Most Critical Factors Responsible For Poor Project Quality Performance in Building Construction Industry (A Case Study of Three Major Cities in Nigeria)

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ABSTRACT

Poor quality project delivery is major problems that face the Nigeria construction industry. It's of high concern to those who are involved in the construction industry. This study was carried out to identify the major causes of poor quality project delivery in Nigeria building construction industry, by means of a literature review and a questionnaire survey. A total of fifty (50) poor quality causative factors were obtained from literature. The questionnaire survey was distributed to randomly selected respondents from a combination of clients, consultants, contractors, site-engineers, project-managers and sub-contractors. In all, one hundred and forty one (141) questionnaires were distributed to randomly selected respondents (clients, consultants, contractors, site-engineers, project-managers and sub-contractors), one hundred and thirty two (132) questionnaires were returned out of which three (3) questionnaires were found incomplete and invalid. Only one hundred and twenty nine (129) questionnaires were found consistent and valid for use in this research. Relative Importance Index (RII) and Severity Index were used to carry out ranking analysis. Based on the data received, the most severe factors affecting project quality in Nigeria construction industries are: construction mistakes, use of inexperienced labours, poor checking and inspection, Poor motivation System (incentives), Poor management commitment and leadership styles, Unavailability of good quality construction materials, Limitation of finance and budget, Inadequate timely supervision among others. Their severity ranges from 89.4% to 80.5%.

Key words: building construction industry; Relative Importance Index (RII); construction mistakes; Poor motivation System and Limitation of finance

1. INTRODUCTION

The construction industry is very important in the socio-economic growth of a nation, as it improves the overall Gross Domestic product (GDP) of a nation. The successful completion of construction projects within the time frame, budget allocation and of expected quality and durability is therefore fundamentally crucial [2].

The construction industry like any other production industry is faced with challenges that affect the performance and output of the endeavor. Identifying potential critical factors that affect the quality performance of small scale contractors before the commencement of projects will ensure client satisfaction at the completion of project. Identifying the potential critical factors will however not eliminate the problem of quality but to a large extent help project team to avoid such negative factors and strictly adhere to project specifications to reduce errors which will call for re-work by consultants.

Completion of projects in time within the budget, and with desired quality is basic requirements which are seldom achieved in the construction industry. Construction industries in Nigeria are facing a lot of challenges in managing construction projects in areas of quality and budget management. In order to reduce cost and maximize profit, some contractors risk using inferior construction materials and incapable human resources which ultimately results in poor quality and thus compromise safety standards [14]. Failure in achieving required quality also has significant negative impact on project costs. Another problem faced by construction industry is poor quality standards. It is very common and serious problem as the expected quality is not complied in the construction projects [6]. Failure in achieving required quality has also significant impact of project cost. [7] stated that quality cost (non-conformance) in construction industry of USA contributed to 12% of total project cost. [5];[8] and [9] studying quality performance of construction projects through case studies showed that quality failures had resulted in rework which incurred extra cost approximately 2% to 12% of project cost while[11] stated that quality rectification problems contributed to approximately 3.4% to 6.2% of project cost.

A variety of authors have provided different categorizations of quality problems, but there have been few attempts to collect together and unify the major sources and factors that affect quality in a comprehensive manner. This research will identify the causative factors of poor quality under different groups. Identifying potential critical factors that affect the quality performance of small scale contractors before the commencement of projects will ensure client satisfaction at the completion of project. Identifying these critical factors may not eliminate the problem of quality but to a large extent help project team to avoid such negative factors and strictly adhere to project specifications to reduce construction mistakes and errors which can leads to re-work by consultants.

The research is aimed at determining the most severe factors influencing project quality for an efficient and effective project quality management in Nigeria.

construction industry. The specific objectives are to: identify the factors influencing project quality, group the factors and to rank the factors.

The scope of this research is limited to identification of the factors influencing project quality; and ranking of the most severe factors influencing quality of construction project. Relationship that exists between quality and other parameters such as: roles of project team (respondents); academic qualification; level of experience (in years); type of project; project funding; and past project challenges will be determined. The study is limited to projects within Nigeria, using Lagos, Abuja and Portharcourt metropolis of Nigeria as case study areas. Target respondents for this study are the principal actors in the construction industry namely: owner/client, consultant, contractor, site-engineers, project-managers, and sub-contractors. The study involved: collection of site reports on quality of projects on some large construction sites; data collection from the selected project sites with the aid of structured and unstructured questionnaires; personal interviews; analysis of data.

