Journal of Advances and Scholarly Researches in Allied Education
Vol. 19, Issue No. 6, December-2022, ISSN 2230-7540

https://doi.org/10.29070/s3gb2442

A study the overview of quality management system in construction projects

Pensalwar Shalaka Dileeprao[1]*, Dr. P. S. Charpe[2], Dr. Ranjit Nagnath Shiral[3]

[1] PhD Student, Kalinga University, Raipur, Chhattisgarh, India

Email - isobesin@gmail.com

[2] PhD Guide, Department of Civil Engineering, Kalinga University, Raipur, Chhattisgarh, India

[3] PhD Co Guide,Head of department Civil engineering, Bhagwat institute of technology, Barshi, Maharashtra, India

Abstract- Quality management is a critical aspect of any construction project, ensuring that the final product meets or exceeds the expectations and requirements of stakeholders. In the dynamic and multifaceted realm of construction, where myriad factors influence project outcomes, a structured approach to quality management is indispensable. This introduction provides an overview of quality management systems (QMS) in construction projects. The construction industry is both massive & dangerous, encompassing a wide variety of tasks, from initial conceptualization to final dismantling. It is vital to the wealth-generating processes of economy. It encompasses a systematic approach to quality assurance and quality control, aiming to identify, mitigate, and prevent defects or deficiencies throughout the project lifecycle. QMS empowers construction stakeholders to consistently deliver projects that meet the highest standards of safety, performance, and durability.

Keywords- QMS, Quality Assurance, Quality Control, PDCA Cycle, TQM

----------X----------

INTRODUCTION

The construction industry is vital to the growth of any economy, & India is no exception. Time constraints and extensive use of labor, materials, and machinery are hallmarks of this endeavor. Therefore, it has a significant impact on the national economy and its rapid expansion. The construction business has been profoundly impacted by the technical breakthrough. The building industry is experiencing extreme cycle changes. Manufacturing cement, pipes, sanitary products, tiles, ready mix concrete, and other construction-related goods & services all benefit from construction's expansion. In addition to being a moneymaker for the country, building also fosters the growth of its human capital & creates more jobs than any other industry. Given the magnitude of the construction industry's impact, it's critical that the most pressing obstacles to productivity be pinpointed. Poorly developed & accepted technologies in the building sector in many nations, as well as a disjointed relationship among construction costs and delays, have an impact on overall quality.

QUALITY IN CONSTRUCTION

The construction industry is huge and risky, covering a broad range of activities from planning to demolition. The economic mechanisms that generate wealth rely on it. Massive, intricate building projects are getting more and more out of the reach of emerging nations (Swan & Khalfan, 2007). In order to guarantee the effective completion of construction projects and the satisfaction of all parties involved, certain limits are imposed, such as time, money, resources, and quality performance metrics. Timely and perfect completion, within the set financial and quality restrictions, is an obvious feature of a well-executed project. Serious consideration ought to be given to worries over the project's schedule and finances. The fight for market dominance and greater profitability in the global marketplace has turned quality into a strategic weapon (Bergman & Klefsjo, 1994). The construction industry is currently facing challenges related to the performance of commercial buildings and the quality of construction outputs in satisfying client needs and assuring customer satisfaction. Although the term "quality" is usually linked with expensive things, it doesn't imply that inexpensive products can't be of good quality. Any product can be considered high-quality if it

satisfies both the explicit and implicit needs of the buyer. There are hardly any quality-related reports from the building business compared to the many from the manufacturing sector. Including inferred needs in defining excellence also implies a sense of responsibility. However, the conversation goes both ways. Both the supplier and the client have obligations, with the latter having explicit needs and duties. Both the client and the provider will benefit from a well-functioning relationship.

HISTORY OF QUALITY

Quality control has always been a challenge, whether in the construction industry or any other sector where records are kept. Several unique cultures and civilizations emerged throughout the New Stone Age, which lasted from 4000 to 5000 years ago, and each of them placed a premium on creating better construction methods. Between 2589 to 2566 BCE, the Egyptians built the pyramids. The architects were held accountable for the project's perfection by King Hammurabi of Babylonia in 1792–1791 BCE, according to historical accounts, who codified the laws and regulations into a thorough code. They would also be subject to the death penalty in the event that an incident, such a building collapse, occurred within their premises and resulted in the death of any of the occupants (Rumane, 2011).

