ Building Professionals	Civil Engineers	Structural Engineers	Architects	Builders	Town planners	Total
Lagos	3,500	3000	3000	3000	2500	15,000
Ibadan	2,000	2,000	1,500	1,000	500	7,000
Abuja	3,500	3,000	2,500	2,000	1,000	12,000
Enugu	2,000	1,500	2,000	1,000	1,000	7,500
Port-Harcourt	1500	1000	1200	800	500	5,000
Kaduna	850	600	700	750	600	3,500
Total	13,350	11,100	10,900	8,550	6,100	50,000

Source: Nigerian Institute of Building, 2013.

2.1 Calculation of Sample Size

The sample size was determined from the population of 50,000 registered members of Nigerian Institute of Building using Yamane [31]) formula for sample size determination thus:

$$n = \frac{N}{1+N(e)^2}$$

Where: n= sample size, N= population size, e= level of significance/sample error factor.

$$N = \frac{50,000}{1 + 50,000(0.05)^2} = \frac{50,000}{126} = 396.83 = 397$$

3. RESULTS AND DISCUSSION

3.1 Distribution of Responses on Research Questions

3.1.1 Question number 1

Does any significant relationship exist between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria? Table 5 shows that questions: 1, 2, 3, 4, and 5 with varying mean scores of 3.00, 2.92, 2.98, 3.02 and 2.88 were above the weighted average of 2.50. The table further revealed a grand mean score of 2.96 indicating a strong evidence of the existence of a significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria. This conclusion is buttressed by Windapo and Rotimi [3] observation that the approach to construction by industry stakeholders does not match sustainable principles and contributes to general under performance of buildings in Nigeria. The implication of this result is that estate developers/owners should ensure efficient/effective supervision of building projects from cradle to completion to avoid unsustainable construction practices that may result in building failure.

Mean Score
$$\frac{4n_4+3n_3+2n_2+1n_1}{(n_4+ n_3+ n_2+n_1)}$$
Equation (1)

Where n_1, n_2, n_3 and n_4 are the respective number of responses obtained from each of the four options provided while 1, 2, 3 and 4 respectively represent the weights (SA (4), A (3), D (2) & SD (1)) attached to each of the four options.

Table 4. Distribution of Sample Respondents

Cities/ Professionals	Building	Civil Engineers	Structural Engineers	Architects	Builders	Town planners	Total
Lagos		$\frac{3,500*397}{50,000}=28$	$\frac{3000*397}{50,000}=24$	$\frac{3000*397}{50,000}=24$	$\frac{3000*397}{50,000}=24$	$\frac{2500*397}{50,000}=19$	119
Ibadan		$\frac{2000*397}{50,000}=16$	$\frac{2000*397}{50,000}=16$	$\frac{1500*397}{50,000}=12$	$\frac{1000*397}{50,000}=8$	$\frac{500*397}{50,000}=3$	55
Abuja		$\frac{3,500*397}{50,000}=28$	$\frac{3000*397}{50,000}=24$	$\frac{2500*397}{50,000}=20$	$\frac{2000*397}{50,000}=16$	$\frac{1000*397}{50,000}=8$	96
Enugu		$\frac{2000*397}{50,000}=16$	$\frac{1500*397}{50,000}=12$	$\frac{2000*397}{50,000}=16$	$\frac{1000*397}{50,000}=8$	$\frac{1000*397}{50,000}=8$	60
Port-Harcourt		$\frac{1500*397}{50,000}=12$	$\frac{1000*397}{50,000}=8$	$\frac{1200*397}{50,000}=9$	$\frac{800*397}{50,000}=6$	$\frac{500*397}{50,000}=3$	38
Kaduna		$\frac{850*397}{50,000}=7$	$\frac{600*397}{50,000}=5$	$\frac{700*397}{50,000}=6$	$\frac{750*397}{50,000}=6$	$\frac{600*397}{50,000}=5$	29
Total		107	89	87	68	46	397

Source: Field Survey, 2013.

Table 5. Mean responses on the relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria (n=397)

S/No.	Research Questions	SA(4)	A (3)	D(2)	SD(1)	Total Responses	Mean Score
1	Do you experience poor construction supervision in the execution of building projects in your city of domicile?	175	95	79	48	1191	3.00
2	Does poor construction supervision account for the use of substandard designs in building projects execution in your city of domicile?	159	103	79	56	1159	2.92
3	Does poor construction supervision account for the use of substandard materials in building projects execution in your city of domicile?	167	95	95	40	1183	2.98
4	Does poor construction supervision account for the use of substandard manpower in building projects execution in your city of domicile?	183	87	79	48	1199	3.02
5	Does poor construction supervision account for the use of substandard procedures in building projects execution in your city of domicile?	151	103	87	56	1143	2.88
	Grand Mean	604	309	174	56	1143	2.96

Source: Field Survey, 2013.

