Evaluation of Quality Assessment System for Building Contractors in Lagos, Nigeria[1]

Ngozi Marykate Okoye[1], Kevin Chuks Okolie[1], Nathan Ndubisi Agu[2]

1. Department of Building, Nnamdi Azikiwe University
2. Department of Quantity Surveying, Nnamdi Azikiwe University
Awka, Anambra State, Nigeria

ABSTRACT

This study assesses the quality systems for building contractors in Lagos with the aim of developing guidelines for a quality assessment system that can be applied by any building contractor in Lagos state Nigeria. In order to achieve this aim, the study looked at the quality systems that are currently in place, and their impact on the contractors' performance. Quantitative data were obtained from senior managers, project managers, engineers, architects, quantity surveyors, and technical managers working with building construction companies in the Lagos Metropolitan Area using the mixed method approach. Descriptive case study was adopted while one sample student's t-test and principal component analysis techniques were employed. Findings indicate that the major quality assessment method used by Lagos contractors in construction industry is the observation/physical inspections method. The findings also provided that this quality assessment method has a significant positive impact on project delivery in the area. Based on these findings, it was recommended among others that the Lagos QAS should emphasize the use of objective and statistical quality assessment approaches. They should also encourage the integration of information technology in the quality assessment process.

Keywords: Quality Systems, Building Contractor, Quality Assessment

1. INTRODUCTION

Development of an effective quality assessment system for a given industry begins with the identification of quality indicators relevant to the industry. The construction industry is one of the significant pillars in Lagos economy. In recent years, this industry has been characterized with a myriad of problems including low levels of customer satisfaction, increased competition, and heightened safety concerns. In order to overcome these challenges and increase performance, building contractors need to change how they manage quality.

The construction industry contributes 1% employment opportunities to Nigerians (Ding, 2008). According to the World Bank, an active industry should contribute at least 3.2% of the employment opportunities in the country (Elinwa& Joshua, 2001). According to Idiake, Shittu, Anunobi, &Akanmu, (2015), the construction industry in Nigeria can create more jobs if it

[1] How to cite this paper: Okoye, N.M., Okolie, K.C., Agu, N.N. (2019). Evaluation of Quality Assessment System for Building Contractors in Lagos, Nigeria; *PM World Journal*, Vol. VIII, Issue VIII, September.

upholds quality. Despite overall growth and good performance, Shittu, Idiake, and Akanmu, (2015) observed that the last decade was characterized by declining level of clients' satisfaction with the built facilities due to perceived poor quality. In addition to quality, other major problems affecting the clients' perception and overall performance of the industry include time and cost overruns (Oladinrin& Ho, 2015).

In this regard, it is imperative for leaders in the construction industry in Nigeria, including financiers of construction projects and government agencies responsible for overseeing and monitoring these projects to introduce radical change in industry practice in order to guarantee quality (Rashvand, Majid& Pinto, 2015). This can be done through the development of a quality evaluation methodology to analyze, gauge and rate the performance of different contractors.

Quality assurance in the industry should also include consideration for cost and time implication. Quality practices not only focus on producing quality buildings in terms of aesthetics, durability and functionality, it also focuses on reducing the cost and time implications of the completed project. Utilization of new and improved technology can help contractors provide quality services at reduced costs and using shorter time spans (Zeng, Tam, & Tam, 2015). For instance, the use of prefabricated segments in construction has been shown to reduce significantly the time and cost implications of a construction project. Crucial to delivering quality in construction projects is engaging in quality planning. With reliable quality and planning, the construction industry would not only expand, it would survive social change and become the key economic driver well into the future.

To date, numerous buildings including residential houses have collapsed, killing many people and injuring scores to others. The damages caused by collapsing buildings differ from time to time. For instance, on September 12, 2014, a six-storey guesthouse at the Synagogue Church of All Nations in Lagos State collapsed, killing 115 and injuring 131, and sparking a national dialogue on building safety (Babatunde, Perera, Zhou &Udeaja, 2015). Incidents of collapsed buildings are common in Nigeria with most cases being reported in Lagos. Between 2007 and 2012, national statistics indicate that there were 130 cases of collapsed buildings in Lagos State while nationwide, more than 135 buildings were reported to have collapsed in the year 2013. This high rate of building collapses can be attributed to poor workmanship and utilization of poor quality materials. Hence, Wahab and Lawal (2011) noted that, although the construction industry in Nigeria is well developed and continues to mature, there is no reliable standard quality assessment system.

