



Perception of Professionals on Quality Control Factors in Project Constructions

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Abstract - Adherence to the quality control in project construction is the key focus for sustainability and quality job. This paper presents the views of professionals in identifying and evaluating the factors constituting the quality control in project constructions and to suggest possible ways of reducing the effect on project works to the bearest minimum. Using various variables from relevant literature as the basis, data were obtained through the use of questionnaire administered to engineers, architects, builders and quantity surveyors. A 100 structured questionnaire was distributed and used to collect data amongst professional stakeholders. The Ranking Average (RA) and Relative Importance Index (RII) approach were used for the analysis. The critical factors identified are technical and operational abilities of personnel during supervision, provision of adequate resources, and project conformance to specification. The study showed that most pressing factor affecting the quality control in constructions is the technical and operational abilities of personnel during supervision, with a RII value of 0.89 (very high rating); while the effect of weather condition has the least value of RII as 0.67 (low rating).

Keywords: Construction, Professionals, Project works, Quality control, Specification.

1. Introduction

Construction projects are extremely complex process, involving wide range of activities with many factors affecting the quality of construction such as design, material, machinery, topography, geology, hydrology, meteorology, construction technology, method of operation, technical measure, management system, and so on. According to Ying (2010), quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the business. It can be said that if there is no quality control, there is no economic benefit. He also stressed that, quality control is a process employed to ensure a certain level of quality in a product or service. The basic goal of quality control is to ensure that the products, services, or processes provided meet specific requirements and are dependable, satisfactory, and fiscally sound.

Failure to investigate the quality of materials and workmanship in Nigeria building industry will continue to cause building collapse. Teena (2014) identified some factors affecting the quality control in project construction as; conformance to codes and standards, selection of contractor, top management support, financial issue, material, labour, equipment, management factor, method of execution, selection of designer, lack of communication, co-operation of parties, design, and contract document. However, Jha and Iyer (2006) identified the factors affecting the quality performance in construction projects which helps to suggest possible measures for improving the project quality. Questionnaire survey was carried out and the data collected were from large construction industries. From the study, the critical success factors obtained were: project manager's competence; support of the management; as well as monitoring and feedback by project personnel.

The factors that adversely affected the quality performance of projects were: conflict among project participants, hostile socio-economic environment, harsh climatic condition, PM's ignorance and lack of knowledge, faulty project conceptualization, and aggressive competition during tendering. Adnan *et al.* (2009) stressed that the top significant factors affecting the performance of construction projects include;

material price increase, inadequate resources as planned through the project duration, average delay because of closures leading to materials shortage, inadequate personnel with minimum experience and qualification, quality of equipments and raw materials in project and leadership skills from the project manager.

The perception of registered professionals in the building industry (quantity surveyors, engineers and architects) did not go unnoticed. Their views on the pressing factors influencing the quality of project work was analysed with the help of questionnaire survey. According to Lukumon *et al.*, (2003), a total of 180 experienced Nigerian consultants comprising sixty each of architects, engineers and quantity surveyors were questioned with the help of questionnaire survey. A total number of 41 Architects, 37 Engineers and 29 Quantity surveyors responded and their corresponding data were analysed. Poor level of commitment among design professionals, insufficient and unrealistic constraints of project cost and inadequate technical knowledge are the three severe factors ranked within the first five common factors to all professionals.

From the analysis of the data received, the degree of correlation among consultants showed that there was strong relationship between architects and quantity surveyors (0.75), and a low relationship between architects and engineers (0.21) and (0.24) for engineers and quantity surveyors. The Percentage rank agreement factor (PRAF) showed that the five most important factors affecting quality are design changes (78.9%), inadequate involvement of other professionals during design stage (78.9%), insufficient and unrealistic constraints of project cost (71.1%), poor level of commitment to quality improvement among design professionals (63.2%), and making design decisions on cost and not value of work (55.3%).

Tengan *et al.*, (2014) identified and evaluated the critical factors influencing the quality performance of small scale contractors by ranking; according to their relative importance and recommended measures to reduce its significance on project outcome. Sixty-nine (69) questionnaires were self-administered to professional staff including architects, quantity surveyors and engineers, engaged by small scale contractors (SSCs). The study identified three critical consultants' related factors as fraudulent practices and kickbacks, poor monitoring and feedback and lack of coordination between designers and contractors; which affect the quality performance of small-scale contractors; with relative importance index (RII) of 1.0245, 0.9945 and 0.9645 respectively. In addition, lack of quality trained staff, lack of management leadership and lack of experience of contractors were all identified as contractors' related factors; with relative importance index (RII) of 1.3043, 1.1644 and 1.1344 respectively.

