AN INVESTIGATION OF THE IMPACT OF QUALITY AND COST MANAGEMENT ON PROJECT PERFORMANCE IN THE CONSTRUCTION INDUSTRY IN NIGERIA

H. C. O. Unegbu, D.S. Yawas, B. Dan-asabe*
Department of Mechanical Engineering, Ahmadu Bello University, Zaria, Nigeria

*Corresponding email: chidieberehyg@gmail.com

ABSTRACT

The importance of quality and cost management in construction projects cannot be overstated as it significantly influences project outcomes. This research is aimed to examine the degree of quality and cost management implementation, assess its impact on construction project performance, and evaluate the factors that affect its implementation in Nigeria's construction industry. Quantitative research methods were employed, using a questionnaire with 68 variables and 15 constructs, utilizing a five-point Likert scale. Data was collected from 260 respondents, and 242 valid responses were used for analysis, employing Microsoft Excel, SPSS, and LISREL. Reliability and validity tests, including Crombach's alpha, composite reliability, and average variance extracted, were conducted for all constructs, establishing their suitability for further analysis. The exploratory factor analysis in SPSS revealed inadequate implementation of quality and cost management. This finding aligned with the confirmatory factor analysis results, which indicated a significant impact of the factors influencing quality and cost management implementation. The structural equation model (SEM) analysis, used to assess the impact of quality and cost management on construction project performance, demonstrated a high level of impact, with the strongest correlation observed between project cost monitoring and control and construction phase performance. Therefore, urgent measures are needed from industry stakeholders to address the factors hindering the effective implementation of quality and cost management, aiming to enhance project performance.

Keywords: Quality Management, Construction projects, Cost Management, Project performance

1.0   INTRODUCTION

The role of the construction industry in a country's economic development is crucial, encompassing job creation, revenue generation, and the provision of essential community facilities. However, this industry is notorious for encountering various challenges, particularly in quality and cost management. Effective management of quality and cost plays a pivotal role in project performance within the construction sector, significantly influencing project success. Quality management in construction projects entails implementing processes and practices that guarantee adherence to the required standards and specifications (Chen, 2009). Conversely, cost management in construction projects focuses on controlling expenses to ensure the project remains within budget (Panda, 2012). In recent years, numerous studies have explored the impact of quality and cost management on project performance within the construction industry (Ogunlana, 2010).

The importance of quality and cost management in the construction sector cannot be emphasized enough. Substandard work and excessive expenses have adverse effects on the industry, leading to project delays, dissatisfied stakeholders, and a negative industry reputation. Efficient management of quality and cost ensures that projects are completed on schedule, within the allocated budget, and meeting the required standards. This, in turn, enhances project performance and boosts

stakeholder satisfaction. Research has demonstrated that implementing quality management practices, such as quality control, quality assurance, and continuous improvement, positively affects project performance within the construction field (Chen, 2009). Similarly, effective cost management practices, such as budgeting, cost control, and value engineering, have been proven to contribute positively to project performance (Panda, 2012). Additionally, adept quality and cost management can minimize risks and enhance efficiency throughout the construction process (Ogunlana, 2010).

Furthermore, the impact of quality and cost management on project performance can be influenced by several factors, including project complexity, project size, and organizational culture (Chen, 2009). It is important to consider these factors when evaluating the impact of quality and cost management on project performance in the construction industry in Nigeria. In Nigeria, the construction industry is facing numerous challenges, including a lack of investment, inadequate infrastructure, and a shortage of skilled workers (Ogunlana, 2010). Despite these challenges, the construction industry in Nigeria continues to grow, driven by the country's need for infrastructure development. The impact of quality and cost management on project performance in this context is particularly important, as effective management can help to mitigate the challenges facing the industry and improve project outcomes. Effective quality and cost management practices are essential to ensure that projects are completed on time, within budget, and to the required standards.

This study aims to investigate the impact of quality and cost management on project performance in the construction industry in Nigeria. Nigeria's construction industry has faced several challenges in recent years, including project delays, cost overruns, and poor quality work (Ogunlana, 2010). These issues have led to dissatisfaction among stakeholders and an unfavorable reputation for the industry. Despite the significance of quality and cost management in the construction industry, little research has been done to examine their impact on project performance in Nigeria. This study aims to fill this gap in knowledge and provide valuable information to stakeholders in the industry on the importance of quality and cost management and its impact on project performance. The findings of this study will help to improve project performance in the construction industry in Nigeria and contribute to the body of knowledge in this area.

This study will focus on the impact of quality and cost management on project performance in the construction industry in Nigeria. The study will not focus on specific projects or specific construction firms but will instead focus on the construction industry in Nigeria as a whole. The study will cover both public and private sector construction projects and will consider both large and small scale projects. The study will also consider the challenges faced by stakeholders in the implementation of quality and cost management in the construction industry in Nigeria.

1.1 The Concept of Quality and Quality Management

The concept of quality and its management has been extensively explored and discussed in the fields of business, management, and engineering. It has become an indispensable aspect of organizations, regardless of their size or industry, as it plays a crucial role in determining customer satisfaction, competitiveness, and overall success. Quality can be defined in various ways, but a common understanding is that it pertains to the extent to which a product or service fulfills customer expectations. On the other hand, quality management involves a systematic and continuous approach to enhancing and maintaining the quality of an organization's offerings. This encompasses the development and implementation of quality policies, processes, and procedures to ensure that customer requirements and expectations are met.

In the context of project management, the concept of quality is multifaceted and encompasses diverse viewpoints from various stakeholders. According to the Project Management Institute (PMI, 2017), quality is seen as both adherence to predetermined requirements and fitness for use, which represents the ultimate goal of customers when it comes to a product. Another definition of quality comes from BS 5750 (1987), which defines it as the attributes and functional features of a project, product, or service that impact its ability to meet stated needs. Jabnoun (2000) defines quality as the ability of a project, product, or service to conform to design requirements. Meanwhile, Evans (2008) discovered that managers in the United States define quality as perfection, consistency, waste elimination, delivery speed, compliance with policies and procedures, providing a usable product, doing it right the first time, pleasing customers, and offering total customer service and satisfaction. Lesley

and Malcolm (1992) view quality as a means to maintain a competitive advantage and ensure customer loyalty and satisfaction. Quality can be categorized into two types: product quality, which refers to the tangible features perceived by customers, and service quality, which relates to the overall customer experience. A successful project is one that meets its quality, cost, and schedule requirements, ultimately leading to customer satisfaction. The concept of quality management holds significant importance in industries such as production, manufacturing, construction, and services (Japhary, 2017).