More so, most contractors use substandard construction implements and materials, and this reduces the quality of buildings while at the same time increasing the time it takes to finish such projects (Kam and Abdul Hamid, 2015). Previous researchers also observed that the construction industry in Nigeria suffers from lack of local skilled labourers, power shortages and unavailability of reliable and quality building materials and this affects significantly the quality of facilities (Oyedele et al., 2015). Consequent upon these, the study is set out to develop a quality assessment system for building contractors in Lagos State Nigeria, so as to improve the performance of their building construction projects in the area.

2. REVIEW OF RELATED LITERATURE

2.1 Various Methods of Quality Assessment in the Construction Industry

Quality assessment cannot be effective without the application of reliable and valid methods of data collection and analysis. Quality assessment methods used in the construction industry can be divided into; statistical methods, visual methods, and feedback/ questioning methods.

Statistical methods

The statistical methods are focused on the use of quantitative data and approaches of analysis (Mancill& Thompson, 2012). They have high degree of accuracy because they tend to eliminate bias. They are also more thorough as statistical techniques are used to analyze data. However, these methods require more time, money, and technical skills to implement.

Work sampling is one of the statistical techniques that are widely used to measure performance. The technique entails evaluating the amount of productive, non-productive, and supportive time that workers spent in the workstation (Kumar, Kumar, Myneni, &Charan, 2014). According to Pradeepkumar and Loganathan (2015), work sampling is an observational technique where the observer walks through the job site and record information regarding the work in progress. The technique considers each individual worker as a sample and requires the observer to document what the worker is doing based on predetermined work categories. The observation tours are usually random and may being at any point in the work site so as to make it difficult for workers to anticipate.

The observation goes on for several days until the right number of samples is obtained (Goso&Imoto, 2011). A large number of observations are usually required to provide an accurate view of the productivity of the workforce. This technique helps to establish labor productivity and trends that affect it. Orth, Welty, and Jenkins (2006) argue that work sampling is a valuable tool in the construction setting because labor productivity has a major impact on projects' completion time and costs. A significant advantage of this technique is that it measures the work process rather than outcome; hence, it can lead to improvements that have an immediate impact on performance. Work sampling also require relatively little time than other types of studies.

In their study, exploring labour management techniques used by building contractors in the Zimbabwe construction industry, Moyo, Mangore, and Chigara (2014) found work sampling technique was utilized in 10% of the surveyed companies. Results also revealed that projects that used a combination of work sampling, time study, and estimating technique had no time overran concerns. Kumar, Kumar, Myneni, and Charan (2014) also found that work sampling is widely applied in the Indian construction industry to measure performance of direct work.

The study by Pradeepkumar and Loganathan (2015) demonstrated the applicability of the work sampling technique in the construction industry. In this study, the researchers applied the technique on a construction projects resulting in generation of useful information regarding the productivity of the workforce. Data collected during the observation established that labor productivity at the site was above average and that nonproductive time was 36%. The authors attribute the nonproductive time to inadequate supervision since it was observed that the supervisors stayed on the site for a short amount of time each day.

On the other hand, Goso and Imoto (2011) found that the work sampling was not widely applied in the Japanese construction industry due to absence of inventory of personal data in most organizations. They noted that an inventory of personnel data is essential in work sampling as it enables managers to track improvement in labor productivity. To solve the inventory problem, the study recommended the automation of labor productivity assessment. In their study, Josephson and Bjorkman (2013) found that work sampling is of little value in assessing productivity and analyzing performances of construction projects over time because of extreme variation in the conditions of the project.

Visual Methods of Quality Assessment

Visual assessment methods refer to a wide range of methods that rely on physical observation to judge the quality of materials, on-going work, or product (Mancill& Thompson, 2012). One of the most common methods of visual assessment is physical inspection. Visual assessments are common in the construction industry because they are cheaper and faster to perform and facilitate immediate generation of usable information. Visual assessments can be used to evaluate materials, processes, and products/ outcomes. However, these assessments are highly subjective as judgment is made based on the assessor's competence, experiences, taste, and preferences. Their application is also limited as the can only provide information regarding surface flaws.

Although it is not possible to completely eliminate bias, visual methods can be made more impartial by developing elaborate scoring systems that detail items that should be rated and procedure for developing estimates (Mancill& Thompson, 2012). Other factors that influence the effectiveness of observational methods include the viewing distance, view duration, view activities, and planning (Hojat&Sina, 2014). The visual methods can also be enhanced by develop a clear decision-making criteria to help the assessor determine the rating of each quality attribute.

