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Development of a Conceptual Model for Effective Quality Management Practices in Construction Organisations: the Case of Nigeria

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Abstract

Effective quality management practices are critical to successful project delivery. However, the quality challenges in developing countries such as Nigeria, which is the focus of this research, have been a concern to construction practitioners and other interested parties such as clients and regulatory bodies. Some scholars suggest that part of these challenges can be attributed to ineffective quality management systems; thus, leading to consequences such as building collapse, poor organisational/industry reputation, poor/lack of traceability, poor documentation process, and lack of planned audit. This research aims to develop a contextual model that is intended to improve the culture of quality that can facilitate effective quality management practices in construction organisations in Nigeria. A mixed (quantitative and qualitative) methodological approach was deployed based on a pragmatic research philosophy paradigm. A questionnaire (quantitative) survey was adopted to gather data and results from the data analysis and reviewed literature were discussed, and the findings supported the development of a conceptual quality management model in construction as the outcome of this research. The designed model comprises eight integrated components. The model is a quality system that construction organisations can use: to identify some typical barriers hindering effective QMSs implementation; to assist them to develop cultural values that can drive effective QMSs implementation; to undertake effective QMSs practices as they relate to construction, and to recognise the potential results and longer-term benefits obtainable from implementing effective QMSs. The model was evaluated and validated by professional construction practitioners and academic experts for its usefulness and applicability. Future study should focus on the practical validation of the model.

Keywords: ISO 9001; Quality Management Practices; Quality Management System.

1. Introduction

Quality management practices, according to Watson and Howarth (2011) and Ofori et al. (2002), can speed up projects and increase profitability, help to satisfy clients, reduce the number of defects, reduce inspection costs, enhance workmanship efficiency, and improve construction repute; however, quality management practices have evolved dramatically since they first emerged. Initially, quality management in construction was primarily by inspection; the faulty goods were scrapped or transferred to the customers. This was followed by quality control. Subsequent attempts ensured quality assurance by considering quality cost, reliable technology, and eliminating defects (Winch, 2002). Nowadays, the emphasis is on quality management systems; they may be adopted, or organisations can develop their own. However, many construction organisations, especially in the developed countries, have adopted ISO 9001 (Quality Management System Requirements). As a result, ISO 9001 is the most widely used quality management system globally (ISO 9001, 2015).

According to Harris et al. (2013), management of quality in construction is an area of specialisation that has been growing over the past four to five decades to embrace aspects of company activities and projects that are often seen as isolated from the physical product. They further identified aspects of quality (for example, quality planning and quality control) that influence the quality of

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the construction projects. Quality management in construction is a distinct feature that needs to be given the utmost attention in any construction work. It is a holistic approach to managing a project and delivering value for money and fitness for purpose. Dada, Obiegbu, and Kunya (2016) stated that quality management covers all processes, procedures, and responsibilities to achieve quality objectives. According to Agbenyega (2014), quality is aimed at standardisation, while Bala, Keftin, and Adamu (2012) perceived quality management as a wide-scale failure prevention program. However, the quality of construction projects in Nigeria is not given the desired attention.

Nwabueze (2001) lamented that one of the major reasons for clients' dissatisfaction with most construction projects is poor quality, and Nigeria is not an exception. The construction industry in Nigeria has been reportedly maligned with quality issues such as building collapse, construction delays, project abandonment, and cost overrun (Nwachukwu et al., 2010, Windapo and Rotimi 2012). Similarly, in Ghana, the delivery of construction projects is still characterised by poor quality (Government of Ghana, 2007). This has been partly attributed to technical incapacity, poor materials, and a general lack of competence and capacity (technical and human resource) within both client and contractor organisations (Government of Ghana, 2007). In addition, previous research identified quality consequences such as poor company/industry reputation, poor/lack of traceability, conflicts due to customer dissatisfaction, poor documentation process, and lack of planned audit in some organisations. According to the Federal Ministry of Power, Works, and Housing (2016), 54 buildings collapsed across Nigeria between 2012 and 2016. Furthermore, National Emergency Management Agency (NEMA; 2019) reported that twenty people were killed on March 13th, 2019, when a four-storey building containing a primary school in Nigeria's commercial capital, Lagos, collapsed, and forty-five others survived. The investigation showed that the reasons for the building collapse include poor enforcement of building regulations and substandard construction materials.

In a previous study, Ibrahim and Sodangi (2007) attributed low-quality project deliveries in Nigeria to ineffective quality management practices. Olatunji et al. (2012) emphasised the need for effective quality management practices in Nigerian construction organisations to reduce the effects of pertinent quality issues. Many construction organisations in developed countries such as the United Kingdom and Germany have adopted ISO 9001 (Quality Management System Requirements) for improved organisational effectiveness. On the other hand, most construction companies in Nigeria mainly practice an inspection-based quality management system, and only a few companies (240 in 2016) embrace ISO 9001 (Oludare and Olugboyega, 2016). Iwaro and Mwasha (2012) concluded in their research that ISO 9001 certification is important to an organisation because it can be used to improve workmanship performance, improve systemic factors, and improve the organisation's quality substantially. However, getting certified to ISO 9001 cannot guarantee quality projects; instead, it is the organisation's willingness to create the right culture for effective quality management practices.

For the Nigerian construction industry to realise the full benefits of quality management practices, Zubairu (2016) recommended that a framework needs to be developed that suits building construction projects in Nigeria. This need formed the foundation of this research to develop a contextual, conceptual model for construction organisations in Nigeria. The model is expected to nurture an appropriate culture of quality (organisational pattern of habits and behaviour) that will, in turn, improve the quality of construction projects in Nigeria and promote competitiveness between the local and foreign contractors..

2.0 Literature Review

It is widely acknowledged that the construction industry is a great contributor to the economic growth of any nation. Willar (2012) reported that the construction industry globally is one of the largest contributors to the Gross Domestic Product (GDP) and plays an important role in determining a country's economic growth. To this end, the Nigerian construction industry plays an important role in meeting the needs of the nation's infrastructural and economic development; thus, making it one of the main economic indicators that determine the growth of the Nigerian economy, according to the National Bureau of Statistics (2017). However, the quality of construction projects in Nigeria has been described as 'poor' by many scholars. For example, Hughes and Williams (1991) asserted that factors such as the subjective nature of quality, project uniqueness, the transient nature of construction projects, and several teams with different skills and interests all make quality particularly challenging to attain in the construction industry. It is, however, noteworthy that many other industries also have several teams with different skills and interest and yet do not suffer from the same quality issues. Therefore, to address quality challenges in the construction industry, quality management practices need to become a key part of management functions. Many have claimed that effective quality management practices in the construction industry can improve quality and productivity, according to Arditi and Gunaydin (1997). This can be true when an organisation has the right culture regarding leadership commitment and an effective quality management system.

2.1 Quality Management System

A survey of firms in Lagos, Oludare and Olugboyega (2016) found that quality management systems used among construction organisations are not applied in a standardised manner as organisations indicated different quality management systems. According to them, supervision of workmanship is the most used quality control tool among construction companies in Nigeria. This suggests that supervisors are relied upon to ensure the quality of work undertaken. The level of quality of projects, therefore, depends on the expertise of the supervisors.

