



IMPACT OF QUALITY ASSURANCE AND QUALITY CONTROL ON CONSTRUCTION PROJECTS

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Abstract: Quality Assurance Quality (QA) and Control (QC) are part of quality management that ensures product and services comply with requirement, it is a work method that facilitates the measurement of the quality characteristics of a unit, compares them with the established standards, and analyses the difference between the results obtained and the desired results in order to make decisions which will correct any differences. The main purpose of this research is to assess the impact of quality assurance and quality control on construction projects. The study was carried out using a qualitative method. Quality assurance and quality control on building projects in Birnin Kebbi, Nigeria may be studied using qualitative analytical techniques. However the construction industry relies on the efforts of every team member to ensure that projects are completed on time, under budget and with greatest possible quality, the research finally recommends that, all team members should work together, quality management techniques be improved across all procurement methods in the study area.

Keywords: Quality Assurance, Quality Control, Construction Project, Quality Management

1.0 INTRODUCTION

Large-scale construction projects are dynamic systems that are susceptible to many random phenomena. The word quality is defined as being appropriate for purpose. It's all about meeting or exceeding client expectations while charging a price that's fair to the consumer in the first place (Bernold and Abourizk, 2010).

The quality of operational methods and the materials used are examined.. In terms of operational processes, concrete pouring is an example. There are certain projects where concrete flow rate and curing time are established by the Quality Assurance (QA) and the operator must adhere to the standard supplied. A concrete's purpose or workability standard may be assured by the QA guidelines that are set out. QC is concerned with ensuring that the procedures outlined in the Quality Assurance (QA) are being followed to the letter on site by those responsible for production. In this case study, the implementation of QA/QC will be assessed to find the optimum manner to execute these procedures in a building project. Anyone who fails to achieve quality criteria in either of the two dimensions might face harsh penalties (Abdul, 2011).

Clients' expectations for project quality are rising in tandem with the complexity and scale of construction projects being undertaken. As a means of increasing their competitiveness, enhancing their overall performance, and bringing down the total project cost, contractors are likewise eager to implement high quality standards inside their own companies. As a never-ending process, the deployment of QMS in

construction calls for ongoing improvements and adjustments. That's why monitoring the long-term effectiveness of a construction project's management system and its processes is a sensible strategy. (Pheng and Jasmine, 2004).

High performance can only be attained by rigorously monitoring and controlling the quality of each process. Some issues have been identified in the construction sector such as inadequate contract management and lack of professional planning, as well as sluggish decision-making and the use of unconventional techniques (Paulet, 2015). Since the quality of a building project is affected by many elements, it is critical that all stages of construction are examined. It is also necessary to explain on the function of management, the quality assurance system, and the many uses of this system (Atout, 2014).

1.1 Statement of Research Problem

Construction businesses in Nigeria are lacking in their ability to teach and educate their employees, as well as in their ability to apply overall quality equipment and procedures naturally. This is according to Kado (2010). Construction-related fatalities and injuries are often caused by the use of subpar building materials and the hiring of amateurs by contractors and clients in an effort to save expenses.

Several academics have discovered these quality-related challenges in the building business. Nigeria's construction sector is concerned about the recent rise in the number of fallen structures in the nation. There is further worry that huge building projects have a substantial impact on the economy and quality of life, and hence are seen as a matter of national importance (Abdulkareem and Adeoti, 2010).

There is a problem with technical professional organizations and allied government agencies not focusing on creating project quality management in such a way that a statistical foundation on the current state or status of their quality management implementation exists.

1.2 Significance of Study

It takes a lot of money to build anything. The cost of any project is heavily influenced by time and resources, and defects and failures in built facilities can result in delays and additional costs when restoration is required and facility operations are restricted. Costs and delays will increase as a consequence of this decision. It is possible that failures might result in serious injury or even death (Sanni and Windapo, 2008). The entire cost of a project may be significantly lowered by spotting faults, assessing the situation, and fixing any unanticipated problems that may develop when adhering to quality management techniques from the start. For the building sector in Nigeria, any additional costs represent large losses for the contractor and increasing costs for the clients alike (Aibinu and Odeyinka, 2006). Quality control research is needed in order to prevent such a large amount of rework in the building process and delivery. Architects, engineers, builders, and contractors, despite the importance of quality control, have not received the respect they deserve for adhering to tight standards (Jimoh, 2012).

Quality management is crucial in Nigeria's construction sector for achieving overall project cost benefits and successful service delivery, since it has already been tested and demonstrated to be very effective at optimizing total cost throughout the project life cycle in many nations across the world.

