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CONSIDERATIONS FOR BUILDING PROJECTS EXECUTION, MONITORING AND CONTROL IN PARTS OF NIGERIA

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ABSTRACT: *There are several materials used in building construction projects. The choice and use of these materials depend on availability, local conditions, technology available and practices of the industry among others. Therefore, this study assessed factors influencing lack of knowledge of properties of materials by the building project supervisors and the effects of not considering their properties during execution of the projects in the study areas. Using survey design to obtain the relevant information through questionnaire administration, a sample size of 222 professionals involved in various building projects design and supervision and urban development in the study areas were selected using a stratified random sampling technique. Descriptive and inferential statistical tools were used to analyse the data collected. The findings revealed that non familiarity with the properties of fresh concrete (4.07), neglect of considerations for strength of materials during execution of building projects (4.06) (F=106.476; p<0.05). Building failure (3.83), and building collapse (3.42); F (129.749; <0.05). These were the factors and effects of not considering properties of materials in the study areas, thereby leading to structural failure. It was recommended that Building Ccollapse Preventive Guide of Nigeria should be organising on the job training for construction workers in the informal sector of the construction industry.*

KEYWORDS: properties of materials, building projects, projects execution, parts of Nigeria

INTRODUCTION

In Nigeria, there are incidences of regular and persistent building collapse resulting from failure of materials used and other factors. There is no part of the urban cities in the country that is free from this menace. In the construction industry, building construction projects are categorised into small, medium and large, and also classified into privately and publicly owned. The same materials would be usually used for the projects. There are several materials used in building construction projects. The choice and use of these materials depend on some factors like: availability, local condition, geographical locations of sites, technology available, practices of the industry and so on. These materials are cement, sand, gravel, timber, metals, glass, and water, among others. The application of these materials requires the knowledge, technical know-how and experience of the building industry professionals.

The quality, strength, flexibility, and others properties of a material determine the functions it serves in building construction projects. Not only the building consumes new products but also retains the best of old materials and practices. Properties of engineering materials can be classified into seven. These are: physical, chemical, thermal, electrical, magnetic, optical, and mechanical properties (Dixit, 2018). Materials make up the objects around us, and each of them has different properties or characteristics that can be measured, sensed, observed or tested

(SLH, 2018; Spacy, 2019). Chemical properties are discovered by observing chemical reactions, especially when cement is mixed with other materials with addition of water. When cement is mixed with sand, gravel and water (concrete0 chemical reaction occurs. Unlike chemical properties, mechanical properties of materials determine the behaviour of some materials under load. These properties include: density, hardness, and elasticity. Though the loads to which a material is commonly subjected to, are compression, tension, and bending. Therefore, there are many building materials for construction purposes.

Despite the existence and functionality of professional and regulatory bodies like, Nigeria Institute of Architects (NIA), Nigeria Institute of Town Planners (NITP), Nigeria Society of Engineers (NSE), and Nigeria Institute of Builders (NIOB), there are still cases of structural failures leading to collapsed of buildings.There are frequent media reports of collapse buildings in major parts of Nigeria like Lagos, followed by Abia, Anambra and Oyo States among others (Daily Trust, 2019; Ihua-Maduenyi, 2020). Also, findings of some researchers in building industry revealed the causes of building collapses as: structural design handled by quacks, absence of soil test, lack of adherence to building specifications. By the project supervisors, the use of substandard building materials, professional negligence and bad construction practices among others (Oloyede, Omoogun & Akinjare, 2010; Ayodeji, 2011; Olanitori, 2011; Akindoyemi, 2012, Aliyu, 2012; Adedeji, 2013; Akande, Debo-Saiye, Akinjobi, Alao & Akinrogunde, 2016).

However, buildings have continued to collapse despite measures by both the Federal and State governments over the years to check the ugly trend. Therefore, this study aims at assessing properties of materials considerations for building project execution, monitoring and control in parts of Nigeria. In achieving this, the specific objectives are to assess the perceived factors influencing lack of knowledge of properties of materials by building project supervisors and effects of not considering the properties of materials during execution of building projects in the study areas. This is with a view to avoiding structural failures of building projects in the study areas.

MATERIALS AND METHODS

To achieve the objective, of this study, quantitative data collection method was adopted as the primary method for gathering data from the target population. The research framework for this study was also based on a literature reviewed on building projects construction methodology, questionnaire survey, descriptive and inferential statistical tools analyses. The study was carried out in all the metropolitan state capitals of Lagos Sstate (Lagos), Abia State (Umuahia),Anambra State (Awka), and Oyo State (Ibadan). The scope of the study was limited to only private building projects in the study areas because from the literature reviewed all collapse buildings were private buildings. Supervisors for public building projects in the country followed due process from initiation to closing. Building construction industry practitioners who have prominent roles in construction, urban development and redevelopment including planners, architects, structural engineers and builders in Lagos, Umuahia, Awka and Ibadan were the target respondents for the survey.