Ayodeji *et al.*, (2017) also stressed that the major factors influencing quality of construction projects are the use of unskilled, untrained and inexperience trade subcontractors, sub-suppliers, consultants and work force with little or no skills and knowledge. It was also stated that poor site visitation as a result of lack of commitment by teams and individuals shouldered with the responsibilities of monitoring and ensuring that construction projects are delivered to required and approved standard; Lack of communication among project stakeholders especially amongst design team due to ignorance and lack of knowledge may result to poor planning and scheduling of construction resources such as material, plant, labour and time.

Lukumon *et al.*, (2015) identified and studied some factors from literature by means of questionnaire. The questionnaire survey was distributed to construction industries professionals who include architects, engineers, quantity surveyors and builders. The importance of each factor was computed for all the professionals through the severity and frequency responses of the factors. Data analysis included ranking comparison among the professionals using severity, frequency and importance indexes. Percentage rank agreement factor (PRAF) was used to measure agreement of the importance ranking among construction professionals and one sample t-test was conducted to determine the significance of each factor, and also used correlation analysis to measure the degree of correlation among all professionals. However, the results showed that the five most important factors are; poor quality of materials delivered to site, low level of skill and labour experience, poor inspection and testing, poor site installation procedure, and lack of quality assurance. From the analysis, the one sample t-test showed that 79% are important factors influencing construction quality in Nigeria. The results also showed that there was strong agreement between architects and engineers with (PRAF) of 0.71, architects and builders having 0.73, and that of engineers and builders with 0.75; whilst the level of agreement was low with (PRAF) values of 0.43, 0.36 and 0.38 between architects and quantity surveyors, engineers and quantity surveyors, and builders and

quantity surveyors respectively. Finally, it was concluded that determining the construction industry professionals' viewpoints on factors affecting construction quality is therefore an essential step towards establishing methods and processes for real improvement of quality construction work in Nigeria and probably most other African countries that are similar in nature.

Abdulkareem and Adeoti (2011) also cited some factors affecting quality control in construction industries as: lack of adequate budgetary, insufficient quality control laboratories, modern equipments and man power, and inadequate awareness of quality control at the inception of projects. Also, Longtau *et al*, (2016) identified some factors affecting quality control as: corruption, inadequate regulatory framework, quackery, lack of sanctions for offenders, and inadequate budgetary allocation. Essentially, quality control involves the examination of a product, service, or process for certain minimum levels of quality. Lakshmi (2015) stated that monitoring specific project results in terms of quality control help to determine if these results comply with relevant quality standards which will however provide ways of eliminating the cause of unsatisfied performance. According to Frank and Ronald (2013), quality assurance requires systematic preventive activities to ensure final products or services due to the design of business process of production which meet customers' expectation. Thus, quality assurance is done by set of activities before the manufacturing process of product and service in order to control quality at the entire stage of production. It is necessary to provide confidence of organization outputs to maintain close link with customers. ISO 9000 series is a framework for improving quality in construction industry (Kumaraswamy and Dissanayaka 2000).

2. Materials and Methods

Analysis made from the literature was instrumental in gathering notable factors affecting the quality control in project constructions. The adopted approach for the collection of primary data was characterized with structured questionnaires in order to ensure effectiveness of this research. A total of 100 questionnaires were majorly distributed to engineers, architect, builders and quantity surveyors, who are professional stakeholders in the construction industries; out of which 82 were retrieved representing 82%. This was categorized into two sections: Section 1 comprises the demography of the respondents; showing their gender, year of experience, level of education, profession, and professional certification, whilst section 2 consists of a list of 18 factors identified from the literature which serves as secondary data. This section was based on a five response options of Strongly Agree, Agree, Indifferent, Disagree and Strongly Disagree.

Data Analysis

Data analysis is a useful stage where the data collected are used in determining reliable information to achieving the research objectives. There are many methods used in analyzing data. These include; reliability of data obtained to test the internal consistency of the scale used for measuring the factors, comparison of ranking among consultants using severity, frequency and importance indexes, correlation analysis to measure degree of correlation among all consultants and Percentage rank agreement factor (PRAF) to measure the agreement in the importance ranking among the consultants.