1.3 Purpose of the Study

The main purpose of study was to assess impact of Quality assurance and Quality control on construction projects. While the objectives of this study were as follows:

- I. To examine the effectiveness of Quality Management System on construction project.
- II. To find out the impact of Quality improvement on construction project
- III. To investigate the aspects of Total Quality Management that have an impact on construction projects.

1.4 Research Questions

The research questions are indicated below:

- I. How effective is Quality Management System on construction project?
- II. To what extent will Quality improvement affect construction project?
- III. What are the factors of Total Quality Management that affect construction project?

2.0 LITERATURE REVIEW

2.1 Concept of Quality

The goal of quality management is to ensure that everyone in the company is working to provide high-quality results in all of their operations. Quality in construction, according to Willar (2012) and other quality movement experts before him has no specific meaning. If a project is to be considered high quality, it must fulfil the legal, aesthetic, and functional standards established by the American Society of Civil Engineers (2005). Requirements can be simple or complex, and they can be expressed in terms of the end product or as a detailed description of what has to be done. Specifically, TQM and ISO 9001 standards were used to identify aspects of quality management, including the problems and causes affecting TQM and quality improvement methods in the worldwide construction business.

For building projects, quality management includes ensuring that everything is done in accordance with the plans, specifications, and permits. It seems that the days of launching large-scale infrastructure projects without due scrutiny and regulation are past, necessitating that local governments make the most of their infrastructure investments (Arditi, 2004).

When it comes to ensuring quality building projects, Arditi and Gunaydin (1997) believe that hiring an inspection firm is a smart move. There are a number of things an inspector should be aware of before he or she gets started: the plans and specifications; the permits; and the utility system's knowledge of what's being added throughout construction. In most building projects, inspections are performed at the very end, if at all.

2.2 Effectiveness of Quality Management System on Construction Project

The Quality Management System (QMS) is extensively utilized by businesses to gain operational and market advantages, and it is an ideal standard for upgrading and promoting the performance of enterprises and projects. These goals aren't usually met, according to QMS impact assessments. A company's ability to successfully apply ISO 9001 relies on how the standard is perceived. Previous research of the effects of QMS showed that the majority of academics found that QMS had a positive influence on projects as a result (Neyestani, 2016). The QMS ensures consistency and satisfaction in terms of processes, materials, and equipment, among other things, as represented by Figure 1 (Aized, 2012). This means that the enterprises can fulfil their customers' needs and accomplish organizational goals in the projects.

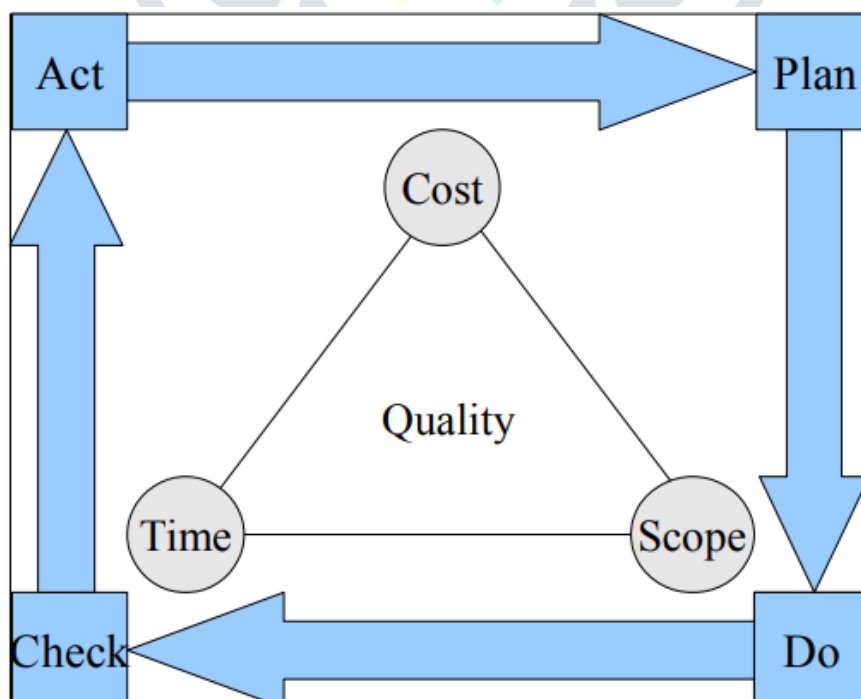


Figure 1. Schematic QMS on organizational targets of projects (iron triangle) (Aized, 2012)

When it comes to improving project performance, the QMS mechanism is a simple one that incorporates all of the necessary elements of the ISO 9001 standard, including its framework (Process approach and the

PDCA methodology), which is based on quality management principles (ISO 9000) throughout its guidance. Quality management systems (QMS) are an integral aspect of any project management process, from the beginning to the end. These procedures, when used in conjunction with the PDCA process, may help to constantly enhance the project's performance.