Birth of Quality Control

The informal systems of quality control and assurance that existed in mediaeval guilds & governments continued today. Workers were organized into three levels: master, journeyman, or apprentice. They took the required steps to guarantee constant high quality between the Middle Ages and the start of the Industrial Revolution. As a whole, the Industrial Revolution didn't start until Europe in the midst of the 1800s (Rumane, 2011). Aiming to increase output while cutting expenses, factories were constructed during this period. It's handcrafted by one master craftsman for one particular group of people. With a factory system in place, competent workers, overseen by the foreman and inspector, are responsible for quality control. Thanks to the industrial revolution and its emphasis on mass production at low unit prices, the situation's economic focus changed to manufacturing.

Total Quality Management

Total quality control & cost of quality were two of the new quality assurance concepts that arose in the 1950s & 1960s. For example, after receiving the Deming Application Prize in 1965—the greatest award in the area of TQM—Toyota Motor Co., Ltd. fully adopted TQM. In 2011, Toyota made a statement. Furthermore, we were honoured with the Japan Quality Control Award in 1970. The name of the prize was given to W. Edwards Deming in honor of him because of his important role in the postwar Japanese development of statistical quality control. Statistical quality control is a way for ensuring and controlling the quality of a product or service by using statistical methodologies. As pointed out by Harold Kerzner (2001), strategic quality management is now the center of attention.

Quality Management System

The government's adoption of the ISO quality policy has caused considerable shifts in the building industry within the last decade. People working in the construction business have started to see the benefits of QMS as time goes on. Using a QMS in a construction project allows for the evaluation of quality policy statements, objectives, or responsibilities or duties of all parties involved, as well as the execution of actions like planning, controlling, ensuring, or improving quality in accordance with quality standards and systems. A quality system is the backbone of quality management that ensures all parts of an organization follow the rules and adhere to the procedures set out by quality management. Compliance with relevant or specialized criteria is used to evaluate the company (Rumane, 2011). Moreover, quality standards are beneficial to numerous sectors, including the public or private sectors, as well as industrial and corporate organizations, regulatory authorities, professionals, suppliers, and consumers. Along with providing governments with a scientific foundation for health, safety, & environmental legislation, there is crucial economic and social consideration. According to Hoyle (2009), management systems are described by ISO 9000:2000 as a set of interconnected guidelines or components that are used to carry out policies and objectives. In the construction business, QMS have become commonplace, especially among large, complicated projects (Tiong, et al., 2014). In order to ensure that products and services are consistently delivered to meet customer needs, a QMS is put in place. This system comprises documentation & procedures.

PDCA Cycle

Quality management systems are based on the PDCA cycle. Establishing the scope of a project is the first stage in the planning process. The following process is used to build the following step. After that, you need to verify the record & determine which process measurements to use. The last stage is to take action, which is an ongoing process of improvement for QMS implementation and quality assurance (Rumane, 2011).

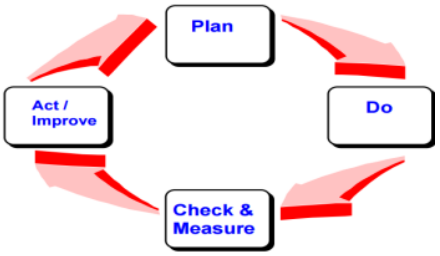

Figure 1: PDCA Cycle

Pyramid of Quality Management System

Figure 2: Pyramid of QMS

QMS pyramid is topped by the quality policy, which lays out the management requirements, objectives, & goals to attain (Rumane, 2011). The next tier of the quality management system pyramid is the quality manual, which details the operations of the system & lays out the goals and objectives of the framework or management. The project's scope and team's level of complexity inform the development of the Project Quality Plan, which sits beneath the quality manual and contains processes & instructions for doing the work. In order to guarantee that the project meets the standard quality requirement, the project manager creates a project quality plan. Included in this plan are the following: a statement of purpose and policies, a list of vendors or subcontractors, a checklist and form for inspections and tests, potential solutions, measures to avoid problems, and decisions to enhance the project's quality. Typically, the processes will go over the tasks at hand, when they are due, any necessary inspections or tests, and any measures to be taken to avoid problems (Rumane, 2011). Quality forms & records are a part of a project's quality strategy; they document the past and present of standard procedures for maintaining project quality (Rumane, 2011). Finally, at the base of the pyramid is the checklist, which is utilized for preventing QMS failure & ensuring quality.