In construction projects, quality management presents challenges due to the substantial capital costs involved and the difficulty in identifying defects after completion. Quality in construction is achieved when the project outcome aligns with the design requirements and functional expectations of the project owner and regulatory agencies (Saeed and Hasan, 2012). The construction industry currently faces the challenge of sustaining effective quality management processes throughout the project lifecycle, encompassing design, planning, construction, operation, and maintenance phases (Zhai et al., 2014). To be effective, quality management in construction projects must address factors such as coordination, integration with the organizational structure, involvement and motivation of top management, and continuous process improvement (Abdel-Razek, 1998; Asim et al., 2013). Despite the significance of quality in construction, the focus of construction organizations often prioritizes time and cost over quality. This highlights the need for research to assess quality management practices in the construction industry, especially in developing countries like Nigeria (Abdel-Salam and Gad, 2009).

1.2 *The Management of Quality in Construction Projects*

Quality management plays a crucial role in ensuring the success of construction projects. By adopting effective quality management practices, project outcomes can be enhanced, resulting in greater customer satisfaction, cost reduction, and improved project performance (Chen, 2009). Quality management encompasses a systematic approach that involves planning, designing, implementing, and monitoring processes to ensure that projects meet the required level of quality (Chen, 2009). Research indicates that the implementation of quality management practices leads to significant enhancements in project outcomes. In the construction industry in Hong Kong, Lee and Cheung (2011) discovered that the adoption of quality management practices resulted in improved customer satisfaction, cost reduction, and enhanced project performance. Similarly, in China's construction industry, Li et al. (2015) found that the implementation of quality management practices led to improved project outcomes.

Furthermore, quality management can enhance the overall efficiency and effectiveness of construction projects. Padiyar (2013) found that the incorporation of quality management practices increased productivity in India's construction industry. Moreover, quality management can mitigate the risk of project failures, which can result in substantial financial losses (Padiyar, 2013). The benefits of quality management extend beyond the construction sector. Other industries, such as manufacturing and services, can also achieve improved outcomes by implementing quality management practices. For instance, in the service industry, Al-Ajmi (2015) demonstrated that the adoption of quality management practices led to enhanced customer satisfaction, cost reduction, and improved performance.

1.3 The Concept of Cost and Cost Management

Cost and cost management are crucial concepts that have been widely studied and researched over the years. The concept of cost is used to describe the resources that are consumed in the process of creating and delivering products and services to customers. Cost management, on the other hand, is a discipline that involves the process of identifying, measuring, analysing, and controlling the costs of a company. The importance of cost management in business has been emphasized by several authors. According to Jain and Narang (2012), cost management is essential for a company's survival, as it enables the company to maintain its competitiveness by reducing costs and maximizing profits. Horngren, Datar, and Foster (2010) also note that cost management plays a critical role in determining a company's success, as it helps the company to improve its financial performance and achieve its goals.

Cost management strategies and techniques have been developed over the years to help companies minimize costs and maximize profits. Some of the common strategies used in cost management include cost analysis, cost reduction, cost control, and cost optimization (Al-Jarallah, Al-

Mudimigh, & Al-Mutairi, 2016). Cost analysis, for example, involves the examination of costs to identify areas where costs can be reduced or eliminated. Cost reduction strategies aim to reduce costs by streamlining operations, reducing waste, and eliminating unnecessary activities. Cost control strategies are used to monitor and regulate costs, while cost optimization strategies aim to find the most efficient and effective ways to allocate resources and reduce costs.

One of the most critical aspects of cost management is the measurement of costs. The accuracy of cost measurements is critical to the success of cost management efforts, as inaccurate cost measurements can lead to incorrect decisions and ineffective cost management strategies (Jain & Narang, 2012). Cost measurement methods include direct costing, indirect costing, and activity-based costing (Horngren, Datar, & Foster, 2010). Direct costing measures only the direct costs of a product or service, while indirect costing measures the indirect costs, such as overhead expenses. Activity-based costing, on the other hand, is a method that uses cost drivers to allocate indirect costs to specific activities.

1.4 Cost Management in Construction

Cost management is a critical component of project success in the construction industry. It refers to the process of identifying, estimating, and controlling costs in order to achieve the project's goals within the given budget (Ogunlana, 2010). Cost management is critical for ensuring that construction projects are completed within budget, which is important for ensuring the financial viability of projects and for ensuring that projects are completed on time (Ogunlana, 2010). Studies have shown that cost management can have a positive impact on project performance. Guan et al. (2014) found that effective cost management practices were associated with improved project outcomes, including increased project efficiency, reduced costs, and improved project performance in Singapore's construction industry. Similarly, Ndekugri et al. (2011) found that effective cost management practices were associated with improved project outcomes in the UK construction industry.

Cost management can also help to reduce the risk of cost overruns, which can have a significant impact on project viability. For example, Ndekugri et al. (2011) found that effective cost management practices were associated with reduced risk of cost overruns in the UK construction industry. This is particularly important in the Nigerian construction industry, where cost overruns are a common problem (Ogunlana, 2010). The benefits of cost management are not limited to the construction industry. Cost management practices can also lead to improved outcomes in other industries, including the manufacturing and service industries. For example, Chen and Yeh (2015) found that effective cost management practices were associated with improved performance in the service industry.

1.5 Quality and Cost Management in Nigeria

Despite the importance of quality and cost management in the construction industry, there is limited research on the topic in Nigeria. The existing research has focused primarily on the challenges faced by stakeholders in the implementation of quality and cost management practices in the Nigerian construction industry. Adebisi and Adewumi (2017) found that the implementation of quality management practices in the Nigerian construction industry is often hindered by a lack of resources, including manpower, equipment, and materials.