Quality Management System (QMS) has been shown to have favorable effects on many industries' performance and market share. In a survey conducted by Thilakarathne and Chithrangani (2014) to determine the benefits of implementing QMS in Sri Lankan companies that are already certified to the ISO 9001 standard, they discovered the following: increased customer satisfaction, decreased production time, increased quality awareness, improved product/service quality, improved employee productivity, and improved employee relations. Many empirical research have proven that QMS standards are beneficial in promoting customer satisfaction by enhancing and motivating the processes of ISO 9001-certified building projects, according to the conclusions of these investigations. QMS adoption in Malaysian construction projects has a significant impact on both the project's functioning and the customer's happiness, according to a majority of the respondents (Ali, and Rahmat, 2010). According to Mane and Patil (2015), the most important variables in establishing a QMS for building projects in India are 90 percent customer happiness and 80 percent client satisfaction.

Hard quality tools, mixing techniques, and soft methods are the three basic categories of quality tools and procedures used in support of quality initiatives (Mathews, Ueno, Kekale, Repka, Pereira, and Silva, 2001). Control charts and statistical sample criteria are two of the most difficult quality instruments to implement. Strategy and action plan review, organizational flexibility, control charts, quality circles, and quality planning tools are all examples of mixing approaches. Customers' satisfaction surveys and frequent communication with suppliers and external groups, initiatives to minimize environmental effect, empowerment, self-audit, and benchmarking are all examples of soft techniques.

Senior management's engagement, comprehension, and emphasis on customers are critical pre-requisites for TQM success, according to Taylor et al. Performance TQM techniques may be strongly predicted by leadership and human resources management, according to Samson et al (1999). According to Chin et al. (2003), the most important component for the effective implementation of ISO 9000 is the commitment of senior management. TQM performance measurements in construction enterprises will represent top management commitment, according to Low et al. (2004) in construction-related research.

2.3 Principles of Quality Management System

People, procedures, and documentation all work together in a QMS to satisfy customers' expressed and inferred demands (Mohammed and Abdullah, 2006).

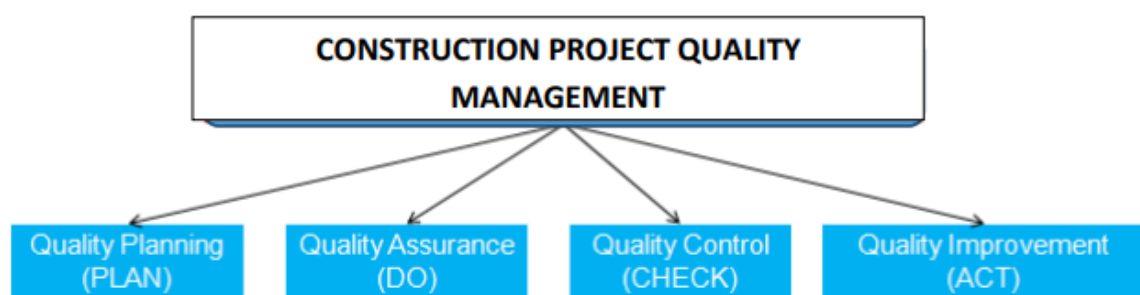


Figure 2: Approaches to conformance in Quality Management

This diagram depicts the four primary approaches of quality management: quality planning, quality control, quality assurance, and quality improvement (Visaya, 2011). The following are some of the most important facets of Quality:

2.3 Quality Engineering

A description of the steps required to ensure that a building's design and engineering meet the standards established by trade associations, building code authority, and other national, state, and local organizations.

As a result, engineers and architects must keep up-to-date on all relevant standards since the law and some regulations mandate that they do so (Barrie and Paulson, 1992).

2.4 Quality Assurance

It's a methodical endeavor to create a formal structure, organization, and operational processes to ensure that the project's quality is maintained throughout its life cycle. In building and engineering, quality assurance is critical because of the inherent risk involved in every project. The project's performance will be affected by a slew of external circumstances, raising the likelihood that it may be delayed or fail altogether. The development of an integrated quality assurance system is essential in order to avoid any inefficiencies that might lead to the delivery of subpar goods and services to clients. This (Bubshai and Al-Atiq, 1999).