Oludare and Olugboyega (2016) pointed out that only a few construction firms in Nigeria use ISO 9001

standards. However, this does not mean that quality projects cannot be delivered without ISO 9001 certification; the most important factor is the organisational commitment to quality and the right culture. They further reported that only 11% of questionnaire respondents expressed commitment to quality management, and less than 16% and 3% of the construction firms relied on project managers and architects to handle quality management. Furthermore, over 45% of the respondents did not indicate the department handling quality management in their companies. This suggests that these companies did not have a specific department handling quality. In addition, the Nigerian Institute of Building (2009) summarised the factors affecting the implementation of quality management systems, and these are lack of quality culture, lack of top management commitment, lack of adequate resources, resistance to change, and corruption.

To achieve quality project objectives, it is important to have an appropriate and well-implemented quality management system. Hoyle (1997) warned that the production of required quality products does not happen by chance, but rather it must rely on the use of a quality management system to meet all the established quality goals. Therefore, construction organisations need a structured and systematic approach to implement a quality management system's practices, principles, and techniques. Hence, the adoption of a formal quality management system (QMS) is important in construction organisations. Thorpe and Sumner (2004) defined a QMS as a formal statement of an organisation's policy, management responsibilities, processes, procedures, and controls that reflect the most effective and efficient ways to meet (or exceed) the expectations of those it serves whilst achieving its prime business objectives.

2.2 ISO 9001 (Quality Management System Requirements)

Although there are many ways to develop a quality management system, many organisations (including in construction) adopt the ISO 9000 family of standards, a set of standards and guidelines for quality management systems that represent an international consensus on the most acceptable and effective quality management practices. The standards provide a comprehensive framework for designing and managing a quality management system and can help organisations establish a process orientation and the discipline to establish, implement, maintain, document and control key processes (Watson and Howarth, 2011). Winch (2010) emphasised that ISO 9000 is not a product standard but a standard for quality management systems. However, ISO 9001 (2015) is the international standard that sets out the requirements for a quality management system (QMS). It helps organisations (including in construction) to demonstrate their ability to consistently provide projects and services that meet clients and relevant stakeholders' requirements.

According to Willar (2012), the ISO 9001 series has become the QMS model recommended by followers of the quality movement as a benchmark for implementing good management and process control in a variety of industries and sectors. However, the weakness of ISO 9001 is its generic nature. For a quality system to produce the desired outcome, it needs to consider the context of the environment within which it is to be implemented. The context includes the national, vocational, and organisational culture. Unfortunately, the organisational culture in Nigeria makes it difficult for local companies in Nigeria to adopt ISO 9001 because of the country's low level of quality culture (Ibrahim and Sodangi, 2007). They added that the indigenous contractors lament the high cost of ISO 9001 implementation and the daunting documentation process of its certification. There is, therefore, a need to bridge the gap between the current quality practices and ISO 9001. Hence, a new model needs to be developed to promote the expected culture of quality for effective quality management practices in construction organisations in Nigeria. However, the prominence of ISO 9001 makes it a useful foundation for the development of the proposed model in this study. Figure 1 presents the ISO 9001 QMS model.

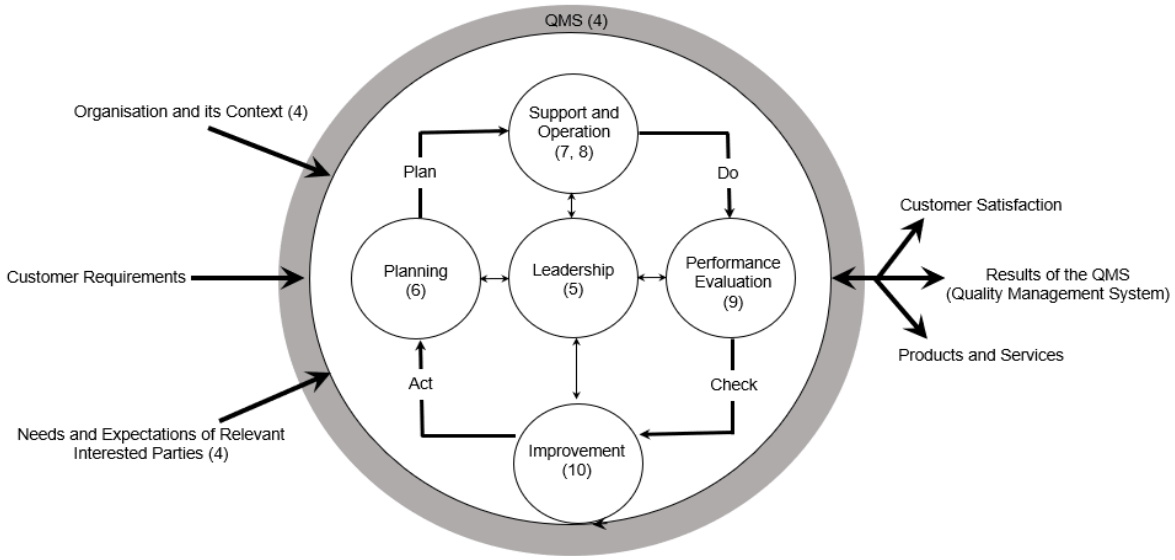


Figure 1: ISO 9001 Model (Source: Figure generated by authors based on ISO 9001: 2015)

Furthermore, successful implementation of a QMS requires effective planning, operation, and review and continuous improvement of the system at all levels of an organisation. ISO 9001 (2015) reinforced that quality management principles (MPs) are required to implement the model successfully. The MPs (fundamental beliefs) can be used as a foundation to guide an organisation's performance improvement. The following section provides a brief description of each of the principles or theories.

2.2.1 ISO 9001 Principles

- Customer focus: The primary focus of quality management is meeting customer expectations and striving to exceed them. Other interested parties should be considered as well. This calls for the identification of all relevant stakeholders in a project.
- Leadership: Leaders at all levels give direction and create conditions in which people are engaged in achieving the organisation's quality objectives.
- Engagement of People: Competent, empowered, and engaged people throughout the organisation are essential to enhance its capability to create and deliver value.
- Process-based Approach: Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system.
- Improvement: Successful organisations have an ongoing focus on improvement. Improvement is essential for an organisation to maintain current performance levels, react to changes in its internal and external conditions, and create new opportunities.
- Evidence-based Decision Making: Decisions based on the analysis and evaluation of data and information are more likely to produce desired results. Facts, evidence, and data analysis can lead to greater objectivity and confidence in decision making. An example of this is the data analysis in this study that is expected to assist in developing the proposed model.
- Relationship Management: For improved performance, an organisation manages its relationships with interested parties, such as suppliers. Interested parties can influence the performance of an organisation.

Furthermore, ISO 9001 has some requirements (clauses) to be met by organisations seeking to get certified to it. However, meeting these requirements depends on each organisation's operational activities and their policy towards quality improvement.

2.2.2 ISO 9001 Clauses

In total, ISO 9001 is made up of 10 clauses, and to successfully implement it, an organisation must satisfy clauses 4-10. The first three clauses are scope, normative references, and terms and definitions. Clauses 4-10 are briefly explained below:

Clause 4. Context of the Organisation: This clause sets out the requirements for an organisation to review the business and the environment, considering the key internal and external factors that impact it and how a defined management system can address these factors.

