EVALUATION OF CONTRACTOR'S QUALITY CONTROL PRACTICES ON CONSTRUCTION SITES IN NIGERIA

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Quality is linked to and affects many areas of human endeavour. This study evaluates the quality control practices on construction sites in Nigeria, by establishing if contractors have a quality control plan, the basis for the quality control plan and the manner in which the quality control plan is implemented on site. The study also identified the areas of difficulty experienced by contractors in the implementation of their quality control plan on the construction site. Relevant literature on quality systems and standards in use that highlights what a quality control plan should contain was reviewed, based on which a 20-point contractor evaluation questionnaire was developed. A total of 46 recently completed building projects were examined and analysed. Using the statistical data obtained and analysed with the use of descriptive and inferential statistics including Pearson product moment correlation test, the survey carried out indicates that most contractors in Nigeria; especially in Lagos possess quality control plans and for which a good level of compliance on site was reported by respondents. The research findings also indicated that there is a significant relationship between the implementation of a quality control plan and delivering a high quality project; where there were no quality control plans the quality of the delivered project was adjudged low. It was concluded that without adequate quality control plans and effective implementation on construction sites the Contractor would not achieve a significant quality delivery. The study recommends that project managers and other team members should view the possession of an effective quality control plan as essential in pre-selecting contractors, and its implementation on site as essential to improving the quality of projects delivered in the Industry.

Keywords: contractor performance, control, plan, practice, quality.

INTRODUCTION

The quality movement can trace its roots back to medieval Europe, where workers began organizing into unions called guilds in the late 13th century (American Society for Quality, 2005). Manufacturing in the industrialized world tended to follow this craftsmanship model till the mid- 1750s when the factory system, with its emphasis on product inspection, started in Great Britain and developed into the Industrial Revolution in the early 1800s. In the early 20th century, manufacturers began to include quality processes in quality practices. At the beginning of World War 2, quality became a critical component of the war effort as a product manufactured in one of the states had to work consistently with products from another state hence the eventual adoption of sampling techniques for inspection, aided by the publication of

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military-specification standards and training courses (American Society for Quality, 2005).

The American Society for Quality (2005) notes that in the few years since the turn of the century, the quality movement seems to have matured beyond Total Quality. New quality systems have evolved and quality has moved beyond manufacturing into service, healthcare, education, construction and government sectors. A general decline in performance of the construction industry has been observed in recent past, perhaps exacerbated by the recent rash of collapsed building, prevalence of abandoned construction sites and general poor quality of completed projects. Forbes (1993) and Alarcon and Ashley (1992) have documented the problem of poor performance in the construction industry of the United States.

In Nigeria the construction industry has been identified as occupying a significant segment of the capital base of the Nigerian economy and also attracts a significant percentage of the labour force in the economy (FOS, 1997). Due to its prime position within the economy, the successful or non-successful performance of the industry impacts either positively or negatively on the whole economy. The construction industry has been slow to apply total quality management, which is standard for most manufacturing concerns, despite the construction industry's capital requirement being equal to many years of output from a typical manufacturing organisation.

Quality control and safety represent increasingly important concerns for project managers. Defects or failures in constructed facilities can result in very large costs. Even with minor defects, re-construction may be required and facility operations impaired. Increased costs and delays are the result. In the worst case, failures may cause personal injuries or fatalities. Accidents during the construction process can similarly result in personal injuries and large costs. Indirect costs of insurance, inspection and regulation are increasing rapidly due to these increased direct costs. Good project managers try to ensure that the job is done right the first time and that no major accidents occur on the project.

The aim of this research is to evaluate the quality control practices of contractors on construction sites in Nigeria and to relate it to the quality of service and product delivered on the sites using the following stated objectives:

- Establish the quality control plan utilised by the contractor.
- Determine the level of adherence to the quality control plan by contractors on construction sites.
- Find out if there is any significant relationship between quality control plan and quality of the project.
- Find out if the quality control practice/compliance by contractors has an effect on the quality of the project.

Quality control is very pivotal in achieving acceptable performance on construction sites. The significance of this research lies in the possibility of adding to the wealth of information on quality control plans and practices by contractors in Nigeria generally, and particularly in Lagos state. An evaluation of the contractor's quality control practice will help contractors develop strategies to improve construction quality; it will aid consultants and clients in pre-contract evaluation of contractors and will help the general public in measuring the success or otherwise of a project vis-à-vis the contractor. This in time will not only impact positively on the construction industry but also the Nigerian Economy as a whole.