For Quality Assurance, defining and standardizing each work activity, as well as keeping records of each activity, are the most important components. According to the Arkema Inc. facility (Arkema Inc. Facility, 2011), the construction contractor is in charge of ensuring that construction paperwork, drawings, and specifications are followed and that the completed product meets quality standards. The Project Engineer will be in charge of overseeing the construction and ensuring that the construction plans, specifications, and quality assurance standards are met.

2.5 Quality Control

The activity and practice of quality control is essential if the project is to meet the quality standards it has set for itself. Barrie and Paulson (1992) state that part of this process involves establishing specified performance requirements for the construction project via the plans and specifications. The standard deviations are then calculated. As a final step, the standards themselves and their adherence to the standards are examined and plans for future changes are drawn up. Quality control, on the other hand, guarantees that the actual work is in line with those requirements.

Total Quality Control (TQC) is a company-wide effort to enhance the quality of its goods or services that encompasses all aspects of the business, such as market research, R&D, design, manufacturing, inspection, after-service, human resources, staff training, and so on (TQC). It is the goal of total quality control to find out where and why errors are occurring, as well as to see whether it is feasible to avoid them from occurring in the future.

According to the Arkema Inc. facility (2011), the construction contractor hires members of the Construction Quality Control team. As a result, the contractor hired will provide specific jobs, along with the associated job descriptions and duties. The construction contract terms, on the other hand, require the contractor to nominate an employee to lead the Construction Quality Control team, who will not be physically involved in monitoring construction operations.

2.6 ISO 9000 Series Standard

All businesses and economic sectors may use ISO 9000 since it serves as the foundation of a universal quality system. A supplier's commitment to quality and capacity to satisfy customer demands may be shown via the implementation of an effective quality system (Bubshai and Al-Atiq, T. H. 1999).

The concept of ISO 9000 has been viewed in the past in a variety of ways, including as a way to improve overall project quality, a way to cut costs, a way to improve the flow of activities and coordination in an organization, a way to improve product quality, and a way to keep a competitive edge in the industry. In many cases, they have already enrolled with certification bodies to build formal quality management systems and pursue ISO 9000 certification, according to (Bhuan and Al-Zamal 1996; Lamprecht 1992).

The majority of businesses, including construction, are now moving toward ISO certification. The revision of the ISO 9001 standard is now taking place. System for quality management; accountability for managers; resource management; product realization; and measurement; analysis; and improvement are the five clauses under which it is to be carried out. Research on the use of ISO standards has drawn a lot of interest (Tan and Hamzah, 2011).

2.7 Factors of Total Quality Management

Owners must carefully balance their project costs and schedules, desired operating characteristics, construction materials, and other requirements with the design professional's need for adequate time and budget to meet those requirements during the design process. Owners must weigh their needs against financial concerns and, in some situations, the risk of failure (Arditi and Gunaydin 1997).

Public health and safety must be safeguarded in all aspects of a finished project by a design specialist. It is the responsibility of the builder to ensure that the building process is carried out safely and efficiently, including establishing and enforcing safety protocols and procedures. When it comes to building, the specifications of the project are what really matter. There are three major parts to the building process: planning, design, and construction.

- The planning and design phase
- Construction phase, and
- Operation and maintenance phase.



Figure 3: Total Quality Management in Construction Process

Source: Arditi and Gunaydin (1997)

Construction-related TQM components and industry-specific aspects that influence the quality of a building project's process are shown in Figure 3 by Total Quality Management (TQM).

I. Cost of Quality

Both (Crosby, 1976) and (Juran, 1988) believe the cost of quality to be the key method for gauging quality. Quality improvement projects are chosen and the TQM process' efficacy is tracked, as is its cost, under this method. Quality improvement may be shown to upper-level executives by combining the relatively low expenses of review, inspection, testing (including scrap) and rework. In recent years, the cost of quality has become more prominent. In terms of conveying to management the monetary advantages of TQM, it is efficient in its stated objective of boosting quality awareness.