Feedback/ Questioning Methods

Questioning is also a common method of assessing quality in the construction industry. This method entails asking different stakeholders to provide their views concerning specific quality issues either through interviews or questionnaires (Harrison, 2005). Today, many standardized questionnaires for assessing quality of buildings and construction projects have been developed. The Construction Owners Association of America (COAA) Questionnaire and the Building Quality Assessment (BQA) are excellent examples of such tools (Lam et al., 2006). It is also a common practice for contractor to conductor formal and informal interviews with the aim of obtaining stakeholders views regarding the quality of their processes or product.

Questionnaires are often preferred because they facilitate collection of large amount of data within a short duration and at lower cost (Akbayrak, 2000). However, interviews also have their own advantages such as increased flexibility where the assessor can ask follow-up questions and seek clarification where responses are not clear (Alshenqeeti, 2014). Questioning methods are appropriate in assessing project processes, capturing quality attributes that differ from one individual to another, and examining dynamic issues. A significant disadvantage of the two methods of assessment is that there are prone to distortion of data. The respondents may not provide an accurate position of the actual situation due to several issues such as attribution,

distorted memory, and exaggeration (Lam et al., 2006). These methods may also raise reliability issues where questions are understood differently by different respondents.

Use of Records

Another method of assessment entails the use of records. Construction projects often have a lot of documentations (Mancill& Thompson, 2012). Some documentation can provide valuable data regarding materials, processes, and practices of the constructors. For instance, procurement records and reports can provide essential information about the quality of the materials used. Documents such as the punch list, daily activity logs, project reports, daily construction reports, and track project logs can help provide valuable information regarding the quality of workmanships (Hojat&Sina, 2014). A major advantage of using records is that they provide an objective means of verifying performance. However, the use of records can be a cumbersome and time-consuming way of assessing quality given that a given project may generates tens if not hundreds of documents. Documents are also secondary source of information; hence, the assessor cannot be absolutely certain about their accuracy.

Automated Methods

Automated methods of assessments rely on computerized tools and techniques to collect and/or analyze quality data. Today, many mechanical techniques of analysis have been developed including the use of sensors, SD laser can measurement, thermal imaging analysis, mobile robots, and infrared thermography (Liu et al., 2016). Sensors are often installed on strategic areas such as walls and floors to help collected variable data such as vibrations, sound, and heat that would help detect flaws (Abdelrazig, Chang, &Skibniewski, 1999). For instance, a sensor can help detect structural flaw such as development of cracks by detecting sounds and vibrations that are difficult for humans to perceive.

Digital imaging technologies such as SD laser and infrared thermography are often used to scan surfaces and generate data regarding their quality. Assessors can also use it to observe underlying structures such as steel reinforcement (Kalyan et al., 2016). They can also facilitate the generation of data such as thickness of floors, evenness of surfaces, verticality of walls, and hollowness of the ground (Kayan, 2016). Mechanical methods have several advantages such as high level of accuracy and multiple functionalities. However, these methods are quite expensive and the technologies involved are not readily accessible to small constructors.

2.2 Empirical Literature

There is increased desire to improve the performance of construction industry in Nigeria and increase the level of stakeholder satisfaction. Obunwo, Chinyio, and Suresh (2013) asserted quality management is one of the key requirements that the Lagos construction industry may satisfy in order to improve performance. Their study noted quality assessment in the Lagos context was hindered by a myriad of factors including lack of proper project definition, limited project responsibility, inadequate information management, risks, and lack of team work.

The importance of quality to the Lagos construction industry was confirmed in the study by Obunwo, Chinyio, and Suresh (2015), where it was found that attributes of project quality had a

significant effect on level of customer satisfaction. In this study, the researcher regressed aspects of quality such as reliability and performance and customer satisfaction indicators such re-patronage and referral. Results showed that project quality attributes explained 58.3% of variation in the level of customer satisfaction. Project performance, which was one of the quality attributes that were tested, was found to have the most significant effect on re-patronage while project aesthetics had the most substantial impact on contractor referral.

The study by Idoro (2009) compared the level of patronage in local construction firm with expatriate-owned firms. Results revealed that foreign contractors were being preferred over local Lagos contractors due to the perception that the former have better quality performance. The study recommended that local contractors should initiate programs and develop system that would enhance actual and perceived quality of their performance so as they can be able to compete with the foreign contractors. Iboronke (2012) also found that noncompliance with cost, time, and quality management procedures in the Lagos construction industry has resulted multiple cases of building collapse, high cost of construction, and loss of public confidence. On the other hand, Adafin, Daramola, and Ayodele (2010) found that contractors that were aware of material control practices and implemented the associated strategies had high level of timely project completion and delivery of work within reasonable cost and quality. This study also highlights the value of quality and quality management to the construction industry in Nigeria.