Similarly, Ogunlana (2010) found that cost management practices in the Nigerian construction industry are often hindered by a lack of effective cost control systems and a lack of skilled personnel. These challenges can lead to cost overruns and decreased project performance in the Nigerian construction industry. Despite these challenges, the benefits of quality and cost management cannot be ignored. Implementing effective quality and cost management practices can lead to improved project outcomes, including increased customer satisfaction, reduced costs, and improved project performance.

1.6 The Impact of Quality and Cost Management on Project Performance in Construction

The literature extensively discusses the influence of quality and cost management on project performance within the construction industry. Numerous studies have indicated that proficient quality and cost management strategies result in enhanced project outcomes, including greater customer

satisfaction, cost reduction, and improved project performance (Hwang & Yoon, 2001; Turnipseed, 2003). Quality management is crucial for project performance in construction as it involves implementing processes and practices to ensure the delivery of high-quality products and services (Lu & Yang, 2010). Similarly, cost management is critical in the construction industry for project performance, encompassing processes and practices to control expenses and minimize waste (Javalgi, White & Ali, 2006).

There are various methods available to implement quality and cost management practices, such as quality control and assurance processes, cost estimating and budgeting processes, and cost tracking and control processes (Turnipseed, 2003). Effective implementation of these practices contributes to timely project completion, adherence to budgetary constraints, and fulfillment of quality standards (Lu & Yang, 2010). Nevertheless, implementing quality and cost management practices in construction presents challenges. Obstacles include inadequate cost control systems, scarcity of skilled personnel, and insufficient commitment from stakeholders, which hinder successful implementation (Gunlana, 2010).

1.7 The Construction Industry in Nigeria

The construction industry is an essential sector in Nigeria, contributing significantly to the country's economy and providing job opportunities for its citizens. It has been characterized by low productivity, high costs, and low quality of construction services (Adediran & Adeyemo, 2013). Despite the recent growth in the sector, the construction industry in Nigeria is still facing various challenges, including lack of technical skills, inadequate infrastructure, and limited access to funding.

The construction industry in Nigeria has experienced significant growth in recent years, particularly in the area of real estate development (Adediran & Adeyemo, 2013). This growth can be attributed to the increasing demand for housing and infrastructure, as well as the government's efforts to develop the sector. The Nigerian government has implemented various policies and initiatives aimed at improving the construction industry, including the establishment of the Construction Industry Development Board (CIDB) to regulate and promote the sector (CIDB, 2020). The Nigerian construction industry has also been boosted by increased foreign investment, particularly in the form of joint ventures with local companies (Adeyemo & Adediran, 2012).

In spite of the advancements and expansion witnessed in the Nigerian construction sector, it continues to encounter numerous obstacles that impede its advancement. A few of these hurdles encompass:

1. Lack of Technical Skills: The construction industry in Nigeria is facing a shortage of skilled professionals, particularly in the areas of architecture, engineering, and construction management (Adeyemo & Adediran, 2012). This shortage is contributing to low productivity and poor quality of construction services.
2. Inadequate Infrastructure: The lack of basic infrastructure, such as electricity and water supply, is affecting the performance of the construction industry in Nigeria (Adeyemo & Adediran, 2012). This is hindering the development of the sector and increasing the costs of construction services.
3. Limited Access to Funding: The construction industry in Nigeria is facing difficulties in assessing adequate funding for its projects (Adediran & Adeyemo, 2013). This is due to the lack of an efficient banking system and the limited availability of financing options for construction companies.

The Nigerian government and the construction industry stakeholders are making efforts to overcome the challenges facing the sector. The government has implemented various policies aimed at improving the infrastructure and increasing access to financing for the construction industry (CIDB, 2020). The private sector is also making efforts to overcome the shortage of skilled professionals by investing in the training and development of local workers (Adeyemo & Adediran, 2012).

1.8. Previous Studies on Quality and Cost Management in Nigeria

Several studies have been carried out on quality and cost management in Nigeria's construction industry. Gunlana (2010) examined the difficulties faced by stakeholders when implementing quality and cost management practices in the Nigerian construction sector. The study identified two major challenges: the absence of effective cost control systems and a lack of skilled personnel in Nigeria. Similarly, Adebayo, Adejare, and Obafemi (2015) investigated the influence of cost management practices on the success of construction projects in Nigeria. Their findings emphasized the criticality of accurate cost estimation, budgeting, and the negative impact of stakeholders' lack of commitment on the implementation of effective cost management practices in Nigeria.

Adebayo et al. (2018) conducted a qualitative study to explore how cost management practices affect the success of construction projects in Nigeria. The researchers interviewed construction professionals and stakeholders involved in various projects in Nigeria. Their study revealed that budgeting, estimating, and cost control significantly influence project success in terms of time, cost, and quality. In-depth interviews allowed the authors to gather detailed insights, but the study's limitation was the small sample size, as only a few construction professionals and stakeholders were interviewed. Olutola and Babalola (2019) conducted a survey to examine the impact of quality management practices on project performance in Nigeria's construction industry. The study utilized questionnaires to collect data from a sample of construction projects. The findings demonstrated that quality planning, control, and assurance positively affected project performance in terms of time, cost, and quality. Effective quality management practices resulted in projects being completed on time, within budget, and to a high standard. The study's limitations included a small sample size and a limited geographic scope.

Dauda and Salau (2020) conducted a valuable study that sheds light on the influence of cost and quality management practices on the success of construction projects in Nigeria. Their findings suggest that integrating and implementing effective cost and quality management practices comprehensively significantly contribute to project success in the Nigerian construction industry. However, further research is necessary to address the study's limitations and gain a more comprehensive understanding of how cost and quality management practices impact construction project success in Nigeria. Akintoye and Ogunlana (2021) conducted a study to examine how quality management affects project performance in the Nigerian construction industry. The study involved collecting data from construction professionals and project managers through surveys and interviews. The findings revealed that quality management practices, such as quality planning, control, and assurance, significantly impact project performance in terms of time, cost, and quality. The authors emphasized the importance of implementing effective quality management practices to enhance project performance in the Nigerian construction industry. However, they suggested that future research should consider a larger sample size and a wider range of participants to increase the generalizability of the findings.