1.2 POOR QUALITY

Another problem faced by construction industry is poor quality standards. It is very common and serious problem as the expected quality is not complied in the construction projects [6]. Failure in achieving required quality has also significant impact of project cost. [7] stated that quality cost (non-conformance) in construction industry of USA contributed to 12% of total project cost. [5];[8] and [9] studying quality performance of construction projects through case studies showed that quality failures had resulted in rework which incurred extra cost approximately 2% to 12% of project cost while[11] stated that quality rectification problems contributed to approximately 3.4% to 6.2% of project cost.

 [3] identified among other factors; lack of management commitment to continual quality improvement; lack of quality training of staff; management leadership; efficient team work among stakeholders as generic factors that affect the quality process. [13] also identified lack of technical and professional expertise and resources to perform task, lack of employee commitment and understanding, lack of education and training to drive the improvement process when he studied the quality assurance practices of some selected construction firms in the Kumasi metropolis in Ghana.

Table 1: Quality Problems Factors

Lack of contractor supervision	(Arditi&Gunaydin, 1998; Wong & Fung, 1999)
Poor relationship and partnering among project participants	(Arditi&Gunaydin, 1998; Jha&lyer, 2006; Tang *et al.*, 2009)
Reduced Subcontractor responsibility	(Leonard, 2008; Pheng& Wei, 1996; Wong & Fung, 1999)
Inappropriate method of contractor selecting	(Arditi&Gunaydin, 1998; Pheng& Wei, 1996)
Poor quality procedure and department	(Chan & Tarn, 2000; Moody, 2005; Saraph, *et al.*, 1989)
Lack of auditing system	(Pheng& Wei, 1996; Samuels, 1994)
Poor Training system	(Arditi&Gunaydin, 1998)
Low quality continues improvement	(Joaquin *et al.*, 2008; Pheng& Wei, 1 996)
Lack of process improvement	(Pheng& Wei, 1996; Saraph, *et al.*, 1989)
Lack of Management commitment	(Hiyassat, 2000; Marosszeky, *et al.*, 2002; Yung & Yip, 2010)
Low effective project management system	(Anderson, 1992; Chan & Tarn, 2000; Yung & Yip, 2010)
Bureaucracy	(Marosszeky, *et al.*, 2002)
Supplier impact	(Arditi&Gunaydin, 1997; Wong & Fung, 1999)
Low quality drawing and specification	(Arditi&Gunaydin, 1998; Pheng& Wei, 1996)
Design complexity	(Chan & Tarn, 2000)
Poor performance of quality tools	(Arditi&Gunaydin, 1997; Leonard, 2008)
Difficult application of quality system	(Mohammed & Abdullah, 2006; Serpell, 1999)
Project size and complexity	(Chan & Tam, 2000; Jha&lyer, 2006)
Material/Equipment specification	(Hiyassat, 2000; Pheng& Wee, 2001)
Project Environment	(Chan & Tam, 2000)
Low quality and poor availability of resources	(Joaquin, *et al.*, 2008; Yung & Yip, 2010)
Lack of motivation	(Marosszeky, *et al.*, 2002; Pheng& Wee, 2001; Serpell, 1999)

Source: Adenuga, 2013

2. MATERIAL AND METHOD
2.1 STUDY AREAS
Three locations (study areas) were selected in Nigeria for this research. These are Abuja, Lagos and Portharcourt (as shown in Figure 1). The choice of locations was based on commercial viability, social status, economic considerations and area accessibility which provide opportunities for diverse industries like: construction, consulting, manufacturing, agriculture, telecom, marketing, legal, health and technological advancement.

Figure 1: Map of Nigeria showing study areas (Abuja, Lagos and Portharcourt)

2.2 DATA SOURCE

Questionnaires were administered to collect necessary data, descriptive analysis of respondents' characteristics, ranking and severity analysis, reliability statistics and Pearson correlation. A total of One hundred and twenty nine (129) experienced personnel involved in handling construction projects, responded to the questionnaires in Lagos, Abuja and Portharcourt, as a representative of the entire Nigeria construction sites.