In this research, Ranking Average (RA) and Relative Important Index (RII) were used for the analysis because they measure the centre of a numerical data set, and take into account the size of the population and relative disadvantage experienced by different groups. The analysis focuses on transferring the questionnaires and filling the gaps between all variables. The five-point likert's scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) was adopted. The data analyses used are as follows:

- a) **Ranking Average:** The ranking average for each answer choice was used as follows, to determine which answer choice was most preferred overall. The answer choice with the largest ranking average is the most preferred choice.

$$\text{Ranking Average, RA} = \frac{\sum xw}{N} \quad (1)$$

where: w = weight of ranked position (1, 2, 3, 4 and 5).
 x = response count for answer choice
 N = total number of respondents

- b) **Relative Importance Index:** The relative importance index for each factor constituting the quality control in project constructions was calculated as follows:

$$\text{Relative Importance Index, RII} = \frac{\sum xw}{N} \times \frac{1}{A} \quad (2)$$

where: A= the largest weight (i.e. 5, in this case)

- c) **Ranking:** Ranking of the factors under consideration based on their RII values were evaluated. The order of the factors with highest RII value was ranked 1, 2, 3, e.t.c.

The results of the RII values were interpreted using the ratings adopted by Mbimali and Okotie (2012); which stated that if $\text{RII} \leq 0.60$, the result is assessed as ‘low rating’; when $0.60 \leq \text{RII} \leq 0.8$, it is considered as ‘high rating’, and when $\text{RII} \geq 0.80$, it is assessed as ‘very high rating’.

3. Results and Discussions

Table 1 Distribution of respondents by gender

	Gender	Frequency	Valid percent
Valid	Male	72	88
	Female	10	12
Total		82	100

Source: Field Survey, (2016)

A representation of gender in population of the 82 respondents shows that 72 were male representing 88% and 10 were female representing 12% as shown in Table 1.

Table 2 Years of working experience

	Work Experience	Frequency	Valid Percent
Valid	1 – 5	20	24
	6 – 10	28	34
	11 – 15	14	17
	16 – 20	12	15
	21 and above	8	10
Total		82	100

Source: Field Survey, (2016)

The frequency table for work experience (Table 2) shows the different range of work experience amongst the respondents (professionals). The table indicates that 28 is the highest number of respondents having working experience ranging from 6-10 representing 34%; and 8 respondents is least with working experience above 20 years representing 10%.

Table 3 Academic qualification of respondents

	Level of Education	Frequency	Valid Percent
Valid	HND	14	17
	BSc.	22	27
	Masters	40	49
	PhD	2	2
	Others	4	5
Total		82	100

Source: Field Survey, (2016)

Table 3 shows the academic qualifications of the respondents. The table indicates that 40 is the highest number of respondents with Masters Degree (49%) while only two respondents are PhD holders.

Table 4 Professional certification

	Professional Certification	Frequency	Valid percent
Valid	Registered	62	76
	Non registered	20	24
Total		82	100

Source: Field Survey, (2016)

Table 4 shows that 76% are registered members while 24% are not yet registered. This means that the respondents are capable of providing the much desired perception to achieving the aim of this research.

Table 5 Quality control factors in project constructions

S/N	Factors	No. of Respondents					N	Σxw	RA	RII	Rank
		1	2	3	4	5					
1	resources Provision of adequate (cash, time) for the project	4	4	4	34	36	82	340	4.15	0.83	2
2	Detailed description of designs and materials during construction	10	4	4	24	40	82	326	3.98	0.80	8
3	Increment in raw material costs	4	8	10	48	12	82	302	3.68	0.74	12
4	Responsibility of the procurement department in assuring the quality of purchased materials	8	12	4	30	28	82	304	3.71	0.74	12
5	Verification of relevant standards used during construction	2	10	8	20	42	82	336	4.10	0.82	5
6	State of the atmosphere	2	16	20	38	6	82	276	3.37	0.67	18

7	Sustained increase in the general price level of construction materials, labour etc.	6	10	18	34	14	82	286	3.49	0.70	17
8	Communication gap amongst individuals involved during construction	2	22	6	26	26	82	298	3.63	0.73	15
9	Political influence in the course of the project	8	6	10	28	30	82	312	3.80	0.76	11
10	Inadequate and quality of materials and equipments	6	8	2	26	40	82	332	4.05	0.81	6
11	Technical and operational abilities of personnel during supervision	0	2	0	40	40	82	364	4.44	0.89	1
12	Proper documentation of the entire project	2	6	8	40	26	82	328	4.00	0.80	8
13	Creating a good environment	4	12	8	38	20	82	304	3.71	0.74	12
14	Functioning management	2	6	2	46	26	82	334	4.07	0.81	6
15	Level of quality training amongst employees	2	6	2	38	34	82	342	4.17	0.83	2
16	Compatibility between the standard provided by different firms	4	12	12	44	10	82	290	3.54	0.71	16
17	Conformance to specification	0	6	8	34	34	82	342	4.17	0.83	2
18	Provision of incentives	0	12	10	38	22	82	316	3.85	0.77	10