In Sanusi and Ogunlana's (2022) review of cost and quality management practices in the Nigerian construction industry, they analysed relevant literature to understand the current state of these practices. The findings indicated that although cost and quality management practices are widely recognized as important, their implementation in the Nigerian construction industry is still limited. The authors concluded that more efforts are needed to improve the implementation of these practices in the industry. However, a critique of the study is that it lacks an in-depth examination of the reasons behind the limited implementation and potential solutions to address the issue. Babalola and Adebayo (2023) conducted a quantitative study to assess the effectiveness of quality and cost management practices in the Nigerian construction industry. The findings showed that while these practices are considered essential for improving project performance, their implementation in the Nigerian construction industry is still limited. The authors concluded that greater investment in training, resources, and infrastructure is necessary to enhance the implementation of these practices. The study had limitations, including a small sample size and the absence of a comparative analysis with other countries.

Based on the reviewed literature, there is a need for further studies on the impact of quality and cost management practices on project performance in the Nigerian construction industry. This study aims to investigate this impact using a large sample size. It will examine the level of implementation of quality and cost management and provide a comprehensive analysis of their relationship with project performance in the Nigerian construction industry using a structural equation model (SEM).

The study will also offer insights into the challenges faced by stakeholders in implementing quality and cost management practices in the Nigerian construction industry.

2.0 METHOD

This study employed a quantitative research method to collect data from 260 construction professionals in Nigeria. The purpose was to evaluate the effectiveness of quality and cost management practices in the Nigerian construction industry and their influence on project performance. Quantitative research involves the systematic gathering and analysis of numerical data, providing a structured approach to data collection and analysis. It allows researchers to identify patterns and relationships between variables (Krippendorff, 2013). The advantages of this method include generalizability to larger populations, the use of standardized measures for reliable and valid data, and the ability to test hypotheses using statistical methods (Creswell, 2014). Additionally, it facilitates precise measurements and comparisons, enabling valid inferences about diverse populations (Hulley, Cummings, Browner, Grady, Hearst, & Newman, 2013).

The study developed a conceptual framework based on existing literature to determine the constructs and variables for data collection. A questionnaire consisting of 15 constructs and 68 variables was designed and used for data analysis. The study focused on assessing the level of implementation of quality and cost management, the impact of these practices on project performance, and the factors influencing their implementation in the Nigerian construction industry.

2.1 Method of Data Collection

In this study, data was collected using a self-administered questionnaire survey. The purpose of the questionnaire was to gather information about the extent to which quality and cost management practices are implemented in the Nigerian construction industry, as well as the factors influencing their implementation. The questionnaire was carefully designed to ensure that the questions were easy to understand and relevant to the research objectives. A total of 260 construction professionals in Nigeria, including project managers, site engineers, quantity surveyors, and other relevant personnel, were selected as participants using a convenience sampling technique.

The questionnaire for the study consisted of three sections. The first section focused on gathering demographic data about the respondents and their construction companies. The second section aimed to collect data on the quality and cost management practices, which were selected from the Project Management Body of Knowledge (PMBOK), as well as the project performance variables for construction projects. The third section aimed to collect data on the main factors that affect the effective implementation of quality and cost management in the Nigerian construction industry. Both sections two and three utilized a five-point Likert scale, with ratings ranging from 1 (neutral) to 5 (strongly agree). The constructs and variables used in the study are presented in Table 1 to Table 4.

Table 1: Quality Management Practices

SN	Constructs	Variables	Label
1	Plan Quality Management: (PQM)	Project requirements were clearly defined to ensure that the end product meets the customer's needs	X11
2		Plans were developed for quality management that outlines the activities and processes to be implemented to ensure that the project meets the quality criteria	X12
3		Quality measures were used to evaluate the quality of the project and its processes	X13
4		Identifying, assessing and mitigating potential risks that could impact the quality of the project were observed	X14
5		Active engagement of stakeholders to ensure that their needs and expectations are considered in the quality planning and management process was observed	X15
6		Ongoing process of identifying and implementing improvements to the quality management are followed	X16

7	Quality Assurance: (QA)	Documented processes and procedures were followed to ensure that the project meets the quality criteria.	X21
8		Project documentation was managed and controlled to ensure that it is accurate, complete and up-to-date.	X22
9		There was periodic review and evaluation of the project processes and outputs to ensure that they are consistent with the quality standards and requirements	X23
10		Training was provided to project team members to ensure that they have the knowledge and skills required to implement the quality management processes	X24
11		Deviations from the quality standards and requirements were identified, documented and addressed	X25
12		There was ongoing process of monitoring the project processes and outputs to identify areas for improvement and provide feedback to the project team	X26
13	Quality Control: (QC)	The process of evaluating the project outputs to ensure that they meet the quality criteria was followed	X31
14		The process of managing and controlling the project components and artifacts to ensure that they are accurate and consistent with the quality standards and requirements was followed	X32
15		The process of verifying that the project outputs meet the specified requirements and are consistent with the quality criteria was followed	X33
16		The process of identifying, documenting and resolving defects in the project outputs was followed	X34
17		The process of identifying and analysing the underlying causes of defects or deviations from the quality standards and requirements was followed	X35
18		The process of communicating the quality status and results of the project to stakeholders and making decisions based on the results was followed	X36

Table 2 Cost Management Practices

SN	Constructs	Variables	Label
1	Project Cost Planning (PCP)	Project scope definition was implemented	X41
2		Resource identification and allocation were implemented	X42
3		Activity Cost Estimation	X43
4		Budget approval and baseline development were implemented	X44
5		Cost risk identification was implemented	X45
6		Budget review was implemented	X46
7		Cost contingency planning was implemented	X47
8	Project Cost Monitoring and Control (PCMC)	Cost tracking and reporting tools were implemented	X51
9		Regular cost status report generation was implemented	X52
10		Cost variance identification was implemented	X53
11		Cost recovery and correction planning were implemented	X54
12		Earned value analysis and tracking were implemented	X55
13		Performance measurement and evaluation were implemented	X56
14		Performance variance analysis and correction planning were implemented	X57
15	Project Cost Closeout (PCC)	Final cost report generation was implemented	X61
16		Final cost audit and approval were implemented	X62
17		Unused budget reallocation was implemented	X63