Clause 5. Leadership: This clause encompasses a range of key activities to demonstrate leadership and commitment concerning the quality management system.

Clause 6. Planning: This clause is based on the organisation's actions to address risk and opportunities and assess whether the organisation manages risks effectively.

Clause 7. Resources: An effective quality management system cannot be maintained or improved without adequate resources. This clause sets out planning activities for determining and providing such resources, including contract or project-specific resources.

Clause 8. Operation: This clause represents the core production and operational control parts of the organisation.

Clause 9. Performance Evaluation: Collection and analysis of relevant data are necessary to measure the management system's suitability and effectiveness and identify opportunities for improvement.

Clause 10. Improvement: This section requires reviewing processes, projects and services and quality management systems for continual improvement.

In the context of quality management implementation in organisations, culture cannot be ignored.

2.2.3 Quality Culture

Coffey (2010) and Gryna et al. (2007) defined quality culture as "the pattern of habits, beliefs and behaviour concerning quality". There are varieties of cultural influences on individuals and stakeholders which shape their expectations. These are referred to as the frames of reference, which include national culture, vocational culture (industry, institutional and professional culture) and organisational culture (Gryna et al., 2007). Hence, the development of quality culture in an organisation can be influenced by these frames of reference. Arguably, organisational culture appears to have a stronger influence than professional (vocational) and national culture in developing a quality culture in construction firms. The foundations for quality orientation or culture of an organisation are defined at the corporate level. The corporate quality culture is the organisational value system that encourages a quality-conscious work environment. It establishes and promotes quality and continuous improvement through values, traditions, and procedures (Goetsch and Davis 2006). According to Evans and Lindsay (1996), quality-conscious companies adopt quality management systems that focus not only on delivering high-quality products but also on creating performance improvement in the internal and external services generated by the company. Therefore, the existence of a strong quality culture can lead to organisational effectiveness. Therefore, it is suggested that organisations need to pay more attention to the development of appropriate quality culture for effective quality management practices.

3.0 Methodology and Sampling

Based on pragmatic philosophical assumptions, a mixed-method approach was adopted to explore the quality management systems used in construction organisations in Nigeria and the factors affecting the implementation of

organisations' QMSs. According to Mahamadu et al. (2015), pragmatism is an approach that works in between the interpretive and positivist paradigms. This approach is more appropriate for this study because it is pinned on both interpretive (qualitative) and positivist (quantitative) tenets. Therefore, a questionnaire survey (quantitative) was used to collect data from construction professionals on using QMSs in their respective organisations. On the other hand, qualitative interviews were used to validate the model and assess its applicability.

Drawing a suitable sample for data collection is an obvious necessity since it is rarely possible to investigate an entire population due to source restrictions in most research. The three most used types of random sampling are simple random sampling, stratified random sampling and cluster random sampling (Kumar, 2011). Simple random sampling is the most used method of selecting a probability sample. Under simple random sampling, each element in the population is given an equal and independent chance of selection, whereas the stratified random sampling is a method employed to randomly choose a few samples representing each stratum of a population (Kumar, 2011); "it has advantages of high generalisability of findings and is the most efficient among all probability designs" (Sekaran and Bougie 2009). This method was used to select respondents representing a typical construction practitioner, including Quality/Project Managers, Architects, Quantity Surveyors, Site Engineers, and General Managers. Finally, cluster sampling was used primarily to choose the location of designated construction companies. The population of the study was mainly construction professionals across the six geo-political zones in Nigeria. Nigeria's construction sector is estimated to employ about 1% of the country's labour force (Idrus and Sodangi 2010), giving a population for this research of the order of magnitude of about 600,000 construction professionals.

The following cities were chosen based on the six geo-political zones in Nigeria for the data collection; Abuja, the Federal Capital of Nigeria and Lokoja representing North-Central; Kaduna representing North-West, Lagos State representing the South-West, Enugu represents South East, and Port Harcourt representing South-South. However, the North-Eastern part could not be reached due to an insurgency attack in that region. The sampling across different regions reflected the view of Sekaran and Bougie (2009) that the sampling design is most useful when studying a heterogeneous group at one time.

To avoid response bias, the questionnaire was designed to be anonymous, and leading questions were avoided. Furthermore, ethical norms such as integrity of data and the exact representation of data were adhered to in this research by following the ethical research procedures of Loughborough University (including formal approval of all data collection plans).

4.0 Data Collection, Analysis and Model Development

The distribution and collection of the questionnaires were conducted from February 2018 - July 2018 in Nigeria. The questionnaires were delivered personally by the researcher. Three hundred questionnaires were distributed amongst three different groups of construction organisations in Nigeria, 150 were distributed to the public sector, and 75 each to foreign and local contractors. This distribution covers the scope of this study; the public sector acts as clients on behalf of the government, while the contractors, both foreign and local, are the project constructors. Descriptive statistical analysis was first undertaken after reliability testing to establish the demographic profile of the participants and the construction organisations involved in the survey.

This research adopted both closed-ended and open-ended questions to draw on the strengths of each type of question and minimise bias arising from similar questions. Since most of the questions sought opinions or subjective perceptions, the formats of some questions were based on an even itemised rating scale of 4=Strongly Agree, 3=Agree, 2=Disagree, 1=Strongly Disagree. According to Coffey (2010), findings of previous research (Hofstede et al. 1990) revealed that there had been a significant experience that managers tend to select the mid-point of an odd-number based rating scale in a questionnaire. Many researchers have different views of the use of the 'middle-way' response. There is no consensus on the optimum choice of scale (Bernard 2000).

The collected data were analysed with the aid of statistical software (SPSS), and the results from the data analysis and reviewed literature supported the development of a conceptual quality management model in construction as the outcome of this research. In addition, parametric testing was further conducted using Factor Analysis (Appendix 4) to reduce a large number of QMS variables into a subset of more meaningful QMS variables used in the model formulation.

Having developed and presented the proposed conceptual Quality Management Model, it was necessary to evaluate its validity, usefulness, and applicability to the Nigerian construction industry. This was achieved by the involvement of academic experts, policymakers and construction practitioners in Nigeria through focus group and semi-structured interviews. The interviews and focus groups were audio-recorded, and the data collected were analysed qualitatively through thematic analysis. The participants comprised 17 participants, including academic experts, policymakers, and construction contractors. The participants' experiences span from 10 to 30 years within the built environment, and their contributions assisted greatly in the refinement of the model. The participants all confirmed the suitability of the model for the construction industry in Nigeria.

4.1 Data Analysis

Of the 300 questionnaires sent, 46 were returned undelivered, bringing the questionnaires distributed to 254. Therefore, the completed questionnaires returned were 124, which is equivalent to a 48% response rate. The response rate of 48% is considered satisfactory for the survey purpose according to Fellows and Liu (2008); the sample size of 100 with a response rate between 35-40% is adequate for questionnaires in construction-related studies.