This research methodology was carried out under literature review, interviews, questionnaires survey and secondary data collection. These methods acted as supplement to each other which made the data collection more comprehensive, meaningful and valid. Basically, the literature review focused on gaining a better understanding of quality performance and causative factors of quality non-conformance or substandard in construction projects. These factors were analyzed in conformance to represent the problems of quality in prevailing construction industries in Nigeria through administered questionnaire and interviewing experienced personnel involved in handling construction projects. This revealed the perception of owner/client, consultant, contractor, site-engineers, project-managers, and sub-contractors towards the factors causing cost overrun. Gathered data was ranked using Relative Importance Index (R.I.I) method and statistical tools in order to draw the conclusion in determining the current situation of project quality problem and factors contributing to these problems of quality.

2.3 POPULATION AND SAMPLE

The entire population size (N) and total representative sample (n) for this research was determined using simple random sampling (SRS) method. Simple random sampling is a method in which members or items of the population can only be selected one at a time for inclusion in the sample. The sample size **(n)** for each study area was calculated using:

n = n'/ [1+ (n'/N)]   (Mahmoud, 2012)[10]

Where:

N = total number of population

n = sample size from finite population

n' = sample size from infinite population = **S²/V²;**

where:

S² is the variance of the population elements and

V is a standard error of sampling population.

Usually **S** = 0.5 and **V** = 0.06; [4 &12].

2.4 RELATIVE IMPORTANCE INDEX AND SEVERITY

The Relative Important Index method (RII) was used to determine Respondent's perception of the relative importance of the identified influencing factors on quality in construction sites.

$$\text{Relative Important Index (R.I.I)} = \frac{\sum_{i=1}^{5}(a_i)(n_i)}{A \times N} \qquad (1)$$

$$\text{Relative Important Index (R.I.I)} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \qquad (2)$$

(0 ≤ R.I.I ≤1)

Where:

a_i   is Constant expressing weight given to *i*th response: *i* = **1,2,3,4,5**

n   is variable expressing frequency of *i*

N   is Total number of Respondents,

A   is Highest weight (as shown in Table 2, where A=5)

n_5   is Number of Respondent for very important

n_4   is Number of Respondent for Important

n_3   is Number of Respondent for Moderately important

n_2   is Number of Respondent for Not important

n_1   is Number of Respondent for Not very important

The item with the highest RII value was ranked first (1) the next (2) and so on.

Interpretation of the RII values is as follows:

      RII < 0.60, item is assessed to have low rating

      0.60 ≤ RII <0.80, item assessed to have high rating.

      RII ≥ 0.80, item assessed to have very high rating.

Table 2: Likert scale showing ranking and rating

Item	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Description	Not very Important	Not Important	Moderately Important	Important	Very Important
Scale	1	2	3	4	5

The Severity Index (I) was calculated to interpret the degree of severity effect of the identified factors influencing quality on building construction projects using Lagos, Abuja and Portharcourt as case study areas in Nigeria. The categorizations reflected the scale of the respondents answer to questionnaire. The severity index of a category was the average severity indexes of all its related factors.

This index was calculated as follows:

$$\textbf{Severity Index (I)} = \frac{\sum_{i=1}^{5}(a_i)(n_i)}{A \times N} \times \textbf{100}\% \qquad \textbf{(3)}$$

i.e. **Severity Index** $(I) = \textbf{R.I.I} \times \textbf{100}\%$ \qquad **(4)**

The severity index was categorized into five levels:

- 0-49% was categorized as none severe;
- 50-69% was categorized as fairly severe;
- 70-74% was categorized as moderately severe;
- 75-79% was categorized as severe; and
- 80-100% was categorized as most severe.

The most severe independent factors for project quality as the dependent variable under investigation were selected as most relative important factors influencing apportioned research objective.

3. RESULTS AND DISCUSSION

The results presented are characteristics of respondents to questionnaire distributed (Figure 2); descriptive analysis, ranking and severity analysis; reliability statistics; and correlation results.
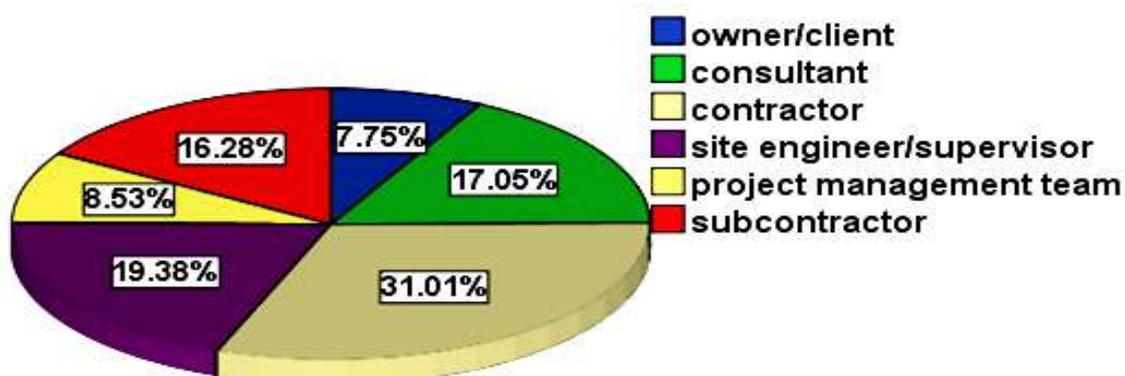
Figure 2: Pie Chart Representing Percentage of Respondents' Role