In their study, Odusami, Bello, and Williams (2014) ascertained that quality performance in the Lagos construction business was at best relatively important to companies with small scale companies indicating the quality was a less important factor. These findings suggest a lack of commitment on the part of industry players when it comes to the management of quality. Dosumu and Adenuga (2013) found that errors in the Lagos construction industry had major impacts include delays in project completion, expensive rework, and project abandonment. The study linked these errors to a number of factors including changes to specifications, negligence, poor communication, and inadequate documentation.

The study by Oyedele, Jaiyeoba, and Fadeyi (2003) examined design factors that influence the quality of projects in Nigeria. Data was collected from 107 consultants, and analysed using frequency and importance indexes and percentage rank agreement factor. Results showed that design change, insufficient and unrealistic project cost, inadequate involvement of other professional in the design stage, making decision based on cost rather than value of work, and little commitment to quality improvement were the five most significant factors affecting quality of construction designs.

Bello, Soyingbe, and Akinwamide (2012) examined the implementation of quality culture in the Lagos construction industry. They noted that a strong quality culture is a vital prerequisite to the delivery of excellent product and services. Results revealed that the quality culture has not been fully implemented in the Lagos context. Although elements such as leadership and top management commitment were presents other vital component such communication, supplier partnership, and customer focus were not widely practiced.

In another study, Oyedele, Jaiyeoba, Kadiri, Folagbade, Tijani, and Salami (2015) examined pertinent factors affecting the quality of construction in Nigeria. The study revealed that the most

significant factor influencing quality include poor inspection and testing, low level of skill and experience in workforce, poor quality of materials, inadequate quality assurance, and poor site installation procedure. Opoko, Ezema, and Ediae (2014) used qualitative methods to examine the degree to which quality control procedures are applied in the production and use of alternative building materials. The authors noted that there is a widespread adoption of alternative building materials such as interlocking blocks in the Lagos construction context in the effort to reduce costs. The study disclosed low level of implementation of quality control measures in the production of the alternative building materials due to time constraints, lack of manuals, non-optimal equipment performance, insufficient training, and low education and motivation among staff.

Empirical evidence shows limited application of proven quality management systems in the Lagos building construction context. In their study, Okpachui, Effiong, Oko, and Ozor (2010) examined the extent to which Lagos organization have implemented TQM. Findings revealed that although contractors had a high level of TAM awareness, the application of this philosophy was low. Adenuga (2013) also found that there were inadequate quality assurance practices in public housing projects in Lagos. Results showed that the objectives of quality assurance were often compromised due to heavy reliance on individual contribution from designers, subcontractors and suppliers, and contractor in the implementation of quality assurance mechanisms. The researcher recommended the development of a coordinated framework for implementing quality assurance.

In another study, Shehu and Ijego (2014) found that professionals in the Lagos construction industry have limited awareness of quality control and assurance mechanisms in building construction management. Consequently, there is low application of quality assurance and control measured in the production process. The study revealed that most contractors do not conduct spot inspection of on-going projects. Ayodeji and Deji (2011) found that professionals in the Lagos construction industry have average knowledge and little involvement in value management (VM). VM is a common management approach in the global construction industry; hence, the little level of its application in the Lagos construction industry suggests the existence of a deficiency in the area of quality assessment.

3. METHODOLOGY

The target of this research work was to assess the quality systems for building contractors in Lagos, Nigeria, so as to develop guidelines that will lead to the development of a quality assessment system that can be applied by any building contractor in the State in order to achieve this target, the researcher adopted descriptive case study design and utilized a primary data obtained from 109 randomly selected participants comprising of senior managers, project managers, engineers, architects, quantity surveyors, and technical managers working with building construction companies in the Lagos Metropolitan Area. Analytical tools employed were one sample t-test and principal component analysis.

The one-sample t-test specified thus:

$t = \frac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}}$; with n–1 degrees of freedom …… (equation 3.1)

Where,
$\bar{x}$is the sample mean,s = sample standard deviation of the sample; and n = sample size was used to measure the impact of quality assessment system on project delivery in Lagos; while the Principal Component Analysis (PCA)was used to determine the method and approaches that the Lagos contractors are currently using to assess quality in their organizations.