18		Cost management best practices identification was implemented	X64
19		Lessons learned documentation and sharing were implemented	X65

Table 3: Factors Affecting the Effective Implementation of Quality and Cost Management

| SN	Construct	Variables	Label
1	Organizational factors (OF)	Company size hindered implementation	X01
2		Ownership structure hindered implementation	X02
3		Management systems hindered implementation	X03
4		Organizational culture hindered implementation	X04
5	Industry factors: (IF)	The nature of the construction industry in Nigeria hindered implementation	X05
6		The level of competition hindered implementation	X06
7		The regulatory environment hindered implementation	X07
8	Project factors: (PF)	Project size hindered implementation	X08
9		Project complexity hindered implementation	X09
10		Project location, hindered implementation	X10
11	Resources factors (RF)	Investment in technology hindered implementation	X11
12		Human resources hindered implementation	X12
13		Equipment hindered implementation	X13
14	Economic factors (EF)	The state of the economy hindered implementation	X14
15		The availability of funding hindered implementation	X15
16		The cost of implementing quality hindered implementation	X16
17		Cost management practices hindered implementation	X17
18	Political and legal factors: (PLF)	Government policies hindered implementation	X18
19		Government regulations hindered implementation	X19
20		Legal frameworks hindered implementation	X20

Table 4: Project Performance Metrics.

SN	Constructs	Variables	Label
1	Planning and Design Phase Performance (PDPP)	Evaluation of project scope and goals was carried out	Y11
2		Assessment of project schedule was carried out	Y12
3		Review of project budget was observed	Y13
4		Evaluation of project risk management was observed	Y14
5		Analysis of project team organization and communication was carried out	Y15
6	Construction Phase Performance (CPP)	Evaluation of construction quality and safety was carried out	Y21
7		Assessment of project progress and schedule performance was observed	Y22
8		Analysis of project cost control and cost management was observed	Y23
9		Evaluation of project risk management was observed	Y24
10		Analysis of project team organization and communication was observed	Y25

11	Post-Construction Phase Performance(PCPP)	Evaluation of project maintenance and operations was carried out	Y31
12		Assessment of project sustainability and energy efficiency was carried out	Y32
13		Analysis of project life cycle cost and value was observed	Y33
14		Evaluation of project user satisfaction was carried out	Y34

2.2 Hypothetical Model

The development of the hypothetical SEM model involved utilizing three quality management constructs: plan quality management, quality assurance, and quality control. Additionally, three constructs of cost management were employed: project cost planning, project cost monitoring and control, and project cost closeout. Furthermore, three project performance assessment metrics were considered: planning and design phase performance, construction phase performance, and post-construction phase performance. The relevant variables for each of these constructs and metrics were derived from the existing literature. To create the model, brainstorming sessions were conducted with ten experts from the construction industry, and the works of Shanmugapriya and Subramanian (2015) as well as Unegbu et. al., (2021) were taken into account. Empirical testing in LISREL was conducted on the following 20 positive relationships that were developed.

1. Plan quality management positively impacts planning and design phase performance.
2. Plan quality management positively impacts construction phase performance.
3. Plan quality management positively impacts post-construction phase performance.
4. Quality assurance positively impacts planning and design phase performance.
5. Quality assurance positively impacts construction phase performance.
6. Quality assurance positively impacts post-construction phase performance.
7. Quality control positively impacts planning and design phase performance.
8. Quality control positively impacts construction phase performance.
9. Quality control positively impacts post-construction phase performance.
10. Project cost planning positively impacts planning and design phase performance.
11. Project cost planning positively impacts construction phase performance.
12. Project cost planning positively impacts post-construction phase performance.
13. Project cost monitoring and control positively impacts planning and design phase performance.
14. Project cost monitoring and control positively impacts construction phase performance.
15. Project cost monitoring and control positively impacts post-construction phase performance.
16. Project cost closeout positively impacts planning and design phase performance.
17. Project cost closeout positively impacts construction phase performance.
18. Project cost closeout positively impacts post-construction phase performance.
19. Planning and design phase performance positively impacts construction phase performance.
20. Planning and design phase performance positively post-construction phase performance.
21. Construction phase performance positively impacts post-construction phase performance.
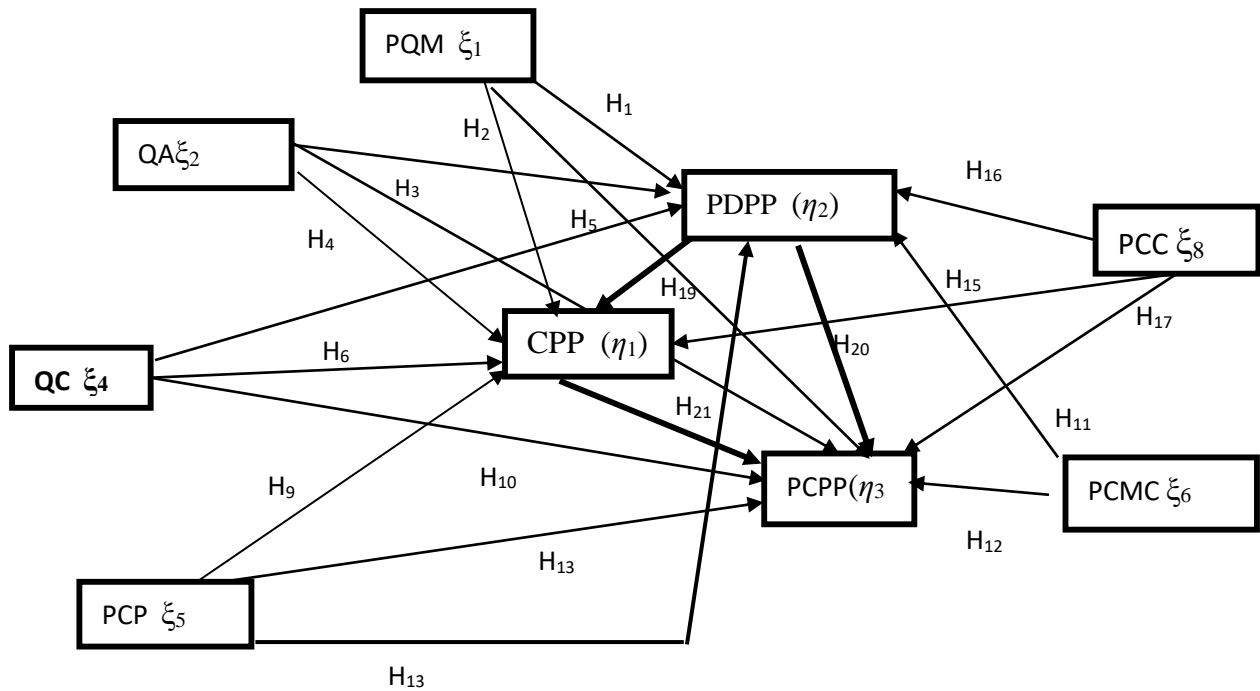
Figure 1: Hypothetical SEM Model