The first step of the analysis was to subject the data to a reliability test. Cronbach's Alpha was used to assess the reliability of the questionnaire. According to Pallant (2007), "Cronbach's Alpha coefficient of 0.70 or above is

considered adequate". Table 1 shows a Cronbach's Alpha test result of 0.87; this provides evidence of the data's reliability for further analysis.

Table 1: Reliability Test

Cronbach's Alpha Test	Number of Items
0.87	54

4.1.1 Demographic Information of Respondents

The analysis of this data begins with the demographic information of the respondents and their respective construction organisations. Then, Table 2 shows the distribution between the public sector, domestic contractor, and foreign contractor organisations to assist in comparing the performance of those three categories. The involvement of foreign contractors has introduced fierce competition in the construction industry in Nigeria.

The Table also reveals that 94% (59+21+14) of all the respondents have professional qualification within the construction industry. The project types were limited to two: civil and building projects. Some of the major projects include infrastructure such as roads, bridges, rail lines, hospitals, and schools.

Table 2: Background Information of Respondents

Category	Frequency
Construction Organisations' Involvement	
Foreign-based Contractors	19%
Public Sector	49%
Local Contractors	32%
Professional Qualifications	
Civil and Building Engineering	59%
Architecture	21%
Quantity/Land Surveying	14%
Other	6%
Project Types	
Building	12%
Civil	20%
Both	68%

4.1.2 Current Quality Management Practice

This section summarises the use of current quality management systems in construction organisations in Nigeria. Regarding ISO 9001 certification in Table 3, the result shows a higher mean of 1.7 and a standard deviation of 0.47. This indicates that only 30% of construction organisations are certified to ISO 9001 or another system standard. On the validity of the quality management system certificate, the response rate of 1.7 was recorded, and a standard deviation of 0.46. This means that 70% of their organisation's QMS certificate were invalid at the time of the data collection, and only 30% recorded valid certificates. However, the result finally shows an effective reporting structure with a mean of 1.4 and a standard deviation of 0.5. This reflects 56% of an effective reporting structure within construction organisations in Nigeria. Table 3 further shows respondents' indication of the quality standards or quality management systems used in their organisations or projects. Standards or systems were felt to be an important indicator of quality practices in Nigeria.

Table 3: Formal Quality Management System or Standard

Elements	N	Mean	S.D
Formal quality management system	124	1.30	0.46
Quality policy and quality objectives	124	1.44	0.50
ISO 9001 Certification or other Standards	124	1.69	0.46
Valid QMS certificate	124	1.71	0.46
Effective Quality Reporting Structure	124	1.44	0.50
Total	124	1.52	0.48

Overall, the result shows a mean of 1.5 and a standard deviation of 0.5 across all QMSs or standards. This indicates that 60% of construction companies in Nigeria have formal quality management systems in place. However, the challenges lie mainly with their implementation.

The analysis (Figure 2) shows that all the construction organisations represented in this research use inspection and flowcharts to manage quality on the current quality tools used in Nigeria. The flowchart shows the responsibilities of employees for operations. The analysis unveils that other quality tools such as Quality Function Deployment (QFD), Lean, Total Quality Management (TQM), and European Foundation for Quality Management are not commonly used in construction companies in Nigeria.

Figure 2: Quality Management Tools

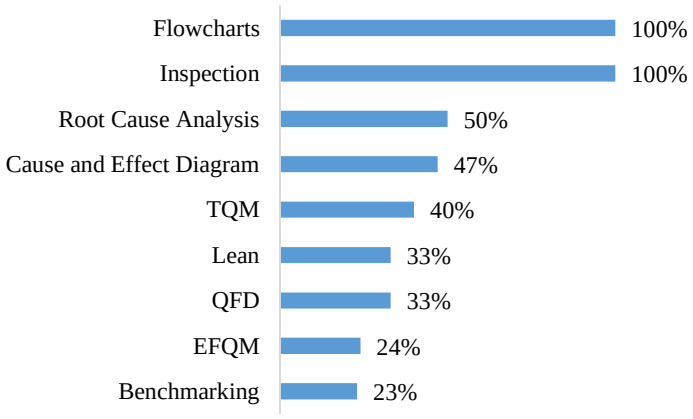


Figure 3 shows respondents' use of ISO 9001 or other standards among the three groups established for this data collection. The graph shows that six out of 60 respondents from the public sector are certified, while 8 out of 40 respondents of local contractors are certified to ISO 9001 or other standards. This is relatively low compared to the foreign-based contractors.

In identifying factors affecting quality management system implementation in construction organisations in Nigeria, as shown in Appendix 1, the respondents revealed the following:

- lack of top management commitment to quality policy and quality objectives,
- provision of inadequate resources,
- lack of quality training and culture, and

corruption within and outside construction organisations.

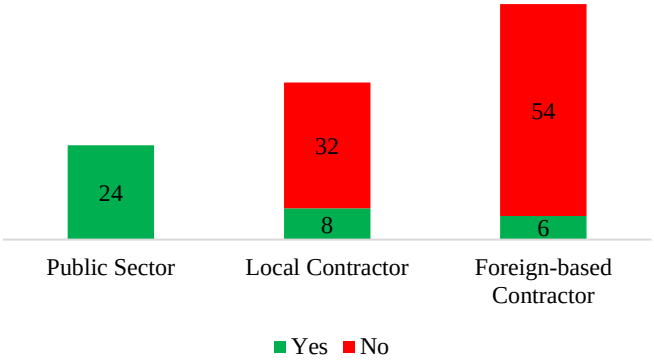


Figure 3: ISO 9001 Certification

The respondents added other challenges that were not listed in the questionnaire: client's focus on cost rather than quality, no enforcement of standards, poor understanding of quality, use of substandard building materials, poor understanding of building codes, and use of unqualified engineers and tradesmen (Appendix 1). However, suggestions for improvement on quality management system implementation were made in Appendix 2 by various respondents, and the result shows the promotion of quality training and culture as the most significant factors for quality improvement in construction organisations in Nigeria.

The last part of the questionnaire evaluated the implementation of the quality management systems used by construction organisations in Nigeria. The key elements of this section are based on quality principles of ISO 9001 (2015), as explained in the literature review. Respondents were asked to indicate their agreement with statements of the importance of these factors, as shown in Table 4.

Table 4: Implementation of Quality Management System

Key Elements of the Questionnaire	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	Mean Score*
Customer Focus	0.66	4.89	57.31	37.14	1.25
Leadership	13.71	38.71	27.42	20.16	0.02
Engagement of People	16.33	43.75	28.43	11.49	-0.25
Process-based Approach	5.05	61.49	11.49	21.97	-0.16
Improvement	23.59	20.36	42.14	13.91	0.02
Evidence-based Decision Making	23.64	20.41	42.04	13.91	0.02
Relationship Management	16.73	31.25	41.73	10.29	-0.02

** From -2 for Strongly Disagree to +2 for Strongly Agree*

Furthermore, based on the relatively large number of dependent variables (45) from data analysis (Appendix 3), factor analysis was deemed necessary to identify the most important variables. The results of the factor analysis show variables that are grouped into six factors. However, Factors 2 and 3 represent the same concept (leadership commitment); the factors were therefore regrouped into five components. These are:

Factor 1 Quality management system challenges
Factor 2 Leadership Commitment
Factor 3 Performance Measurement
Factor 4 Construction Processes (Demographic Information)
Factor 5 Quality Management System Improvement.