4 DATA ANALYSIS AND INTERPRETATION OF RESULTS

Table 1: t-test result of impact of quality assessment system on project delivery in Lagos

One-Sample Test

	Test Value = 3.00					
	t-stat.	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Mean responses on impact of QA	7.210	8	.000	.80333	.5464	1.0603

Source: Researcher's SPSS 25.0 result

The t-statistic value of 7.210 with associated probability value of 0.000<0.05 shows that quality assessment has a significant positive impact on project delivery in Lagos, Nigeria.

Table 2: Correlation Matrix of Quality Assessment Methods applied by Lagos Contractors

		Observation/ physical inspections	Review of records	Feedback	Sampling
Correlation	Observation/ physical inspections	1.000			
	Review of records	.985	1.000		
	Feedback	.923	.920	1.000	
	Sampling	.829	.817	.750	1.000

Source: Field Survey, 2018

The correlation coefficient result shows that the variables/factors are highly correlated among themselves, which satisfies one of the criteria for factor analysis. Particularly, the result indicates that the variables/factors are positively and significantly associated among themselves (r>0.60).

Table 3: Variance decomposition of the Quality Assessment Methods

	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.618	90.443	90.443	3.618	90.443	90.443
2	.277	6.930	97.373			
3	.090	2.261	99.635			
4	.015	.365	100.000			

Extraction Method: Principal Component Analysis.

Table 4: Component Score Coefficient Matrix

	Component 1
Observation/ physical inspections	.272
Review of records	.271
Feedback	.262
Sampling	.246

Extraction Method: Principal Component Analysis.
Source: Researcher's SPSS 25.0 output, 2018

The variance decomposition matrix in table 3 indicates that the one component factor extracted can explain more than 90.4% of the total variation in the system. This is large enough (i.e., greater than 70% benchmark) and therefore, indicates that only one component factor is important for the analysis.

The component score matrix confirmed this component to observation/physical inspections method with a coefficient score of 0.272 greater than all other component factors in quality assessment records in the area.

5 CONCLUSION AND RECOMMENDATIONS

A good Quality Assessment System (QAS) should target to improve customer satisfaction, enhance safety, and increase compliance with industry regulation. This paper assesses the various quality assessment methods used by Lagos contractors in construction industry. Specifically, the paper focused on recommending a quality assessment system (QAS) that can be applied by all building contractors in Lagos State, Nigeria. From the empirical results, it was established that the major quality assessment method used by Lagos contractors in construction industry is the observation/physical inspections method instead of the scientific and statistical methods of assessment. Based on these findings, the following recommendations were made:

- There is need to set up public testing laboratories in the state to enable small contractors access to testing equipment and expertise at low costs.

- The Lagos QAS should emphasize the use of objective and statistical quality assessment approaches so as to improve the quality assessment process in the State.

- They should also encourage the integration of information technology in the quality assessment process and provision of general guidelines for training personnel who are directly involved in the assessment of quality.

- The QAS should also be cost effective; hence, it should recommend the use of tools and procedures that are affordable and within the reach of most local contractors.

- The assessment should also incorporate other quality domains such as space efficiency, energy and water efficiency, waste disposal, quality of the indoor environment and quality of outdoor environment.

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About the Authors

Ngozi M. Okoye

Profile not yet provided

maky444@yahoo.com ,

Dr. Kevin C. Okolie

Nnamdi Azikiwe University
Awka, Anambra State, Nigeria

Dr Kevin C. Okolie is a senior lecturer and Head of the Department of Building at Nnamdi Azikiwe University Anambra State Nigeria. He holds a Doctor of Philosophy Degree in Construction Management from Nelson Mandela Metropolitan University, Port Elizabeth South Africa. His research interest lies in the development of Building Performance Evaluation Methodology, Health and Safety Management and Built Asset Management Systems. His published papers and articles on Construction and Facilities Management have appeared in many international conferences and peer reviewed journals.

Email: kevinokolie@rocketmail.com or kc.okolie@unizik.edu.ng

Dr. Nathan Agu

Nnamdi Azikiwe University
Enugu State, Nigeria

Dr. Nathan Agu is a senior lecturer in the Department of Quantity Surveying, Nnamdi Azikiwe University and the principal partner of Nathquants Associates, a firm of chartered Quantity Surveyors based in Enugu State, Nigeria. His research interests are in professional practice management and construction arbitration. He has a number of notable professional achievements as a professional quantity surveyor and has contributed immensely to the development of the quantity surveying profession in Nigeria. He is also a fellow of the Nigerian Institute of Quantity Surveyors (FNIQS) and a registered member of the Quantity Surveyors Registration Board of Nigeria (QSRBN). You can reach him on nathquants@yahoo.com