Preventive expenses, assessment costs, and deviation costs make up the quality costs. Preventative costs are those expended as a result of actions designed to prevent deviations or mistakes, while appraisal costs

are those incurred as a result of activities used to assess if a product, process, or service meets defined standards. As an example of a preventive cost, the expenses associated with conducting design or constructability assessments or adjusting work methods to meet quality requirements may be evaluated. According to a poll conducted by the American Society for Quality, using the ISO 9000 standards is difficult due to the increased expense of altering work processes and the added cost of updating standard deviation costs (ASQ). Unexpected expenses are spent on-site owing to rework or price reductions caused by quality issues or by supplier errors or nonconformity.

After the facility is completed, further expenditures are spent by the owner. In addition to this, there are expenses for managing and replacing rejected material, repair costs, charges for handling and replacing defective products, and litigation costs. Contractors are chosen by owners in the construction business on a competitive basis. Contractors' safety records, equipment capabilities, and reputation for quality work are all important considerations, even if bids are the primary selection factor. Extremely for private owners, this is especially important. Competition in today's industry means that contractors with a bad reputation for quality are unlikely to win many contracts. As a result, contractors benefit from making investments to improve their job quality in order to maximize their chances of landing new contracts.

II. Quality Improvement Culture

To promote employee input, the organization's culture must be constantly updated. Make the most of the expertise your staff have to offer! Listen to the people who do the tasks that keep your company running on a daily basis. Employees need to feel that their ideas are valued by management or they would not share them.

III. Focus on Customer Needs

Customers nowadays demand and expect flawless products and services. Consumer requirements must be prioritized for long-term viability and the development of solid customer relationships. Affect drives corporate decisions. Competitors are always a possibility. Maintain a tight relationship with your consumers and make sure they are delighted with your service.

2.8 Quality Improvement in Construction

Quality control is ultimately delegated by the general contractor through contracts, subcontracts, and sub-subcontracts. In the 1980s, the construction management project delivery system was introduced, in which construction management firms emerged as entities that were not responsible for design or construction, but instead performed only managerial functions on behalf of the owner from the beginning of the project to the end of the construction phase (Pheng and Hui, 2004). Construction management corporations have taken over the inspection and quality control functions that had previously been carried out by architects and engineers.

As stated by O'Brien (1989), quality control will be given greater attention if the project quality control strategy is developed. At the moment, testing and inspection requirements are dispersed across the contract specifications in an unorganized fashion. To build a strong strategy, testing and inspection requirements could be integrated into a new section of the specifications. This would prioritize quality control and give an organized area where all quality control concerns are identified to the bidders. Construction managers should explain to bidders how they will conduct quality control tests as part of their quality control strategy so that they can properly budget for the tests.

Quality assurance (QA) and quality control (QC) are commonly used interchangeably when discussing quality development or improvement, according to Alexander (2008). A challenging but critical challenge is to keep quality assurance and quality control separate. Quality assurance encompasses all of the planned and methodical efforts that are essential to ensure that a structure, system, or component will work successfully and meet project requirements.

As an alternative, quality control refers to the particular steps that go into the quality assurance process. Planned and coordinated effort is a part of this process. An important aspect of quality assurance is identifying and eliminating any factors that might contribute to subpar product performance, and this is where quality control comes into play (Wick and Veilleux, 2003). The majority of design-related quality assurance and quality control tasks are handled by regular office processes at a design firm. Depending on

the project delivery type, the designer or the construction management company is in charge of designing and overseeing quality assurance program operations throughout construction.

According to Mehra and Kumar (2008), quality must be deliberately controlled at the corporate level, just like any other component of business. Many quality improvement initiatives concentrate primarily on quality improvement tools and the technique for improving certain processes, but these efforts typically overlook their broader influence on the organization. Many organizations that employ sound management techniques to improve quality have been demonstrated to fail because they are either unconnected to the firm's aim or ineffectively coordinated with one another. According to the findings, successful quality management cannot be accomplished in isolation from other initiatives or the company's overall strategy.

According to Kado (2010), despite the existence of such regulations, regulatory bodies, and manuals, flaws in the building sector nevertheless remain. [page needed] Bamisile (2004) also noted that "in some instances, unqualified persons prepared both architectural and engineering designs and/or working drawings are poorly prepared even in some cases without drawings number and the name of the designer or drawn by column completed not to mention the name of the person who checked the drawings before they are issued for construction."

Specifications written by quantity surveyors are often kept out of the design team's hands since they don't have enough information to make an informed decision about how to proceed with the project. In many cases, standards and codes of practice are mentioned in the text without the author having seen a copy of them. Their current condition and usefulness to the project are likewise seldom examined. Conclusion: "One may claim that the design team has not embraced any quality culture in their contribution to building production in Nigeria," as stated by Bamisile (2004)

3.0 METHODOLOGY

3.1 Research Method

This study was carried out using a qualitative method. Quality assurance and quality control on building projects in Birnin Kebbi, Nigeria, may be studied using qualitative analytical techniques.