3.1   CHARACTERISTICS OF RESPONDENTS

Table 3: Questionnaire Distribution and Responses from the selected study areas

	Abuja	Lagos	Portharcourt	TOTAL
Number Distributed	48	60	33	141
Number of Responses	44	54	31	129
Percentage of Responses (%)	91.67	90.00	93.94	91.49

% Responses = (Number of responses/Number Distributed) X 100%

Table 4: Summary of Characteristics of Respondents

	Category	Classification	Frequency	Percent (%)
1.	Roles/Position of Respondents	Owners	10	7.75
		Consultant	22	17.05
		Contractor	40	31.01
		Site Engineer	25	19.38
		Project Manager	11	8.53
		Sub-contractor	21	16.28
		Total	129	100
2.	Respondents' Academic Qualification	O.N.D	0	0
		H.N.D	26	20.16
		B.Sc/B.Tech	40	31.01
		P.G.D	25	19.38
		M.Sc/M.Tech	32	24.81
		Ph.D	6	4.65
		Total	129	100
3.	Respondents' Level of Experience in Construction Project	1 year to 2 year	0	0
		2 year to 5 year	13	10.08
		5 year to 10 year	20	15.50
		10 year to 15 year	43	33.33
		15 year and above	53	41.09
		Total	129	100
4.	Respondent's Type of Project	Residential	9	6.98
		Non-Residential	51	39.53
		Public utility	19	14.73
		Civil works	18	13.95
		Commercial/ special trade	32	24.81

		Others that were not specified	0	0
		Total	129	100
5.	Type of Project Funding	Public	42	32.56
		Private	65	50.39
		Joint	22	17.05
		Total	129	100
6.	Respondent's Previous Project Challenges	Abandoned project (1)	41	31.78
		Delivered behind schedule (2)	52	40.31
		Experienced cost over-run (3)	31	24.03
		Reworked/berated (4)	5	3.88
		has no challenge	0	0
		no project experience	0	0
		Total	129	100

3.2   RANKING ANALYSIS (RELATIVE IMPORTANCE INDEX AND SEVERITY INDEX)

From Table 5, the most severe factors affecting project quality in Nigeria construction industries are: construction mistakes, use of inexperienced labours, poor checking and inspection, Poor motivation System (incentives), Poor management commitment and leadership styles, Unavailability of good quality construction materials, Limitation of finance and budget, Inadequate timely supervision among others. Their severity ranges from 89.4% to 80.5%.

Table 5: Factors Influencing Quality Arranged according to Ranking

FACTORS INFLUENCING QUALITY AFTER RANKED	ID	AVERAGE		SEVERITY (%)	RANK
		MEAN	RII		
Construction mistakes	QSY6	4.51	0.894	89.4	1
Use of inexperienced labours	QL1	4.42	0.884	88.4	2
poor checking and inspection	QSY4	4.35	0.875	87.5	3
Poor motivation System (incentives)	QL3	4.33	0.866	86.6	4
Poor management commitment and leadership styles	QS2	4.28	0.857	85.7	5
Unavailability of good quality construction materials.	QM2	4.25	0.851	85.1	6
Limitation of finance and budget.	QC6	4.25	0.85	85.0	7
Inadequate timely supervision	QS8	4.22	0.845	84.5	8
Lack of communications and interaction between parties	QS7	4.22	0.844	84.4	9
Incomplete preparation of working drawings and specifications.	QD4	4.21	0.842	84.2	10
Lack of quality control assurance system and feedback.	QSY1	4.18	0.835	83.5	11
Incompetence of Project manager	QS1	4.16	0.834	83.4	12
Improper material selection and usage in accordance with specifications in contract.	QM3	4.16	0.832	83.2	13
Poor management of material storage, distribution and usage.	QM5	4.11	0.827	82.7	14
Inadequate training courses for labours	QL4	4.11	0.823	82.3	15
Low Income level and wages of labours	QL2	4.11	0.821	82.1	16
Non-Conformance to codes and standards.	QD3	4.09	0.821	82.1	17
Unavailability of construction equipment.	QE1	4.08	0.816	81.6	18
poor safety and health risk program	QSY3	4.08	0.813	81.3	19
Poor compliance to specification, as identified in contract conditions.	QC3	4.06	0.81	81.0	20
Inadequate experience and incompetence of contractor.	QC5	4.05	0.805	80.5	21
Unavailability of right equipment or machine for construction.	QE5	4.03	0.788	78.8	22