QUALITY PERFORMANCE IN CONSTRUCTION

Quality is a relative term, which means different things to different people; some people would define it as excellence associated with an item. This definition seems inadequate for a construction project though, when one takes into consideration that designs quality, for example is measured by the 'conformance to client's brief'. Performance on a global level represents results of activities. According to Naoum (1999), performance of a project is measured as its ability to deliver the building at the right time, cost and quality as well as achieving a high level of client satisfaction. Quality performance in construction is results oriented, and seeks evidence of quality awareness within the operations and output of a contractor. Quality performance is also defined over the long term for the effects to be permanent (Yasamis, Artiti and Mahammadi, 2002). In other words quality performance improvements are expected to increase the productivity and profitability of contractors, as well as increasing client satisfaction.

The quality performance of a contractor at the project level includes the quality of the constructed facility as well as the quality of the contracting service. This according to Yasamis et al (2002) involves:

- Product delivery performance (technical competence and conformance to specifications the contractor demonstrates during the construction process).
- Service design performance (competence with which the contractor carries out the construction planning activities).
- Service delivery performance (construction management and contract administration skills demonstrated by contractor during the construction process).

Models developed for evaluating contractor quality performance (CQP) include the following:

1. Garvin's Product Quality measurement:

Garvin (1988) created this method of measuring product quality. It uses eight references for evaluating the quality achieved by the contractor in construction. These include Performance, Features, Reliability, Conformance, Durability, Serviceability, Aesthetics and Perceived Quality.

2. Evans and Lindsay's Service Quality measurement:

Evans and Lindsay (1996) developed the service quality measurement system. This measurement of a contractor's service quality uses eight reference items to evaluate the contractor's output. These eight-reference item include: Time, Timeliness, Completeness, Courtesy, Consistency, Accessibility and Convenience, Accuracy and Responsiveness.

3. Construction Quality Assessment System (CONQUAS):

The CONQUAS system was developed in 1989 in Singapore primarily to assess contractors in public sector building contracts. According to Low, Kee and Leng (1999), the CONQUAS system was essentially developed to meet three objectives including providing an objective and measurable system for quantifying the quality standards of building construction. The CONQUAS assessment system is divided into three parts; Structural work (40%), Architectural work (50%), External work (10%), based on the approximate cost of structural, architectural and external works for a typical reinforced concrete building project. The assessments made on site by

assessors from the Construction Industry Development Board (CIDB) in the CONQUAS system follow specified quality standards laid down by the board.

Evaluating a contractor's level of performance regarding the quality control practices on site presents a challenge, mainly due to the difference in evaluation techniques utilised in different parts of the world and the difficulty in sourcing evaluation methods for use in Nigeria. However, the following present a basis for evaluating contractor's quality control practices. The New Jersey DOT Contractor Performance Rating System was prepared by the Quality Management Services Department of the U.S. Public Department of Transportation for Performance Evaluations of contractors working on the Department's projects. The Contractor's performance rating will be determined from: Contractor Performance Checklists, Notice of Non-Compliance Form, and Contractor's Performance Rating Form and Contractor's Rating Calculation Form

CONSTRUCTION QUALITY AND CLIENT SATISFACTION

According to Yasamis et al (2002), literature concerning quality in construction has mostly been about the quality of design and the level of conformance to design. 'Quality of design' involves the degree to which the features of the facility conform to the client's needs. In traditional contracting, Yasamis et al (2002) notes that the quality of design is the responsibility of the architectural and/or engineering firm; hence it depends on the performance of the architect or the engineer or both. The 'level of conformance to design', on the other hand, indicates the degree to which the constructed facility delivered by the contractor is consistent with drawings and specifications. Mostly, the level of conformance to design has been interpreted in the construction industry much as it is interpreted in manufacturing based quality theories.

Yasamis et al (2002) refers to the definition of quality of performance as encompassing the reliability of the original product and/or service as well as the competence, integrity and promptness of staff and support services. For owners to receive more value for their investment definitions of quality in construction need to be expanded to include the performance of the company as a whole and the client satisfaction derived from that performance. There is a shift in business thinking from compliance mode to performance mode. While contractors are striving to improve their overall performance, the control and monitoring mechanisms that clients practice on contractors and their work should also be reengineered (Wilson and Pearson, 1995).

CONTRACTOR'S QUALITY CONTROL PLAN

A contractor quality control plan (CQCP) is the documentation of the contractor's process for delivering the level of construction quality required by the contract. The document serves as a framework for the contractor's process for delivering quality construction. Whilst the plans and specifications define the expected results the CQCP outlines how these results will be achieved (US Federal Highway Administration, 1998).

According to the U.S. Federal Highway Administration (1998) the requirements for a contractor's Quality Control Plan include: Process Control Testing, Inspection/Control Procedures, Description of Records/List of the Records to be Maintained, Personnel Qualifications, detail how subcontractors will interface with the Contractor's and/or other subcontractor's organizations.