3.1.2 Question number 2

Does any significant relationship exist between poor construction supervision and increased rate of building failures in six major cities in Nigeria? Table 6 shows that questions: 6, 7, 8, 9, and 10 with mean scores of 2.94, 3.00, 2.98, 3.06 and 3.10 were above the weighted average of 2.5. The grand mean of 3.02 shows that there is a strong evidence of a significant relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria. This conclusion is buttressed by Folagbade [6] and Badejo [32] which observed that the common causes of poor construction supervision related building failures in Nigeria, have been traced to bad design, faulty construction, use of low quality materials, hasty construction, foundation failure, ineffective enforcement of building codes and lack of proper maintenance. This is also buttressed by the findings of Windapo and Rotimi [3] which observed that the prevalent cause of poor construction supervision related building failure is structural failure, followed by workmanship, the use of sub-standard materials, carelessness and faulty design. The implication of this result is that efficient/effective supervision of building projects from cradle to completion will go a long way in reducing the rate of building failures in Nigerian cities.

3.2 Test of the First Hypothesis

H₀: There is no significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria.

H₁: There is a significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria.

Table 7 in appendix 1 shows that calculated F-Value of 161.81 resulted from the relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria. This calculated F-Value is significant since it is greater than the critical F-Value of 5.29 given 3/16 degree of freedom at 0.01 level of significance. Hence, the null hypothesis is rejected while the alternative is accepted. This shows that there is a significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria.

Table 6. Mean responses on the relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria (n=397)

S/No.	Research Questions	SA (4)	A (3)	D(2)	SD(1)	Total Responses	Mean Score
6.	Do you experience increased rate of building failures in your city of domicile?	159	103	87	48		
		636	309	174	48	1167	2.94
7.	Does poor construction supervision account for the increased rate of building failures in your city of domicile?	175	87	95	40		
		700	261	190	40	1191	3.00
8.	Does poor construction supervision results in cutting corners dovetailing in increased rate of building failures in your city of domicile?	183	79	79	56		
		732	237	158	56	1183	2.98
9	Does poor construction supervision results in violation of the building code dovetailing in increased rate of building failures in your city of domicile?	191	87	71	48		
		764	261	142	48	1215	3.06
10	Does poor construction supervision results in inefficient workmanship dovetailing in increased rate of building failures in your city of domicile?	199	79	79	40		
		796	237	158	40	1231	3.10
	Grand Mean						3.02

Source: Field Survey, 2013.

3.3 Test of the Second Hypothesis

H₀: There is no significant relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria.

H₁: There is a significant relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria.

Table 8 in appendix 2 shows that calculated F-Value of 144.42 resulted from the relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria. This calculated F-Value is significant since it is greater than the critical F-Value of 5.29 given 3/16 degree of freedom at 0.01 level of significance. Hence, the null hypothesis is rejected while the alternative is accepted. This shows that there is a significant relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria.

4. CONCLUSION AND RECOMMENDATIONS

The paper is a perception survey of poor construction supervision and building failures in six major cities in Nigeria. It assumes that incorporation of sustainable construction principles into building projects will stem the tide of incessant building collapse /failures in six major cities in Nigeria. The four major findings of the research are as follows:

- ❖ There is an increased rate of building failures in the six major cities of Nigeria (Lagos, Port Harcourt, Abuja, Enugu, Kaduna and Ibadan).
- ❖ There is poor construction supervision in the execution of building projects in the six major cities of Nigeria (Lagos, Port Harcourt, Abuja, Enugu, Kaduna and Ibadan).
- ❖ There is a significant relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria.
- ❖ There is a significant relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria.

Arising from the findings of this paper, it is suggested that government should take the following steps to stem the tide of incessant building failures in the six major cities of Nigeria:

- 1. Effective monitoring of building projects:** Government agencies in charge of housing development and control need to carry out stricter oversight by ensuring compliance of property developers with the building code. They also need to conduct integrity or stress test on many old buildings to see if they are still strong enough for human habitation. Buildings that fail stress tests should be pulled down if the structural defects are irredeemable. In doing this, priority should be given to multi-storey buildings.
- 2. Establishment of building inspectorate:** Government should establish a building inspectorate staffed with competent professionals that will enforce the provisions of the reviewed national building code to ensure compliance by property developers and building contractors.
- 3. Stiffer Penalties for non-compliance:** Government should review the penalties for contravening the national building code and make them stiffer to discourage non-compliance.

- 4. Provision of low interest mortgage loans:** Government should encourage mortgage institutions to make low interest mortgage loans available to members of the public to discourage the use of substandard materials in building construction in our major cities.

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COMPETING INTERESTS

The author has declared that no competing interests exist.

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Appendix 1

Table 7. Computation of Analysis of Variance on the relationship between poor construction supervision and unsustainable building construction practices (use of substandard designs, materials, manpower & procedures) in six major cities in Nigeria

Source of variance	Sum of squares	Degree of freedom	Mean sum of squares	Calculated F-value	Table critical F- value	Decision
Between groups	36504.55	3	12168.18	161.81	5.29	H₀: Rejected
Within group	1203.2	16	75.2			
Total	37707.75	19				

Source: Statistical Computation and Table 5.

Appendix 2

Table 8. Computation of Analysis of Variance on the relationship between poor construction supervision and increased rate of building failures in six major cities in Nigeria

Source of variance	sum of square	Degree of freedom	Mean sum of square	Calculate F-value	Table critical F-value	Decision
Between group	49912.55	3	16637.52	144.42	5.29	H₀: Rejected
Within group	1843.2	16	115.2			
Total	51755.75	19				

Source: Statistical Computation and Table 6

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