ADVANTAGES OF QMS

According to ISO 9001, quality management system (QMS) application has several potential advantages for organization (ISO 9001, 2015):

Consistently

Through the use of a QMS and quality standards, QMS is able to consistently develop and manufacture goods and services. Data that is compliant with the defined QMS requirements can also be indicated by using a QMS application. This may result in satisfying both the needs of the client and the necessary legal and regulatory standards. (2015, ISO 9001)

Customer satisfaction

The firm should make an attempt to create a quality management system in order to reach a particular level of customer satisfaction. Consequently, consumers gain since they are able to acquire goods and services that are trustworthy, dependable, easily available, and long-lasting.

Risks minimize

To deal with the risk and chance associated with its goal, a QMS can be used. By reducing the amount of defective work, rebuild work, & rejection, contractors can reap benefits from implementing a quality management system (Ivan W., et al., 2012).

Enhance competitive and reputation of company. In order to boost the company's reputation and competitiveness, implementing a quality management system means being able to integrate value with well-documented processes. In addition, stakeholders and clients get benefits like improved operational outcomes, increased profit, market share, or return on investment.

Improving resource management

The goal of a QMS is to improve process flow & quality control so that employees are happier in their work. In addition to lowering environmental impact, it can improve working conditions, worker health, and safety.

Financial performance

Applying a QMS can have a noticeable impact on a company's bottom line, but there are a lot of factors to consider before making that determination. The enhancement of financial performance is directly related to QMS certifications like ISO 9001 (KAZILIŪNAS, 2010).

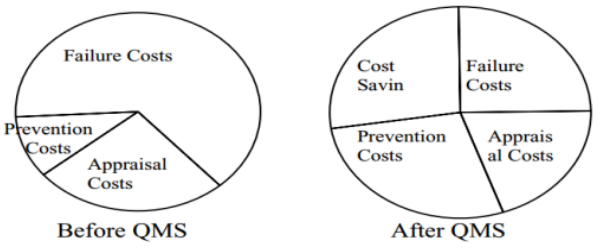

Figure 3: Cost Savings of QMS

Figure 3 showed that QMS saves money, therefore it's reasonable to assume that QMS can help your company cut costs when things don't go according to plan financially. By streamlining processes, documentation, and participants involved in implementing a QMS, inefficiencies or waste can be reduced, leading to improved project quality, morale, & possibility of better outcomes. It needs to be cognizant of failure prevention measures that lead to

savings in expenses and higher customer satisfaction.

Continuous improvement

The organization's goal is to accomplish continual improvement and reap long-term advantages, thus it implements a quality management system (QMS). It is not consumer pressure but rather a strong positive attitude toward enhancing organizational performance that has the company ready to implement the QMS. A project's culture of excellence can be fostered and advanced with its help.

Quality Auditing and Assurance

The significance of quality auditors in enhancing the capacity to disclose compliance and the worth of product cannot be overstated when considering the effects of implementing a QMS. Producing data used in providing a qualified certificate, improving documentation, ensuring consistency, & achieving quality project assurance are all outcomes of creating quality audits, which in turn have an impact on management decision-making.

DISADVANTAGES OF QMS

QMS disadvantages include the time & effort required to complete paperwork. Anup (2015) found that the most significant challenge in implementing a QMS is the sheer volume of documentation involved. Employees will be hesitant to embrace QMS if there is an excessive amount of paperwork. The paperwork includes things like daily checklists, work instructions, quality records, or processes (Anup, et al., 2015). It takes a lot of time: It takes time and effort to run a QMS & guarantee quality.