Use of unskilled or inexperienced operators.	QE4	3.94	0.779	77.9	23
Non Implementation and lack of time schedule	QSY2	3.9	0.779	77.9	24
Lack of thorough supervision of sub-contractors.	QC4	3.89	0.772	77.2	25
Poor construction techniques.	QM6	3.86	0.768	76.8	26
Low experience and incompetence of supervisory staffs	QS3	3.82	0.764	76.4	27
Using computer software and management techniques	QSY5	3.81	0.755	75.5	28
Improper material checking and testing before usage.	QM1	3.77	0.746	74.6	29
Unclear owner's requirements for design.	QD2	3.70	0.74	74.0	30
Inadequate Experience and knowledge of designers.	QD1	3.69	0.738	73.8	31
High cost of construction materials	QM4	3.69	0.737	73.7	32
Improper individual task allocation	QC2	3.66	0.732	73.2	33
Written contract condition with unclear specifications	QO4	3.54	0.709	70.9	34
Inadequate emphasis on quality	QO3	3.53	0.708	70.8	35
Use of Arbitrary designs.	QD6	3.25	0.649	64.9	43
Poor coordination between designer and owners during construction	QO5	3.10	0.62	62.0	44
Incessant Change of orders	QO6	3.06	0.612	61.2	45
Over-utilization of workers	QS6	2.85	0.571	57.1	46
Delay in decision making	QO2	2.83	0.567	56.7	47
Delay of interim payments	QO7	2.75	0.55	55.0	48
Disagreement between supervision and contractor staff	QS10	2.61	0.522	52.2	49
Lack of training for quality control staff	QS9	2.52	0.504	50.4	50

Table 6: Inter-Item Correlation Matrix

		Q1	Q2	Q3	Q4	Q5	Q6	QF
Pearson correlation	Q1	1.000	0.39	0.62	0.74	0.16	0.35	0.42
	Q2	0.39	1.000	0.31	0.15	0.09	0.43	0.89
	Q3	0.62	0.31	1.000	0.24	0.20	0.94	0.912
	Q4	0.74	0.15	0.24	1.000	0.91	0.78	0.42
	Q5	0.16	0.09	0.20	0.91	1.000	0.19	0.83
	Q6	0.35	0.43	0.94	0.78	0.19	1.000	0.60
	QF	0.42	0.89	0.912	0.42	0.83	0.60	1.000
		Q1	Q2	Q3	Q4	Q5	Q6	QF
Sig. (1-tailed)	Q1	.	.000	.000	.000	.000	.001	.000
	Q2	.000	.	.000	.002	.000	.000	.000
	Q3	.000	.000	.	.000	1.223E-5	.000	.000
	Q4	.000	.002	.000	.	.000	.000	.000
	Q5	.000	.000	1.223E-5	.000	.	.000	.000
	Q6	.001	.000	.000	.000	.000	.	8.529E-5
	QF	.000	.000	.000	.000	.000	8.529E-5	.
N	**129**							

Where:

Q1 = Roles of project team (respondents); Q2= Academic qualification; Q3= Level of experience (in years); Q4= Type of project; Q5= Project funding; Q6= Past project challenges; QF= Quality-factor.

4. CONCLUSION

From the study, it was concluded that the most severe factors affecting project quality in Nigeria construction industries are: construction mistakes, use of inexperienced labours, poor checking and inspection, Poor motivation System (incentives), Poor management commitment and leadership styles, Unavailability of good quality construction materials, Limitation of finance and budget, Inadequate timely supervision among others. Their severity ranges from 89.4% to 80.5%. According to the respondents, construction mistakes and use of inexperience personnel was viewed to be the major reason for poor or below standard quality in the Nigeria construction industry.

5. ACKNOWLEDGEMENTS

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