2.3 Data Analysis Method

The collected questionnaire data underwent analysis using Microsoft Excel, SPSS, and LISREL software in five stages. The initial stage involved conducting preliminary data analyses to assess the reliability and validity of the constructs. This included utilizing the Crombach's alpha test, the composite reliability test (CR), and the average variance extracted (AVE). The Crombach's alpha test was performed in SPSS, with values above 0.5 considered significant. Both the CR and AVE analyses were conducted in Microsoft Excel, considering values greater than 0.5 as significant for the constructs (Hair et al., 2010). In the second stage, descriptive statistics in SPSS were employed to analyse the demographics of the respondents and the construction companies. Phase three employed exploratory factor analysis (EFA) to reduce the number of variables used for the structural equation modeling (SEM). Only variables with factor loadings exceeding 0.5 were considered for analysis in SEM (Karl et al., 2016). The results also indicated the level of implementation of quality and cost management.

The fourth stage involved testing and modifying the hypothetical SEM using SIMPLEX Syntax. The final model was validated using goodness-of-fit statistics presented in Table 5, which aimed to identify the interaction between quality management, cost management, and project performance. In the final stage, confirmatory factor analysis (CFA) was employed to determine the extent of impact of the factors influencing the effective implementation of quality and cost management in construction projects. The level of impact was assessed based on the factor loadings (Karl et al., 2016).

Table 5: Goodness of Fit Statistics

SN	Goodness of Fit Statistic	Description
1	Root Mean Square Error of Approximation (RMSEA)	Measures the fit of the model to the data, taking into account both misfit and overfit.
2	Comparative Fit Index (CFI)	Measures the improvement in fit from a null model to the specified model.
3	Tucker-Lewis Index (TLI)	Similar to the CFI, measures the improvement in fit from a null model to the specified model.
4	Standardized Root Mean Square Residual (SRMR)	Measures the average magnitude of the residuals in standardized units.

5	Chi-square/Degrees of Freedom (χ2/df)	Measures the goodness of fit of the model to the data.

SIMPLES SYNTAX FOR SEM

Raw Data from file 'C:\Users\user\Desktop\SPSS\sem 1.psf'
Latent Variables PDPA CPP PCPP PQM QA QC PCP PCMC PCC
Relationships
PDPP = CPP PCPP PQM QA QC PCP PCMC PCC
CPP = PDPP PCPP PQM QA QC PCP PCMC PCC
PCPP = PDPP CPP PQM QA QC PCP PCMC PCC
Y11-Y15 = PDPP
Y21-Y25 = CPP
Y31-Y34 = PCPP
X11-X16 = PQM
X21-X26 = QA
X31-X36 = QC
X41-X47 = PCP
X51-X57 = PCMC
X61-X65 = PCC
Path Diagram
End of Problem

4.0 RESULTS

The individuals were requested to furnish details regarding their age, sex, educational history, duration of involvement in the construction sector, and their present occupational designation. Among the 260 surveys distributed for the research, 242 legitimate responses were utilized for the analysis of data. The findings indicated that most participants were males (73%), with an average age of 35 years and an average experience of 10 years in the construction industry. The largest portion of participants consisted of project managers (37%), followed by site engineers (28%) and quantity surveyors (18%).

4.1 Preliminary Data Analyses

The result of the reliability and validity emerged significant for all the constructs as shown in Table 6 Out of the 51 variables used for exploratory factor analyses, 17 had factor loadings less than 0.5 which disqualified them for being used in the SEM. The result of the exploratory factor analyses was shown in Table 4.2. Based on this preliminary data analyses, 30 variables and 9 constructs were used for the SEM analyses in LISREL.

Table 6: Reliability and Validity Analyses

| SN	Construct	(a)	CR	AVE
1	Planning and Design Phase Performance (PDPP)	0.606	0.8259	*0.78*
2	Construction Phase Performance: (CPP)	0.890	0.7645	0.658
3	Post-Construction Phase Performance(PCPP)	0.822	0.7695	0.740
4	Plan Quality Management: (PQM)	0.848	0.7893	0.656
5	Quality Assurance: (QA)	0.785	0.7636	0.670
6	Quality Control: (QC)	0.675	0.7209	0.763
7	Project Cost Planning (PCP)	0.7191	0.6702	0.718
8	Project Cost Monitoring and Control (PCMC)	0.7877	0.6775	0.743
9	Project Cost Closeout (PCC)	0.675	0.833	0.651