RESEARCH METHODOLOGY

The companies surveyed were based in Lagos state, Nigeria. The population for the study comprised of clients, consultants and contractors who had executed projects within and outside Lagos state. The research approach adopted in this study is a cross-sectional survey design in which statistical data were collected to answer questions in respect of the main subject of study. A non-probabilistic sampling approach was adopted for the research. Consultants, contractors and clients with offices in Lagos were selected based on convenience from different professional areas and professional bodies. These include the Nigerian Institute of Architects (NIA), Nigerian Society of Engineers (NSE), Nigerian Institute of Quantity surveyors (NIQS) and Nigerian Institute of Building (NIOB). Four clients were also selected from a consulting company's register. This resulted in a total sample size of 64, with the distribution matrix presented in Table 1.

Table 1: Consultants, Contractors and Client Organizations surveyed

Organisation	Number selected	Questionnaires received
N.I.A	20 Architects	15
N.S.E	23 Engineers	15
N.I.Q.S.	11 Quantity Surveyors	10
N.I.O.B	3 Builders	3
N.I.E.S.V.	3 Estate Surveyors	3
Company Register	4 Clients	0

Table 1 shows that out of the 64 questionnaires distributed, 46 (71.8%) respondents returned their questionnaires filled. The questionnaire was designed as a 20 item questionnaire grouped into three sections. The questionnaire was not piloted due to time constraints. Respondents in the 40 construction companies visited determined the content validity of the questionnaire. From their responses, the questionnaires were modified to remove ambiguities and test the sincerity and clarity of the respondents. However, the exceptional response rate of 71.8% was achieved through personal contacts and interviews.

The respondent's completed questionnaires were scored based on the responses to the questions in the questionnaire and a basis for the research conclusion made on the average of the scores made on each project. Extensive use was made of ordinal scale for eliciting data on respondents' perceptions. The associated problems of leniency, central tendency and 'halo effect' were alleviated by using a five-point scale. Respondents were asked to evaluate contractors use of quality control plan subjectively based on a five-point scale, where Total compliance = 5, Good compliance = 4, Fair compliance = 3, Poor compliance = 2, none compliance = 1. The instrument used for evaluating contractor's quality control practices was based on the model of the New Jersey DOT contractor performance rating system.

DATA PRESENTATION AND ANALYSIS

The responses from the field survey are presented below:

Contractor's Quality Control Plan

The study sought to establish the quality control plan used by contractors in the study. This is presented in Table 2.

Table 2: Classification of Contractors According to Type of Quality Control Plan

Option	No. of Respondents	Percentage (%)
British Standard Institution	18	39.1
Contract Specification	16	34.8
ISO 9000 Series	6	13.0
Others	3	6.5
No Quality Control Plan	3	6.5
Total	46	100

Table 2 indicates that 39.1% of the quality control plans were based on BSI, 34.8% on contract specifications, 13% on ISO 9000 series, 6.5% on other sources while 6.5% of the respondents had no Quality Control Plan in place, thus indicating that majority of quality control plans are based on internationally accepted standards.

Compliance with Quality Control Implementation Methods

Table 3 presents the level of contractors' adherence to methods of implementing their quality control plan on the construction site.

Table 3: Compliance with Quality Control Implementation Methods

Level of Compliance	No. of Respondents	Percentage (%)
Total Compliance	22	47.8
Good Compliance	19	41.3
Fair Compliance	2	4.3
No Compliance	3	6.5
Total	46	100

Table 3 shows that respondents perceived that 47.8% of the contractors to have totally complied with their quality control plan on site, 41.3% achieved good compliance, 4.34% achieved fair compliance whilst 6.5% achieved zero compliance.

Compliance with Contract Documents

Table 4 presents the level of compliance with contract documents on site by the contractors.

Table 4: Compliance with Contract Documents

Level of Compliance	No. of Respondents	Percentage (%)
Total Compliance	16	34.8
Good Compliance	24	52.2
Fair Compliance	2	4.3
Poor Compliance	2	4.3
No Compliance	2	4.3
Total	46	100

Table 4 shows that 52.2% of the contractors were perceived to have good compliance, 34.8% complied totally with the contract documents, 4.3% of the contractors had fair compliance with the contract documents, 4.3% complied poorly whilst 4.3% did not comply with the contract documents at all.

Quality Performance

The study sought to know the level of quality performance of the surveyed contractors on site. This is presented in Table 5.

Table 5: Contractor's Quality Performance

Level of Compliance	No. of Respondents	Percentage (%)
Total Compliance	10	21.7
Good Compliance	24	52.2
Fair Compliance	4	8.7
Poor Compliance	4	8.7
No Compliance	4	8.7
Total	46	100

Table 5 illustrates the contractor's quality performance on the construction site. It indicates that 52.2% of the contractors exhibited a good quality performance, 21.7% exhibited maximum quality performance on site, 8.7% of the contractors had zero level of quality performance, 8.7% exhibited fair quality performance and 8.7% exhibited a poor quality performance.