INSPECTION, QUALITY CONTROL & QUALITY ASSURANCE IN CONSTRUCTION PROJECTS

The construction industry's quality standards have lagged behind technological and managerial advancements in recent decades. Tragic losses in life and property have resulted from repeated occurrences of poor design and construction. Relative to the human lives lost & physical, emotional, and psychological afflictions, both temporary and permanent, as well as the legal and economic consequences, building failures are insignificant. One factor that can impact the quality of construction is the availability of clear design & drawings. When there is confusion regarding the designs and drawings, it might manifest in subpar construction.

- If there is an accessible, well-structured, & unambiguous set of requirements.
- If there is a well-defined methodology for quality control.
- If the construction processes made use of the appropriate resources (including labor, materials, & machinery).

Delegation of authority and duty for quality assurance is a hotly debated topic in quality control. As the owner's representatives, designers have historically been tasked with making sure everything is up to code. The designer can choose a member of their field staff, the clerk of works, to oversee the contractor's work. Despite his lack of authority, he is accountable for ensuring that the task is carried out in accordance with the requirements. One solution to the authority & responsibility issues in quality control is the linear responsibility chart (LRC), which lists everyone involved in the program, their roles, and how they relate to each other in terms of quality control duties. An essential tool for LRC, the quality control matrix spells out the technique & criteria for quality control in plain English. The quality control program was built on top of the two charts.

INSPECTION

Following the establishment of quality standards and other criteria, inspections are conducted on a regular basis. Visually comparing an object to its specifications is a common part of the inspection process. Inspecting a product or service entails doing things like measuring, looking, testing, and gauging some aspect of it and comparing the results to certain standards. The following are some of the examination stages:

i). Material inspection at the supplier end

ii). Material inspection upon receipt

iii). During the problem resolution phase, during the material inspection phase

iv). During the initial setup phase. inspection of the procedure

v). inspection of the trial run

vi). Evaluating the final product

vii). Equipment and machine installation inspection

Determining what needs inspecting, who will do the inspection, and how will all be part of the planning process for such tasks. Several pieces of essential data that must be included in the design, product, and inspection specifications. Careful consideration should be given to the inspection methods, instruments, and tools. Any of the following inspection methods can be used:

i). Checking each instance for specific physical parameters

ii). Laboratory tests

iii). Machine setup test on an individual basis

iv). Sampling test

v). Final inspection

The inspection approach can be any of these that work best. Sometimes, it's best to use a mix of these approaches.

QUALITY CONTROL (QC)

Quality control is the set of procedures that ensure a project is running smoothly & accordance with its specifications by gathering, investigating, analysing, and reporting on relevant data. There are four main purposes it addresses:

i). Establishing standards & requirements

ii). Appropriate testing, inspections, etc., should be conducted to assess material, process, and output quality.

iii). Evaluating infractions in relation to these criteria

It is recommended that any changes or updates to the specifications be

The following are some of the steps involved in quality control:

i). Control of incoming supplies

ii). Control of pre-construction & planning

iii). Control of the construction process

iv). Among the many roles played by quality assurance are:

v). Collaborating with project designers; and

vi). Creating specifications

vii). Vendor quality control

viii). On-site testing and inspection

Contractors or specialized consultants, like consulting engineers or testing labs, are responsible for quality control in the building industry. In order to ensure that building materials and processes are of high quality, construction quality control includes conducting inspections, tests, measurements, & documentation as needed. Ensuring a safe, dependable, and long-lasting structure is the main goal of construction quality control. This is done to maximize the owner's return on investment. In contrast to companies associated with manufacturing, the construction industry does not adhere to a rigorous quality control program. It is possible that quality control on certain projects is inconsistent & unorganized. It is not feasible to use a consistent method to verify construction work meets quality standards because of heterogeneity. Construction projects often employ three main quality control methods: sampling, testing, & inspection.

Methods range from subjective to objective evaluations of quality achieved. The desired level of assurance and the nature of the construction activities or systems under scrutiny determine the kind that is used. All of the approaches could work in theory, but only certain of them would work for certain tasks. For the avoidance of doubt, the procedure must conform to the specifications laid out in the contract. Thoroughly following all specifications is not feasible in the construction industry due to the nature of the work. Find out how well the quality criteria outlined in the contract are met by conducting a quality assurance examination. The first step toward a practical strategy is to settle on a baseline quality level that will serve as the foundation for approval or rejection. Subsequently, suitable quality control procedures can be employed to determine if the deviations fall within the permitted limits. Maintaining a steady standard of quality control & employing suitable methods yield optimal outcomes.