3.2 Population of the Study

It is possible that the researcher may be interested in a particular subpopulation within a larger group of people. Because they are the finest possible respondents for this research study on the topic matter, estate businesses have been chosen as the best possible respondents. The Kebbi State Development and Property Corporation (KSDPC) is the target of this research.

3.3 Sample and Sampling Technique

It is possible to choose a subset of a larger population and use that subset as a basis for further analysis. The number of people in the sample matched the size of the overall population. Since the study is aimed at building enterprises registered with Kebbi State Development and Property Corporation (KSDPC), the sample procedures employed are simple random and purposive sampling approaches.

3.4 Sources of data

This research relies on data gathered through publications, journals, and construction bulletins, among other sources. Documentation is the primary method for collecting secondary information. The secondary source is used in this study because it serves as a foundation and a guide for the primary research.

3.5 Statistical Tools

A content analysis of the acquired data was performed once it had been properly collected, sorted, and otherwise verified to be accurate. It is possible to compare and contrast the ideas and observations of people who are well-versed in the topic.

3.6 DISCUSSION OF FINDINGS

3.6.1 *Quality Management System and construction project*

Construction projects are more likely to succeed when the management team in charge of construction provides them quality attention, according to studies into quality management systems. One of the tangible aspects that would indicate TQM effectiveness in construction enterprises, according to Low et al. (2004), is top management commitment. According to Chin and Choi, the most crucial component in the efficient implementation of ISO 9000 is top management commitment (2003). Senior managers' engagement, comprehension, and attention on customers are all critical preconditions for TQM's success, as stated by Taylor et al. (2003) as well. This means that the quality of Nigeria's building projects would be raised as a result of the implementation of a quality management system.

3.6.2 *Quality improvement and construction project*

Furthermore, the research found that enhancing the quality of building projects may be beneficial. Managing quality is just as important as managing any other company factor, according to Beecroft (1999). In many quality improvement initiatives, tools and methods for enhancing individual processes are the emphasis, but these efforts frequently fail to take into account their influence on the company as a whole. There are many companies that utilize independently sound management strategies to achieve greater quality, but they fail because they are either not aligned with their goal or not effectively coordinated together. (Srinidhi, 1998). To put it another way, the studies show the need of integrating quality management into a company's entire strategy.

It is common practice to use the phrases QA and QC interchangeably when discussing quality improvement or augmentation, according to Alexander (2008). Maintaining a clear line between quality control and quality assurance is tough, but necessary. Every effort made to ensure that a structure, system, or component will work as expected and meet the needs of the project is considered quality assurance.

3.6.3 *Factors of Total Quality Management that affect construction*

Cost of quality, quality improvement culture, and a focus on customer needs are the three most important aspects of Total Quality Management as they relate to building. In the context of the completed project, design professionals are obligated to safeguard public health and safety. The constructor is responsible for the means, methods, techniques, sequences, and procedures of construction, as well as the safety precautions and programs implemented throughout the construction process.

In the building process, quality is largely determined by the criteria specified in the project specifications. For the owner's benefit, project costs and schedules are carefully balanced with the intended operational qualities, building materials, and other factors (Artid and Gunaydin, 1997). Owners must weigh their needs against the costs and, in certain situations, the risk of failure, as well as the demands of the design professional's need for sufficient time and resources to achieve these criteria throughout the design process.

4.0 CONCLUSION

Quality management procedures include effective site monitoring, personnel training on the importance of quality, quality evaluation, and compliance with quality standards. There is a strong correlation between pre-contract and contract quality management methods and project performance, according to a new research paper in the Journal of Construction Management. On-time completion of projects depends critically on accurate understanding of customer needs and clear, succinct and exact work instructions. The completion of a project in compliance with the specified standards is one of the three key performance aspects often used in the construction industry to evaluate performance. Despite its fragmented character, the construction industry relies on the efforts of every team member to ensure that projects are completed on time, under budget, and with the greatest possible quality.

4.1 RECOMMENDATIONS

The following suggestions were given in light of the findings of the research:

- I. Stakeholders in the construction business must ensure that quality management procedures are correctly interpreted and implemented.
- II. In order to get the greatest possible result, all team members should work together.
- III. At the contract stage of building work, quality management techniques should be improved across all procurement methods in the study region.

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