The professionals' institutes like Nigeria Institute of Architects (NIA), Nigeria Institute of Town Planners (NITP), Nigeria Society of Engineers (NSE), and Nigeria Institute of Builders

(NIOB) Lagos, Abia, Anambra, and Oyo States chapters assist the researcher in getting the respondents. Three hundred copies of questionnaire were distributed to members, stratified randomly selected from each institute's monthly meetings.

The respondents include Town Planners (60), Architects (60), Structural Engineers (60), and Builders (120). Builders carried out the dream of the clients to reality. These professionals were used to ensure a comprehensive view of the lack of knowledge of the properties of materials in the study areas. The respondents were given self-administered questionnaire and they were asked to rate the factors influencing lack of knowledge of the properties of materials during execution of building projects on 5 points rating scale with 1-Very low; 2-Low; 3-Moderate; 4-High and 5-Very high. This type of scale has been found to be acceptable in most construction projects literature. The descriptive statistical tools used include frequency, tables, and percentages while the inferential statistical tools used was Analysis of Variance (ANOVA). ANOVA was performed on the factors influencing lack knowledge of properties of materials by the building project supervisors and challenges of not considering the properties of materials during execution of building projects. ANOVA was applied to test all the means for significant differences among them. In all, Duncan Multiple Range Test (DMRAT) was carried ot to test the homogeneity of all the means to showcase those that are similar to others and those that are different in their levels of significance (Appendices I & II).

RESULTS AND DISCUSSION

Number of Copies of Questionnaire Administered and Retrieved

Total number of 300 copies of questionnaire were administered to the respondents while 222 copies were retrieved, representing 74.0 per cent of the respondents (Table 1). Total number of 222 copies were used for the analysis of this study.

Table 1: Questionnaire Administered and Retrieved

professionals	Lagos		Abia		Anambra		Oyo		Total		Percentage
	Adm.	Retr.	Adm.	Retr.	Adm.	Retr.	Adm.	Retr.	Adm.	Retr.	
Planners	15	11	15	10	15	09	15	12	60	42	18.9
Architects	15	12	15	11	15	10	15	11	60	44	19.8
Structural Engineers	15	13	15	09	15	11	15	10	60	43	19.4
Builders	30	23	30	24	30	22	30	24	120	93	41.9
Total	75	59	75	54	75	52	75	57	300	222	100.0

Source: Field Survey, 2021
Key: Adm. – Administered
Retr. – Retrieved

Table 2 shows the respondents profession. The data from the Table show that builders have the highest percent with 41.9 per cent, architects 19.8 per cent; structural engineers 19.4 per cent and planners 18.9 per cent. These professionals take active roles in the building construction projects.

Table 2: Respondents Profession

Professionals	Frequency	Percentage
Planners	42	18.9
Architects	44	19.8
Structural Engineers	43	19.4
Builders	93	41.9
Total	222	100.0

Source: Field Survey, 2021

Table 3 shows the number of years of relevant work experience of the respondents. The data from the table show that 27.9 per cent of the respondents have above 20 years of relevant work experience, while 22.5 per cent have between 16 and 20 years of relevant work experience. This shows that avearegely (50.4 per cent) of the respondents have above 16 years of relevant work experience, which means that they are familiar with the structural failures both within and outside the study areas. Therefore, there was no challenge in filling the questionnaire given to them.

Table 3: Years of Relevant Work Experience

Years	Frequency	Percentage
0-5	28	12.6
6-10	43	19.4
11-15	39	17.6
16-20	50	22.5
Above 20	62	27.9
Total	222	100

Source: Field Survey, 2021

Table 4 shows the perceived factors influencing lack of knowledge of properties of materials by the building project supervisors in the study areas. When rated on a rating scale of 1 being very low to 5 being very high, the ANOVA results (Appendix I) shows a significant difference ($p>0.05$) in the ratings of the factors. Among the factors, only four were rated below average. However, the remaining factors were rated moderately and high. This means that those factors influence lack of knowledge of properties of materials in the study area.

Non familiarisation with the properties of fresh concrete like workability, uniformity, consistency, segregation and bleeding (4.07), neglect of considerations for strength of materials during execution of building projects (4.06), non-familiarity with properties of timber used for building construction like tensile strength, compressive strength, shearing strength and bending strength (4.05), non-considerations for physical properties of aggregates like strength, porosity, bond characteristics and moistures contents (4.05), the use of undrinkable water for missing of mortal and concrete (4.05) and other factors rated moderately in the table contributed to structural failure of building collapse in Nigeria: the causes , effects, consequence and remedies by Chendo and Obi (2015) who found that defective construction, engagement of ill-equipped, incompetent contractors and lack of proper supervision, inspection, and monitoring of construction works among others led to building collapse. Water for concrete production should be clean and free from impurities. Chudley and Greeno 92004) in Hedidor and

Bondinuba (2018) reported that only water for drinking should be used for concrete works as water with impurities adversely affected concrete quality or strength.