Table 7: Exploratory Factor Analyses

SN	Variable	Factor Loading
1	Y11	.711
2	Y12	.418

| 3	Y13	.475
4	Y14	.756
5	Y15	.796
6	Y21	.804
7	Y22	.401
8	Y23	.755
9	Y24	.474
10	Y25	.626
11	Y31	.658
12	Y32	.766
13	Y33	.456
14	Y34	.747
15	X11	.774
16	X12	.482
17	X13	.760
18	X14	.741
19	X15	.768
20	X16	.402
21	X21	.744
22	X22	.761
23	X23	.703
24	X24	.708
25	X25	.429
26	X26	.487
27	X31	.746
28	X32	.733
29	X33	.482
30	X34	.447
31	X35	.698
32	X36	.783
33	X41	.317
34	X42	.728
35	X43	.718
36	X44	.714
37	X45	.479
38	X46	.390
39	X47	.770
40	X51	.693
41	X52	.656
42	X53	.454
43	X54	.708
44	X55	.452
45	X56	.480
46	X57	.704
47	X61	.721
48	X62	.742
49	X63	.478
50	X64	.772
51	X65	.731

4.2 The Impact of Quality and Cost Management on the Performance of Construction Projects

The outcome of the testing of the hypothetical SEM model in LISREL is as shown in Figure 1. The experimental SEM was modified by deleting paths with low path coefficients in order to improve the value of the goodness of fit statistics. The deleted paths were PCC-PDPP, PCMC-PDPP, QC-PDPP and QA-PDPP. This modification led to a better goodness of fit values and the resulting modified model is as shown in Figure 2.
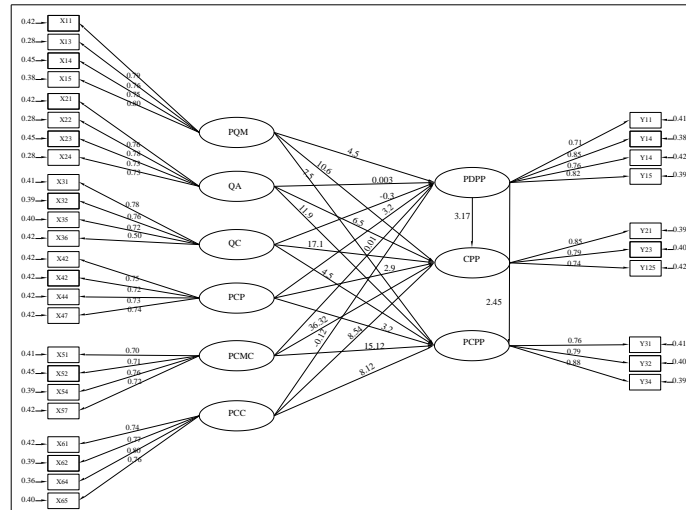
Figure 2: Experimental SEM Model
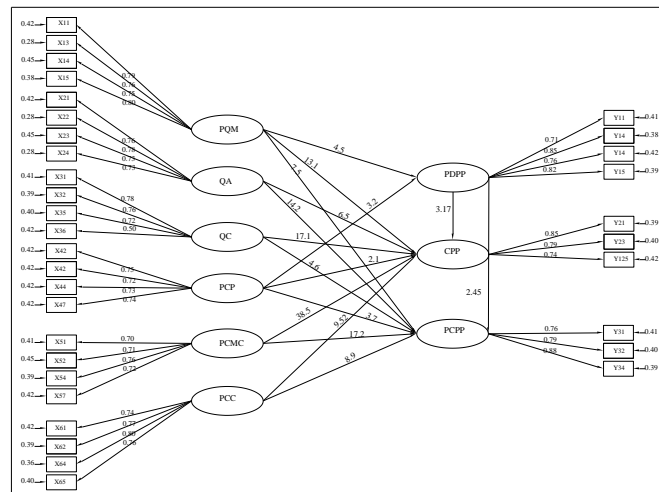
Figure 3: Modified SEM

Table 8: Goodness of Fit (GOF) Statistics

SN	GOF	Experimental Model	Revised Model
1	RMEA	0.088	0.072
2	CFI	0.654	0.777
3	NNFI or TLI	0.67	0.71
4	SRMSR	0.071	0.052
5	X^2/df	2.4	1.52

Table 9: Validated and Rejected Hypotheses

Hypotheses	Validated	Rejected
1	Yes	
2	Yes	
3	Yes	
4		Yes
5	Yes	
6	Yes	
7		Yes
8	Yes	
9	Yes	
10		Yes
11		

12	Yes	
13		Yes
14	Yes	
15	Yes	
16	Yes	
17	Yes	
18	Yes	
19	Yes	
20	Yes	
21	Yes	

4.3 Assessment of Quality and Cost Management Practices within the Nigerian Construction Industry

The following section focuses on the assessment of quality and cost management practices within the Nigerian construction industry. Participants were requested to evaluate their level of agreement with a set of statements regarding the implementation of these practices in their respective organizations. The findings revealed that although quality and cost management practices are widely acknowledged as crucial for enhancing project performance, their adoption in the Nigerian construction sector remains limited. A majority of the participants (75%) acknowledged the presence of a quality management system in their organization, whereas only 50% agreed that their organization has implemented a cost management system. This lack of implementation was further supported by the outcomes of the exploratory factor analyses, which revealed unacceptable factor loadings for 17 of the quality and cost management practices.

4.4 Factors Influencing the Implementation of Quality and Cost Management Practices

The individuals were requested to evaluate the impact of various factors on the implementation of quality and cost management. These factors encompassed organizational factors, industry factors, resource factors, project factors, economic factors, and political and legal factors. The findings of the data analysis, presented in Figure 3, depict the outcome of the CFA model.
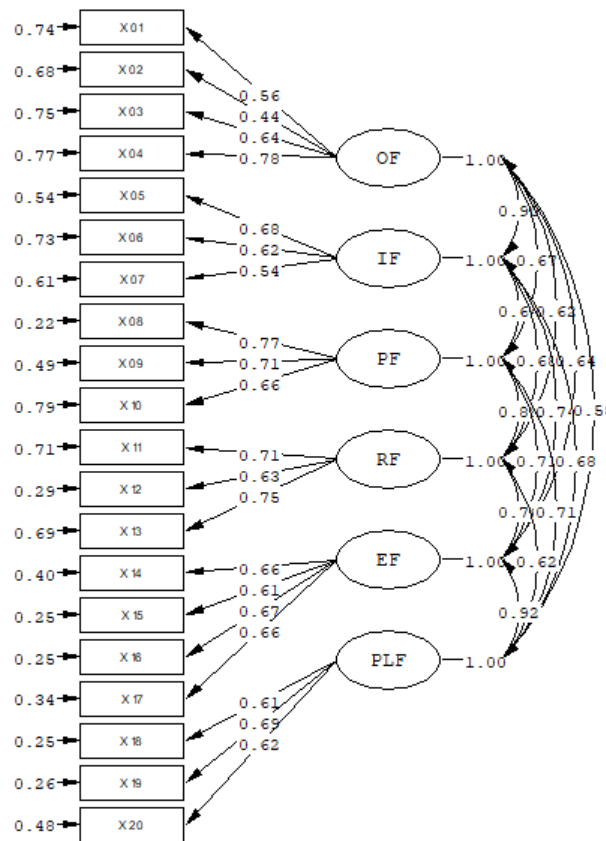
Figure 4: CFA for the Factors Affecting the Implementation of Quality and Cost Management