Quality Control Plan, Quality of Project and Quality Control Compliance

The data obtained from the respondents were rated based on the following: Total quality performance = 5, Good quality performance = 4, Fair quality performance = 3, Poor quality performance= 2, no quality performance= 1.

Hypothesis One

This states that there is no significant relationship between quality control plan and quality of the project. The Pearson's product correlation co-efficient calculated using data obtained from the questionnaire is presented in Table 6.

Table 6: Pearson's Correlation Coefficient between Quality Control Plan and Project Quality

Variable	Project Quality
Quality Control Plan	0.083

The correlation coefficient 'r' of 0.083 shown in Table 6 indicates a weak positive correlation between quality control plan and project quality. The calculated value of .083 is less than the tabulated value of 0.2875 for $P< 0.05$ (2-tailed). Therefore, based on these findings, the null hypothesis that states that there is no significant relationship between quality control plan and quality of the project is accepted.

Hypothesis Two

This states that the quality control practice/compliance by contractors has no significant effect on project quality. The chi-square coefficient calculated using data obtained from the questionnaire is presented in Table 7.

Table7: $\chi2$ Coefficients between Compliance to Quality Control and Project Quality

Variable	Chi-square	Degree of Freedom	Asymp. Sig.
Compliance to Quality control	28.609	3	.000

Table 7 shows that the calculated chi-square value of 28.609 is more than the tabulated critical value of 7.815 for $P< 0.05$, therefore the result of this study is significant. Based on the findings presented in Table 7, the null hypothesis, which states that quality control practice/compliance has no significant effect on project quality, is rejected while the alternative hypothesis is accepted. This implies that the quality control practice/compliance of contractors has a significant effect on the project quality.

DISCUSSION OF FINDINGS

The research findings justify past research findings, which conclude that 'the level of conformance to design' is the responsibility of the contractor (Yasamis *et al.,* 2002). Wilson and Pearson (1995) suggested that while contractors are striving to improve their overall performance, the control and mechanisms on site should be reengineered to ensure compliance with the design standards and specification. This has been brought to the fore by the findings of this research, which reveal that though the possession of a quality control plan is good, it is the actual implementation on site that determines the quality of the project.

This position is supported by the findings in hypothesis one, which reveal that the possession of a quality control plan has no significant relationship with the project quality, which clearly supports Bamisile (2004) claims that the possession of a quality control plan or quality assurance plan does not in itself make the organisation deliver quality products or services, it only suggests that there is a process in place which can lead to attaining the desired quality level on the project. Hypothesis two on the other hand, revealed the remarkable effect that a contractor's compliance with the quality control measures on site has on the quality of the project. The research suggests that quality control compliance/practice on the construction site has a significant effect on the delivery of a quality project by the contractor.

In relation to the quality control plan used by contractors on construction sites, the research findings suggest that over 80% of contractors actually adhere to their quality control plan. This then raises the question as to what extent do contractors actually comply with their quality control plans; again this study suggests that almost 90% of contractors with a quality control plan actually achieve a good level of compliance. This is instructive against the background of new contracting techniques, outmoded QA/QC programmes and safety programmes which Yasamis et al (2002) notes in their research.

It is also pertinent that the study, in seeking to establish the type of quality control plan used by contractors show that at least 39% of quality control plans have their source as the British Standard Institution (BSI). As the BSI (2006) suggests, this might be related to the fact that the BSI was the world's first national standards-making body and is still considered as number one in the world. The research findings show that the contractor's quality performance is dependent on total compliance with the contractor's quality control plan, which is consistent with Chan and Tam's (2000) conclusion that one of the ways of achieving an increase in client satisfaction with quality is by increased emphasis on quality.

CONCLUSION AND RECOMMENDATIONS

Based on the analysis of data collected and the interpretation of such analysis whilst keeping in mind the aim of the study, which is to evaluate the quality control practices of contractors, the study concluded that the possession of a quality control plan does not automatically guarantee delivery of a high quality project by contractors on construction sites and that adherence or compliance to the initial quality control plan by a contractor on the construction site has a significant effect on the quality of the project delivered by the contractor. This is important because in Nigeria, there is no system in place to monitor the compliance of contractors to quality issues.

It is recommended that: all stakeholders in the Construction Industry need to understand the importance of quality control plans and their implementation on

construction sites, as a variable which can either improve or lower the quality of project delivery. It is also recommended that there should be constant evaluation of contractors to determine their level of compliance with standard quality control practices, both by public and private agencies, and only those who maintain a specified level should be invited or selected for projects. Contractors could then be ranked according to their level of compliance. Contractors should also be encouraged by client organisations to use International standards as a basis for their quality control plans. This will improve their competitiveness, ensure contractors maintain high productivity and profitability and result in improvement in the overall level of quality in the construction Industry.

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