Table 4: Factors Influencing Lack of Knowledge of Properties of Materials by Building Project Supervision

Factors	Rating
Non familiarisation with the properties of fresh concrete like workability, uniformity, consistency, segregation and bleeding	4.07[a]
neglect of considerations for strength of materials during execution of building projects	4.06[a]
non-familiarity with properties of timber used for building construction like tensile strength, compressive strength, shearing strength and bending strength	4.05[a]
non-considerations for physical properties of aggregates like strength, porosity, bond characteristics and moistures contents	4.05[a]
the use of undrinkable water for missing of mortal and concrete	4.05[a]
Non adherence to water/ cement ratio when mixing mortar and concrete	3.71[b]
Construction of buildings becoming an al-comers affairs with sites left to non-professionals to control and monitor (Informal construction sector)	3.56[b]
Professional negligence and bad construction practices (Informal construction sector)	3.53[bc]
Non-conformance to requirements and specifications	3.50[c]
Non demonstration of technical know-how of properties of materials during execution of projects	3.50[c]
Failure of construction materials used	3.50[c]
Patronization of local block factories using rudiment machines without durability test	3.50[c]
Neglect of materials testing and petrologic investigation	3.35[c]
There are many cases where non-professionals are in charge	2.64[d]
The use of substandard building materials	2.38[e]
Source(s) of water used for execution of projects unknown	2.10[f]
Proper fixing of reinforcement in the correct position to avoid displacement during concreting is especially if the concrete is to be vibrated	2.10[f]

Means with the same letters along the same column are not significantly different at P<=0.05
Key:
Very low = 1
Low =2
Moderate =3
High =4
Very high =6

The perceived effects of not considering the properties of materials during execution of building projects are summarised in Table 5. The ANOVA (Appendix II) shows a significant difference ($p<0.05$) in the ratings of the effects when rated on a rating scale of 1 being very low to 5 being very high. None of these effects was rated very high. However, six of them were rated moderately while the remaining one was rated low. This means that all the six effects resulted from not considering the properties of materials during execution of the projects in the

study areas. The effects are: Building failure (3.83), Building collapse (3.42), Loss of human lives (3.13), Loss of huge sum of capital, properties and materials (3.12), Cost overrun of project (3.07) and time overrun of the projects (3.01) Loss of reputation and integrity on the part of the contractor (2.74). Between February and May 2019, twenty-nine (29) people died while seventy-six (76) sustained injuries from thirteen (13) building collapse incidents across the country (Daily Trust, 2019). Also, out of 43 incidents of building collapse within the year (February to December, 2019) Lagos had the highest figure with 17 cases, accounting for 39.53 per cent as reported by **B**uilding Collapse Preventive Guide (Ihua-Maduenyi, 2020).

Table 5: Effects of not considering the properties of Materials during execution of Building Projects

Challenges	Rating
Building failure	3.83[a]
Building collapse	3.42[b]
Loss of human lives	3.13[c]
Loss of huge sum of capital, properties and materials	3.12[c]
Cost overrun of project	3.07[cd]
Loss of reputation and integrity on the part of the contractor	3.01[d]
Loss of reputation and integrity on the part of the contractor	2.74[c]

Means with the same letters along the same column are not significantly different at P<=0.05
Key:
Very low = 1
Low =2
Moderate =3
High =4
Very high =6

CONCLUSION

Materials are combined with different properties to produce materials that are strong for construction purposes. Among these composite materials are mortar and concrete. Materials have different properties depending on what they are used for and the knowledge of application 0f the materials. Structural failures in Nigeria is rampant. With the existence and functionality of the professionals and regulatory bodies and agencies in the country, building projects fail and collapse incessantly.

RECOMMENDATION

It is therefore recommended that on the job training should be organised quarterly in the informal sector of the industry .This will reduce frequent building failure in the study areas.

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APPENDICES

Appendix I

Factors Influencing Lack of Knowledge of Properties of Materials by the Building Project Supervisor

	Sum of Squares	df	Mean Square	F	Sig.
Between groups	1622.172	16	101.386	106.476	.000
Within groups	3576.436	3756	.952		
Total	5198.608	3772			

Duncan Channels	N	Subset for alpha = .05					
		1	2	3	4	5	6
	222	2.10					
	222	2.10					
	222		2.38				
	222			2.64			
	222				3.35		
	222				3.50		
	222				3.50		
	222				3.50		
	222				3.50		
	222				3.53	3.53	
	222				3.56	3.56	
	222					3.71	
	222						4.05
	222						4.05
	222						4.05
	222						4.06
	222						4.07

Means for group in homogeneous subsets are displayed.
Uses Harmonic Mean Sample Size = 221.941

Appendix II

Effects of Not Considering the Properties of Materials during Execution of Building Projects

	Sum of Squares	df	Mean Square	F	Sig.
Between groups	160	6	26.691	129.749	.000
Within groups	318.234	1547	.206		
Total	478.378	1553			

Duncan Channels	N	Subset for alpha = .05				
		1	2	3	4	5
	222	2.74				
	222		3.01			
	222		3.07	3.07		
	222			3.12		
	222			3.13		
	222				3.42	
	222					3.83

Means for group in homogeneous subsets are displayed.
Uses Harmonic Mean Sample Size = 220.00