5.0 DISCUSSION

5.1 *Rewording: The Degree of Execution of Quality and Cost Management*

The findings from Table 34.2 of the exploratory factor analysis reveal that the construction industry in Nigeria has made significant progress in implementing quality and cost management practices. However, there are still several areas that require substantial improvement. This observation is supported by the analysis of 17 variables, which exhibited unsatisfactory factor loadings. Hence, it can be concluded that the overall implementation of quality and cost management practices in the Nigerian construction industry is insufficient. The industry encounters various challenges, such as limited knowledge about quality and cost management principles, inadequate training for construction staff, and ineffective systems for quality and cost control.

5.2 *The Impact of Quality and Cost Management on Project Performance*

Out of the 21 hypotheses, 4 were rejected while 17 were validated as shown in Table 4.4. The rejected hypotheses are hypotheses 4, 7, 10 and 13. The validation of these 17 hypotheses is an indication of the high level of impact that quality and cost management has on project performance from the planning and design phase to the post-construction phase. The strongest relationship was found in hypotheses14 which states that project cost monitoring and control positively impacts the performance of the construction phase of the project with a path coefficient of 38.5. This underscores the need for effective monitoring and control of cost not only at the construction phase, but throughout the lifecycle of the project. The second highest level of impact which is similar to the first exist between project cost monitoring and control and post-construction phase performance (Hypotheses 15) with a path coefficient of 17.2. Thus, emphasizing the great importance of project cost monitoring and control. Efficient management of expenses and constant supervision have the potential to enhance project outcomes. Ehsan and Kamal (2019) emphasize the significance of successful cost management in project achievement. Through the implementation of measures to regulate expenses, project managers

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can guarantee that the project is finished within the designated financial framework. Vigilant monitoring and control of costs empower project managers to detect potential budgetary excesses and employ corrective measures to avert them.

The relationship between quality control and the performance of the construction phase (hypotheses 8) came up as the third most significant relationship. This emphasizes the need for effective quality control at the construction phase of the project to ensure that the output falls within the acceptable level of quality standard. This implies that effective quality control can reduce the need for rework in construction projects. Yim et al. (2015) found that rework plays a major role in causing project delays and cost overruns in the construction sector. Project managers can minimize these issues by implementing quality control measures, which enable them to detect and address potential quality problems at an early stage. This proactive approach can effectively mitigate project delays and cost overruns. Overall, the study emphasizes the importance of efficient quality and cost management throughout all project stages, including design, planning, and post-construction, in order to achieve better project performance.

5.3 Factors Affecting the Implementation of Quality and Cost Management.

The CFA model examining the factors influencing the execution of quality and cost management in construction projects reveals that all the identified factors possess a notable impact on the implementation of quality and cost management. Among these factors, project-related factors and resource-related factors emerge as the most critical. Consequently, the presence of adequate resources, the proficiency level of the workforce, and the quality of resources utilized in the project play a crucial role in influencing the implementation of quality and cost management. Similarly, project scope, project complexity, project type, and project team structure are noteworthy project factors that affect the implementation of quality and cost management. Thus, project managers should prioritize these factors in order to ensure the successful execution of quality and cost management in projects. Based on the above, it becomes apparent that substantial efforts are required in the Nigerian construction industry to mitigate the impact of these factors. It is worth noting that the owner's organizational structure is the only variable that has an insignificant effect on the implementation of quality and cost management.

6.0 CONCLUSION

The concept of quality and cost management in construction projects is crucial because it has the potential to influence project performance. In the Nigerian construction industry, there are various factors that collectively and individually affect the implementation of quality and cost management. This research is aimed to evaluate the level of implementation of quality and cost management, examine its impact on project performance, and assess the factors influencing its implementation in the construction industry of Nigeria. Data was collected from 260 respondents working in selected construction companies, using 68 variables categorized into 15 constructs. Data analysis was conducted using Microsoft Excel, SPSS, and LISREL, based on 242 valid responses.

The research findings revealed that although there is a significant level of quality and cost management implementation in the Nigerian construction industry, it remains insufficient. Therefore, more efforts are required from project stakeholders to enhance the implementation level. The analysis of the impact of quality and cost management on project performance, using structural equation model (SEM), demonstrated a high level of influence throughout the project lifecycle. Out of the 21 hypotheses tested, 17 were validated. The most significant impact was observed between project cost monitoring and control and the performance of the construction phase, followed by project cost monitoring and control with the post-construction phase performance. The third highest impact was identified between quality control and the construction phase performance. Furthermore, the analysis of factors affecting the implementation of quality and cost management indicated that all 20 identified factors had a significant impact, except for the owner's organizational structure. This finding aligns with the assessment of the implementation level, emphasizing the need for stakeholders to address these factors.

The study's results contribute to the understanding of the current state of quality and cost management implementation in the Nigerian construction industry and highlight the importance of

stakeholders' efforts to improve implementation by addressing the influencing factors. Moreover, the study emphasizes the substantial impact of quality and cost management on project performance throughout its lifecycle. It is important to note that this research focused solely on the construction industry in Nigeria, a developing country, and thus, the findings may not be readily applicable to other countries due to socio-cultural differences. Conducting similar studies in other developing nations and making comparisons would be desirable.

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