Source: Field Survey, (2016)

Key: 1- Strongly Disagree, 2- Disagree, 3- Indifferent, 4- Agree, 5- Strongly Agree

Table 5 shows that four (4) pressing factors contributing to the quality control in project constructions were identified. These include: technical and operational abilities of personnel during supervision, which was ranked 1, with a Ranking Average (RA) and Relative Importance Index (RII) values of 4.44 and 0.89 respectively, whilst provision of adequate resources, level of quality training amongst employees, and project conformance to specification were all ranked 2, with (RA) and (RII) values of 4.15, 4.17, 4.17 and 0.83, 0.83, 0.83 respectively. The RII values of the identified factors listed above were classified as very high rating (Mbmali and Okotie, 2012). In view of this; Adenuga (2013) observed that under the compliance of quality control measures, materials selection and usage was ranked 1st, whilst inspection and testing of executed works as well as both the use of code of conduct and construction process adopted were ranked 2nd and 3rd respectively; with Mean Item Score (MIS) of 4.30, 4.20 and 4.15 respectively. Also, he stressed that under the identification of factors affecting quality project delivery, poor communication of design requirements by clients and poor labour skills and supervision were ranked 1st and 2nd with corresponding (MIS) of 4.40 and 4.30 respectively. Fig. 1 presents the quality control factors with respect to their ranking average and relative importance index.

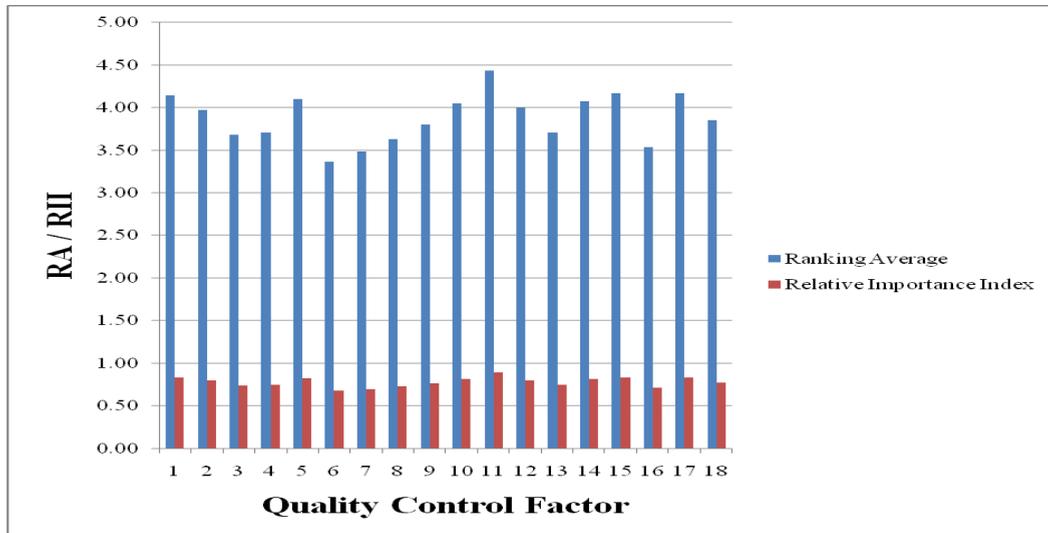


Fig.1 Chart representation showing the ranking average / relative importance index and quality control factors

4. Conclusion and Recommendations

It is necessary to pay adequate attention to various factors that have been affecting quality control of construction projects so as to attain an improved productivity. From the findings above, the major factors influencing quality control of construction projects are technical and operational abilities of personnel during supervision, provision of adequate resources, level of quality training amongst employees, project conformance to specification, verification of relevant standards used during construction, inadequate and quality of materials and equipments, as well as functioning management. This shows that all the critical factors affecting quality control in project constructions are basically the shortcomings of the personnel involved; this therefore can be controlled if adequate system is put in place for verifying and maintaining a desired level of quality in an existing project by careful planning, use of proper equipment, continued inspection, and corrective action as required. However, the condition of atmosphere and sustained increase in the general price level of construction materials and labour are least ranked.

However, there is need to make authorized bodies enforce the quality control clause(s) before the commencement of every project; project managers should strictly enforce relevant specification of materials and designs; and adequate budgetary provision for quality control at every stage of the project. Therefore, relevant laboratory tests on materials should strictly be adhered to; regulatory bodies in the construction industries should be involved in quality control monitoring on projects under construction; communication between the project manager and site workers should be highly encouraged where all site workers are enlightened comprehensively on the significance of quality control and the effects on constructions.

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