The data were subjected to further analysis. The factors were revised based on this further data analysis and following reflections from the literature review. The resulting factors form the fundamental components of the proposed conceptual quality management model in construction for this study. The factors are:

Factor 1: Quality Drivers
Factor 2: Quality Management Implementation Challenges
Factor 3: Leadership Commitment
Factor 4: Performance Evaluation Indicators
Factor 5: Construction Activities and Processes
Factor 6: Quality Improvement Controls
Factor 7: Quality Management Practice Outcomes
Factor 8: Quality Improvement

5.0 Discussion

The demographic data captured in the questionnaire form the basis for data analysis because the first step in data analysis is to determine the respondents' background and ensure that the information obtained can be considered 'fit for purpose.

The reviewed literature reveals that quality has been a problem in the Nigerian construction industry for decades. Olugboyega (2000) observed a general decline in quality performance in the Nigerian construction industry, leading to the prevalence of abandoned projects, high maintenance cost, and loss of lives. This low-quality performance led to the dominance of foreign-based companies over the local contractors in Nigeria. It can be observed that foreign-based contractors handle major construction and special projects in Nigeria. Idrus and Sodangi (2010) asserted that most expatriate contractors adopt ISO 9001, which has distinguished their buildings in terms of quality and time of project delivery but at a higher cost than the indigenous contractors. However, this does not mean that no local contractors are doing it right in Nigeria. It is good to emphasise that getting certified to ISO 9001 cannot guarantee quality projects, rather the organisations' willingness to create the right culture for effective quality management practices. Many companies in Nigeria without ISO 9001 certification have delivered projects successfully within the project constraints of time, cost, and objectives.

Olatunji et al. (2012) maintained a need for effective quality management practices in Nigerian construction organisations to reduce the adverse effects of quality issues. Abdulsalam (2016) added that a framework (model) needs to be developed for quality management practices that suit building construction proects in Nigeria.

The results from data analysis show that the following factors affect quality management system implementation in construction organisations in Nigeria: lack of top management commitment to quality policy and quality objectives, provision of inadequate resources, lack of quality training and culture, and corruption within and outside construction organisations. It is noteworthy that corruption emerged as the main factor affecting QMS implementation in Nigeria in the reviewed literature. However, if corruption is this high, why are some organisations still able to operate ethically in Nigeria? This question led to further analysis to determine the major challenges through principal component analysis. The results show a factor loading of below 0.6; this indicates that corruption is not one of the major factors affecting the quality delivery of construction projects in Nigeria, as shown in Appendix 3. The findings further highlight some quality controls to overcome these challenges, and these are: adopting or establishing a formal QMS, promoting a culture of documentation as well as establishing, implementing, and maintaining quality policy and quality objectives. The following sub-section gives an account of the development of a conceptual quality management model.

5.1 The Conceptual Framework

Based on the global acceptance of ISO 9001 with its associated benefits, the structure of the proposed model in this research is largely based on it. One of the core principles of quality management is continual improvement; therefore, the proposed model in this research is expected to improve ISO 9001, but specifically designed in the context of construction organisations in Nigeria. The findings show that 60% of construction organisations have formal quality management systems, but quality awareness and QMS implementation remain low. Based on these, a new model that can easily be implemented needs to be created in the context of cultural practices in the Nigerian construction market. The framework consists of 8 integrated components, as displayed in Figure 4.

This research highlighted the difficulties in implementing ISO 9001 by Nigerian contractors. The difficulties include the high cost of its implementation and the daunting documentation process, and this is reflected in the low certification of ISO 9001 in Nigeria. Another challenge with ISO implementation is its generic nature; the construction industry has its peculiar characteristics such as site variations, the transient nature of projects and their uniqueness, and different construction processes compared with other industries. In addition, the ISO as an organisation has developed other industry-specific model for oil and gas, automotive, and medical devices, but they are yet to develop a construction-specific QMS standard. This led to Zubairu (2016)'s recommendation that a new framework that is cheaper and easy to implement is needed to improve the quality of construction projects in Nigeria.

Furthermore, this research highlights an apparent lack of consistent performance evaluation of quality management systems in Nigeria. The findings revealed that few construction companies in Nigeria have never performed an organised or planned quality audits to check the effectiveness of their QMSs. Figure 4 presents the conceptual Odiba quality management model for construction organisations in Nigeria based on the findings in this study. The model can be used by both clients (mainly the public sector) and contractors to bridge the gap between the current quality management practices and ISO 9001.

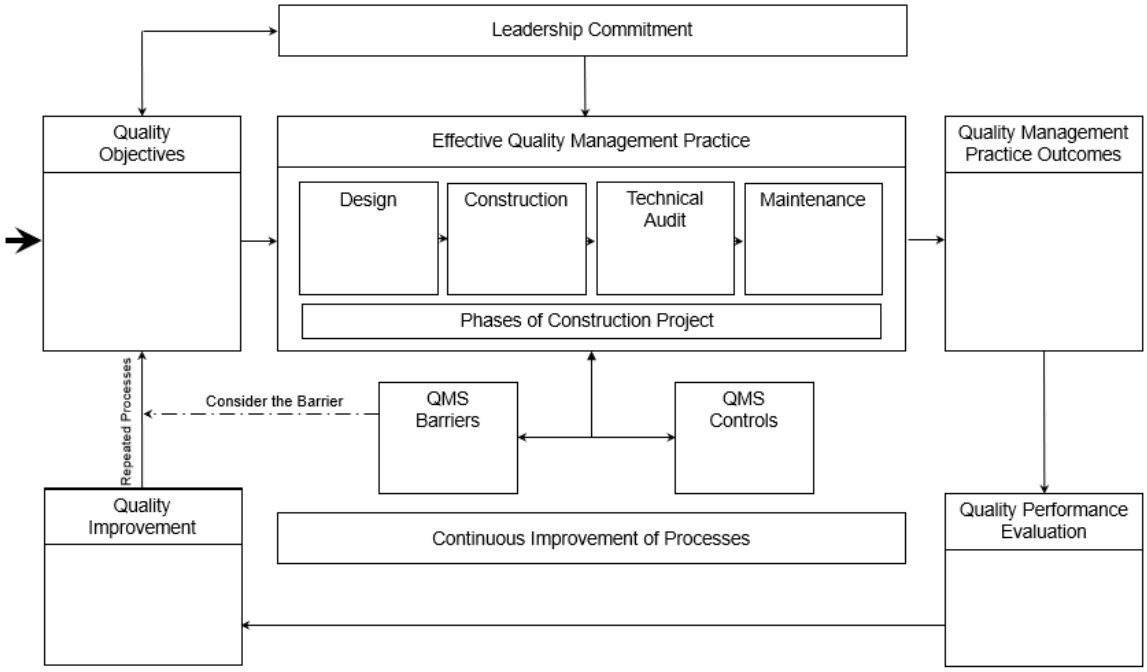


Figure 4: Proposed Odiba Model for Quality Management in Construction

A brief description of each model component is as follows:

- Quality Objectives: Quality objectives are goals set by organisations to meet the needs and expectations of clients and other relevant interested parties. The elements of the components as deduced from the analysis shown in Appendix 4 include customer requirements, employee needs/well-being; functional requirements; statutory and regulatory requirements, and organisational requirements.
- Leadership: Excellent leaders demonstrate commitment concerning QMS by ensuring that the resources needed for its implementation are available. The elements of leadership from the findings in this study include action plans to address risks and opportunities, establish quality policy and quality objectives, provision of adequate resources and infrastructure, establish the context of the quality management system, and continually improve processes.
- QMS Implementation Barriers: The elements include: faulty communication system, lack of consistent quality performance measurement; lack of quality training; resistance to change; and poor documentation of quality management systems.
- QMS Improvement Control: They serve as guidelines for QMS implementation. The elements of the components include a formal quality management system; and quality management system documentation.
- Effective Quality Management Practice: Quality is essential for all construction projects and needs to be managed effectively at all stages.
- Quality Management Practice Outcomes: Knowledge of expected outcomes can motive quality performance. The elements of the components include customer satisfaction, employee satisfaction; enhanced organisation's reputation; organisation's increased profit and growth, and safety of lives and properties.
- Quality Performance Evaluation: Construction organisations are required to evaluate the effective performance of their QMSs. It is essential to identify key performance indicators (KPIs) critical to the successful implementation of their QMSs. The KPIs identified in this study include leadership commitment level, engagement of people, customer focus and evidence-based decision making.
- QMS Improvement: Improvement is essential for any organisation to remain competitive and meet the future needs of clients and interested parties. The elements of the components include quality training, top management commitment, transparent procurement process and staff well-being.

5.2 The Distinctiveness of the Developed Model

There are similarities between the developed model and components of other models, such as ISO 9001, because this was the foundation for developing this model. However, unique aspects of the developed model can still be identified:

The distinctiveness of this model begins with the primary data collected in the geographical location of Nigeria to establish the current quality management practices and the major barriers affecting QMS implementation.

- Construction Processes: ISO 9001 is generic, but this model is specific to construction organisations.
- Employee satisfaction and well-being: The element of this model caught the attention of one of the focus group participants, one of whom stated, "what makes your model unique is the inclusion of employee satisfaction and well-being. In Nigeria here, most employers do not pay attention to workers' welfare".

QMS Barriers: This research shows an apparent lack of consistent performance evaluation of quality management systems in Nigeria. Understanding the barriers will assist project managers to plan for ways to mitigate them.

Quality Improvement: One of the key components of quality improvement is Corrective and Preventive Action (CAPA); an approach that investigates and solves problems, identifies causes, takes corrective action, and prevents recurrence of the root causes of any issue or quality failures as relating to construction processes or projects. The inclusion of CAPA in the model makes it unique in the context of the Nigerian construction industry.

This research focuses on the conceptual development of the model. However, further study will present the full model and how construction organisations can use it. The model is a repeated process that begins with establishing the quality objectives with top leadership involvement. In establishing the quality objectives, QMS barriers and control should be considered during the project's construction phases as reflected in the model.

The proposed model is a guideline, and the sub-components can be adopted selectively depending on the context of the project, but it is suggested to apply all the components of the model for improved quality delivery of projects, especially in Nigeria.

This research aimed to develop a conceptual quality management model that can drive a culture of quality, which can facilitate effective quality management practices in the construction industry in Nigeria. Figure 5 shows the components of the model that can create the right culture of quality for effective quality management practices, which in turn can facilitate the benefits realisation of a structured QMS such as customer satisfaction, reduced construction failures, profits to the organisation, and meeting applicable regulatory requirements as revealed in Appendix 6.

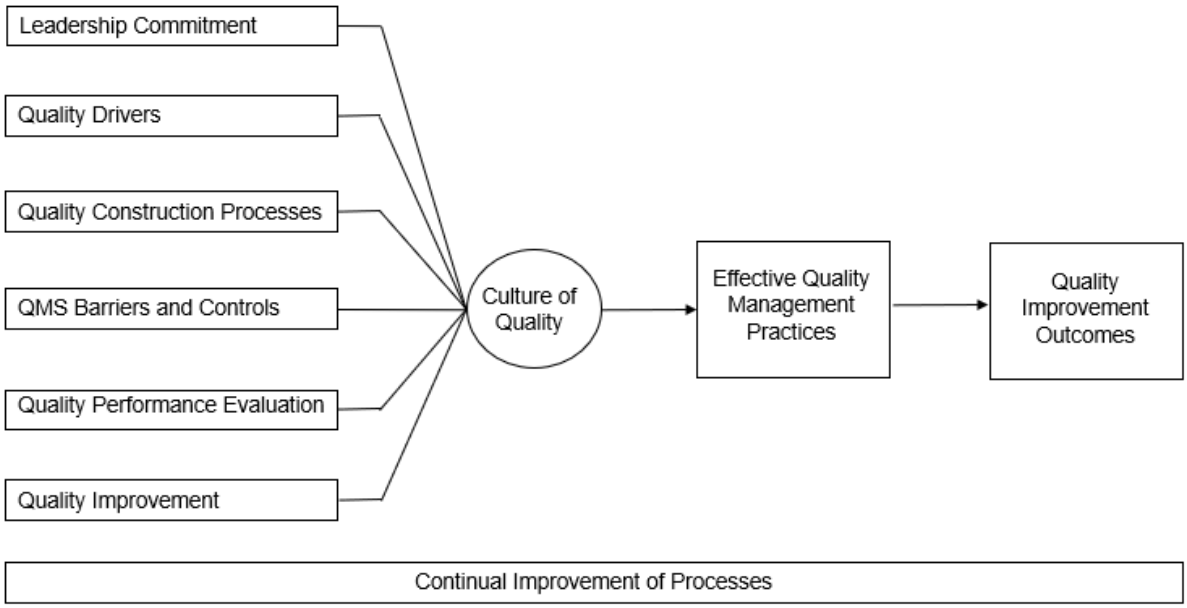


Figure 5: Components of Proposed Odiba Quality Management Model in Construction

6.0 Conclusions and Recommendations

The developed model in this study was designed to bridge the gap between the current management practices in Nigeria and ISO 9001. The findings show that 60% of construction organisations have a formal quality management system, but the quality awareness and QMS implementation remain low.

Based on the findings from data analysis and the information from the literature, it can be observed that there is a clear need for an improved quality management system standard in the construction industry in Nigeria. Although the result of the analysis showed that 60% of construction organisations have formal quality management systems in place, but the implementation remains low. This indicates that having a quality management system in place does not translate to quality project delivery. Further results show that most construction companies in Nigeria mainly practice inspection-based quality management, and only a few companies embrace ISO 9001 in construction in Nigeria. This validates the claim that inspection is the most used quality control tool among construction companies in Nigeria. It is noteworthy that the previous research from which inspection emerged was conducted in Lagos. However, the information from the research was used in the development of the questionnaire instrument. The research discussion concluded that inspection is the most widely used quality monitoring tool by construction organisations in Nigeria. The results also show flowcharts as a commonly used quality tool, but it is mostly used at the corporate level compared to the site level.

To improve the image of the Nigerian construction organisations in terms of quality project delivery, this research developed a new quality model in the context of cultural practices in the Nigerian construction market. The structure of the proposed model in this research is largely based on ISO 9001 because of its worldwide acceptance and associated benefits. The framework consists of eight integrated components inferred from data collection and analysis. In addition, the model contains some elements within the components, as displayed in Appendix 6. This will be expanded in further research.

Significant factors were identified in the implementation of quality management systems, and these are lack of top management commitment, lack of quality training, no consistent quality performance evaluation. In addition, the literature identified corruption as the main factor affecting construction quality in Nigeria, but this research, through the principal component analysis, unveiled an interesting contrary view. It shows that corruption is not among the main factors affecting construction quality in Nigeria, as recorded in the literature.

The proposed Odiba model is expected to facilitate effective quality management practices through managed and controlled processes to achieve improved quality performance outcomes in meeting functional, customer, regulatory, and statutory needs and requirements. The model is expected to improve projects quality delivery and the organisation's overall business performance.

Although this study provides insights into effective quality management practices in construction organisations in Nigeria, it has some limitations.

- The first major limitation was a lack of adequate literature in quality management practices related to construction organisations in Nigeria.
- Secondly, the data used in the development of the model was based on sampling and may not be an exact representation of the population of construction organisations in Nigeria.
- Appropriate professionals only validated the developed model. However, the model has not been used at the site level due to time constraints.

This paper recommends top management commitment to establishing and implementing quality policy and quality objectives in the Nigerian construction industry.

Quality awareness should also be promoted through statutory bodies at both local and national levels.

Construction organisations should institute periodic quality training to improve the quality knowledge of employees.

Further study should concentrate on the detailed operationalisation of the model and the guide for its implementation.

It can be concluded that the Proposed Odiba Quality Management Model in Construction is intended to improve the quality management practices both at corporate and project levels, and this will, in turn, facilitate quality project delivery in the construction industry in Nigeria and other countries with a similar culture. However, it is recommended for any country to examine its context before adopting this model. The expected benefits include improved competitiveness in national, regional, and international markets, organisational capability to meet clients and regulatory requirements, increased profit, and improved employee well-being and satisfaction, and ultimately clients' satisfaction.

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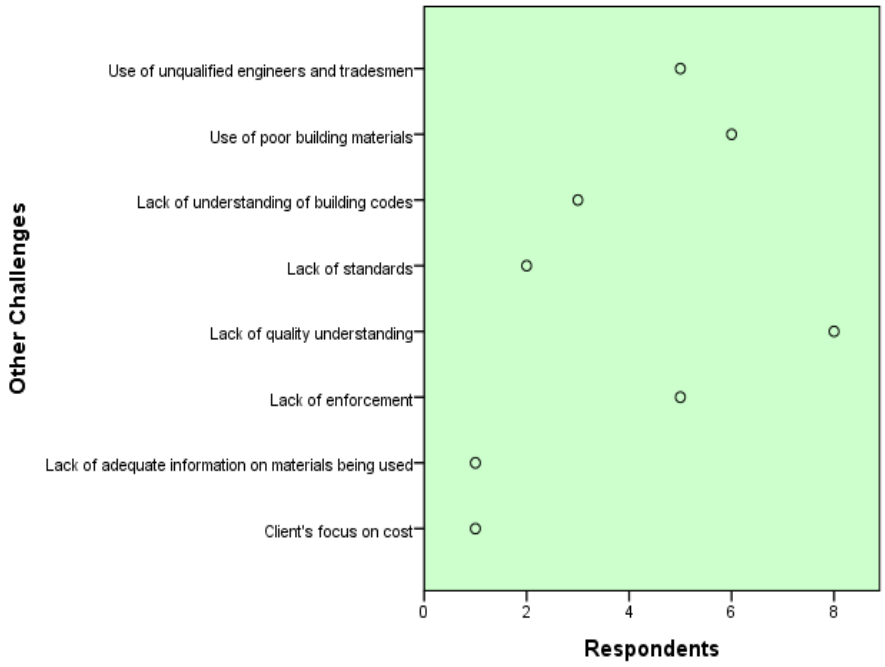
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Appendix 1: Other QMS Implementation Challenges

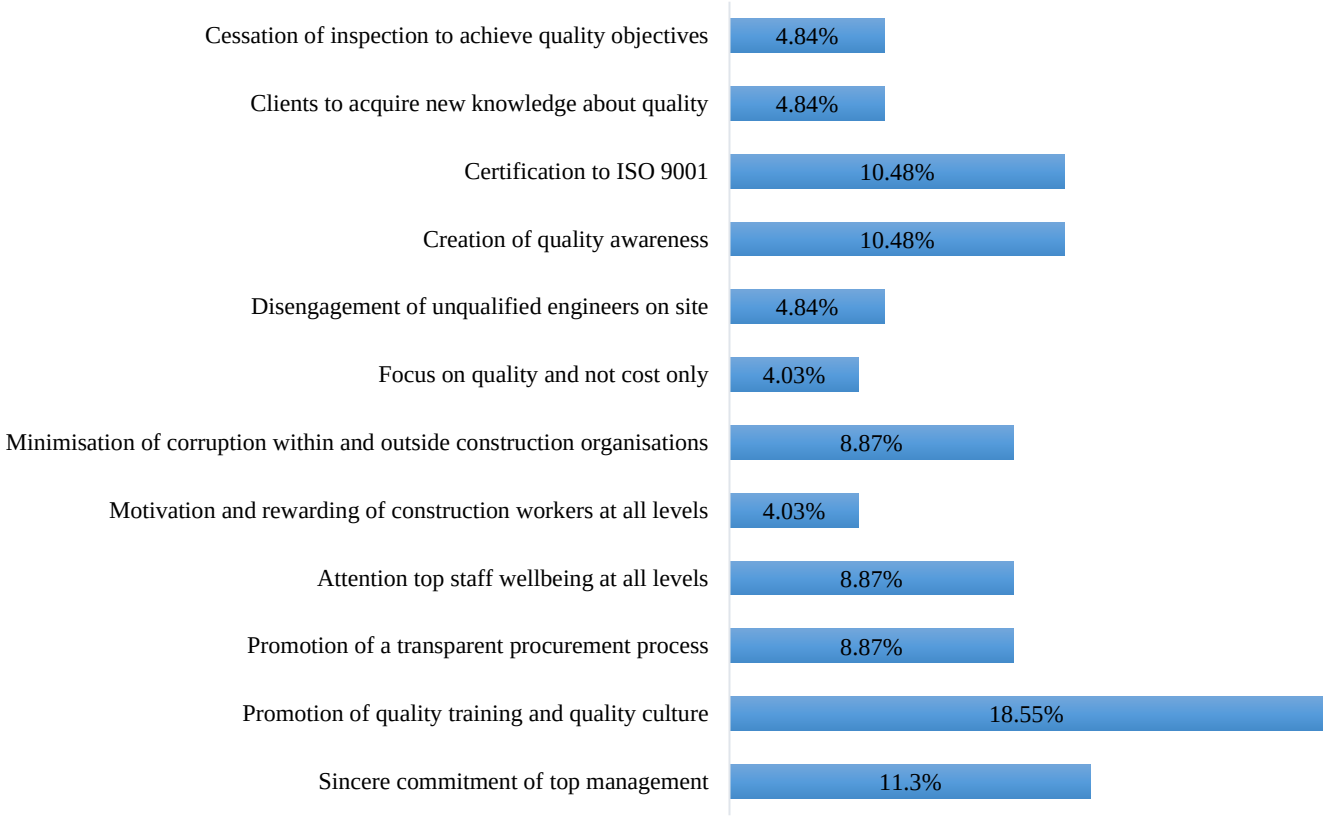
Appendix 1: Other QMS Implementation Challenges

	QMS Implementation Challenges	N	Mean	S.D
	Lack of top management's commitment to quality policy and quality objectives	124	2.6532	1.05956
2	Provision of inadequate resources	124	2.6290	1.06281
3	Resistance to change by the employees and sub-contractors	124	2.3629	.93125
4	Lack of quality culture within the organisation	124	2.3387	1.18175
5	Lack of quality training within the organisation	124	2.6532	1.13370
6	Faulty communication system	124	2.4274	1.10559
7	No consistent quality performance evaluation of the organisation's QMS	124	2.4919	1.16519
8	Poor documentation of the organisation's QMS.	124	2.3710	1.13673
9	Corruption within and outside the organisation.	124	2.7984	1.12604
	Total	124		

The results in the Table above fall mainly into two categories. The first category are the items that fall between the mean score of 2.6-2.8, and this reveals that numbers 1, 2, 5, and 9 strongly agreed and agreed with their respective numbers. Secondly, numbers 3, 4, 6, 7, and 8 revealed a mean of 2.4 approximately, and this signifies strongly disagreed and disagreed with their respective statements. Thus, the results confirm that the following factors affect quality management system implementation in construction organisations in Nigeria; lack of top management's commitment to quality policy and quality objectives, provision of inadequate resources, lack of quality training and culture, and corruption within and outside construction organisations. It is noteworthy that corruption emerged as the factor most affecting QMS implementation in Nigeria. However, if corruption is this high, why are some organisations still doing it right in Nigeria?



Appendix 2: Suggestions for Quality Improvement



Appendix 3: 45 Initial Variables, Extraction Method: Principal Component Analysis.

Variables	Initial	Extraction
Work Experience	1.000	.709
Types of Business Organisation	1.000	.871
Primary Business Activity/(ies)	1.000	.895
Project Types	1.000	.882
Formal quality management system	1.000	.837
Quality policy and quality objectives	1.000	.757
ISO 9001 Certification or other Standards	1.000	.775
Valid QMS certificate	1.000	.758
Effective Quality Reporting Structure	1.000	.564
Up to date QMS Manual	1.000	.824
Work Instructions	1.000	.782
QMS Documentation	1.000	.800
Effectiveness of QMS Documentation	1.000	.861
Procedure for Control of Quality Documents?	1.000	.824
Records of Previous Work	1.000	.827
EFQM	1.000	.748
TQM	1.000	.652
Internal Quality Audit	1.000	.752
External Quality Audi	1.000	.883
Control of Non-conforming Products or Services	1.000	.753
Corrective Action Plan	1.000	.787
Preventive Action plan	1.000	.830
Context of the QMS	1.000	.732
Quality policy and Quality Objectives	1.000	.792
Action Plans to Address Risks and Opportunities	1.000	.736
Provision of Resources and Appropriate Infrastructure	1.000	.742
Execution of Plans and Processes of QMS	1.000	.649

Periodic Quality Audit	1.000	.742
Continual Improvement of Processes	1.000	.786
Lack of Top Management's Commitment to Quality Policy and Quality Objectives	1.000	.704
Provision of Inadequate Resources	1.000	.688
Resistance to Change by the Employees and Subcontractors	1.000	.654
Lack of Quality Culture	1.000	.758
Lack of Quality Training	1.000	.731
Faulty Communication System	1.000	.757
Lack of Consistent quality performance evaluation	1.000	.669
Poor Documentation QMS.	1.000	.725
Corruption	1.000	.618
Customer Focus	1.000	.672
Leadership Commitment	1.000	.669
Process Approach	1.000	.833
Engagement of People	1.000	.669
Improvement	1.000	.687
Evidence-based Decision Making	1.000	.735
Relationship Management	1.000	.705

Appendix 4: Principal Component Analysis Result, Rotation Method: Promax with Kaiser Normalization

	Component					
	1	**2**	**3**	**4**	**5**	**6**
Faulty Communication System	.830					
Lack of Consistent quality performance evaluation	.740					
TQM	.719					
Lack of Quality Culture	.695					
Lack of Quality Training	.689					
Resistance to Change by Employees and Subcontractors	.642					
Poor Documentation QMS.	.618					
Action Plans to Address Risks and Opportunities		-.849				
Quality policy and Quality Objectives		-.830				
Provision of Resources and Appropriate Infrastructure		-.677				
Context of the QMS		-.664				
Continual Improvement of Processes		-.650				
Preventive Action plan		.640				
Provision of Inadequate Resources			.766			
Leadership Commitment			-.626			
Engagement of People			-.618			
Customer Focus			-.614			
Primary Business Activity/(ies)				-.941		
Project Types				-.930		
Types of Business Organisation				-.819		
Corrective Action Plan				.708		
Evidence-based Decision Making					-.790	
External Quality Audi					.643	
Periodic Quality Audit					-.617	
QMS Documentation						-791
Formal quality management system						.728
Quality policy and quality objectives						.673

Appendix 5: Extracted Components and Variables

Factor 1: Quality Drivers	
1	Customer requirements
2	Employee needs/well-being
3	Functional requirements
4	Statutory and regulatory requirements
5	Organisational requirements
Factor 2: Quality Management Implementation Challenges	
1	Faulty communication system
2	Lack of consistent quality performance measurement
3	Lack of quality training
4	Resistance to change
5	Poor documentation of quality management systems
Factor 3: Leadership Commitment	
1	Action plans to address risks and opportunities
2	Establishment of quality policy and quality objectives
3	Provision of adequate resources and infrastructure
4	Establishing the context of the quality management system
5	Continual improvement processes
Factor 4: Performance Evaluation Indicators	
1	Resources
2	Leadership Commitment
3	Engagement of People
4	Customer Focus
5	Evidence-based Decision Making
Factor 5: Construction Activities and Processes	
1	Primary business activities
2	Project types
3	Business organisation types
4	Corrective action plan
Factor 6: Quality Improvement Controls	
1	Formal quality management system
2	Quality management system documentation
3	Quality policy and quality objectives
Factor 7: Quality Management Practice Outcomes	
1	Customer satisfaction
2	Employee satisfaction
3	Enhanced organisation’s reputation
4	Organisation’s increased profit and growth
5	Safety of lives and properties
Factor 8: Quality Improvement	
1	Quality training and quality culture
2	Top management commitment
3	Transparent procurement process
4	Staff well-being

Appendix 6: Model with components and elements