QUALITY ASSURANCE (QA)

Quality assurance encompasses all the systematic and planned actions taken inside the quality system and shown as necessary to ensure that an organization meets quality requirements. To ensure that a provider can confidently meet an entity's quality criteria is the goal of quality assurance. This necessitates carrying out all the steps that were intended to enhance the product's quality. A written quality system should be used to systematically implement these intended actions. Incorporating product quality demands the following:

i) Quality of Design

ii) Quality of Conformance

iii) Quality of Performance

iv) Quality of Service

"Quality assurance can be described as a set of activities whose purpose is to demonstrate that an entity meets all quality requirements," states ISO 9000 (1999). The goal of quality assurance (QA) is to reassure managers and customers that their needs are being satisfied. When it comes to construction, quality assurance encompasses all the administrative and surveillance tasks that are planned and systematic. These tasks are started by the project owner or regulatory agents with the goal of enforcing and certifying, with enough confidence, that the project is made to standard. The goal is to make sure that the finished structure and its components will efficiently, effectively, and economically fulfill their intended purposes. The necessity for more effective QA procedures to guarantee conformity with contract requirements has grown in tandem with the increasing complexity of projects.
Quality assurance programmes includes the following:

- The procedure for defining, developing quality standards in design, construction and the other stages of the construction must be established.
- The procedure to monitor, test, inspect, measure and perform current and review activities to assure compliance with established quality standards, with regard to construction materials, methods and personnel must be established
- The administrative procedure and requirements, relationship and responsibilities of the organization, patterns of communications and information, other management activities required to execute, document and assure attainment of the established quality standards must be well defined.

It is evident that engineers and contractors often mistakenly use the terms QA and QC interchangeably. Quality Control (QC) refers to the process of sampling or inspection, whereas Quality Assurance (QA) refers to the process of construction management. While quality control looks for flaws after the fact, quality assurance aims to avoid them altogether. Actually, quality control is a part of any quality assurance program.

CONCLUSION

Quality management in construction goes beyond regulatory compliance to include excellence into every project aspect. Achieving competent and confident project delivery is possible for all parties involved in the construction industry when quality planning, assurance, control, documentation, and continuous improvement procedures are integrated. As the construction industry undergoes further transformation, quality management systems will further solidify their position as the bedrock upon which innovation, risk mitigation, and stakeholder value are built. Firms in the construction industry can improve their chances of long-term success in today's cutthroat market by adopting quality management practices and making good use of technology and collaboration.

REFERENCES

1. Abd El-Karim, M. S. B. A., Mosa El Nawawy, O. A., & Abdel-Alim, A. M. (2017). Identification and assessment of risk factors affecting construction projects. HBRC journal, 13(2), 202-216.
2. Al-Ani, Raji, and Firas I. Al-Adhmawi. (2008), Implementation of Quality Management Concepts in Managing Engineering Project Site. Jordan Journal of Civil Engineering 5(1): 89-16.
3. Bergman, B. & Klefsjo, B., 1994. Quality from Customer Needs to Customer Satisfaction. Lund: s.n.
4. Chin' K.S and Choi, T.W. (2003), "Construction in Hong Kong: Success Factors for ISO 9000 Implementation", Journal of Construction Engineering and Management, vol 129,no 6, pp 599-609
5. Ekambarampalaneeswaran, (2006). The construction industry is predominantly quality based and projects: A case study
6. Haupt T.C., Smith G. and Ebohon, O.J. (1998),"Total Quality Management in Construction: Towards Zero Defect", Peninsula Technikon, 156 pp25-36.
7. Ibrahim, Khaled M.R (2000), "Quality Practices in the Egyptian Construction Industry: Case Study", M.E. Thesis.
8. ISO 9001, 2015. Quality management systems — Requirements. [Online] Available at: https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en [Accessed 20 3 2016].
9. ISO, B., 2000. 9001: 2008 Quality management systems. Requirements. International Organization for Standardization
10. Rumane, A. R., 2011. Quality Management Construction Projects. United State: Taylor & Francis Group.
11. Swan, W. & Khalfan, M., 2007. Mutual objective setting for partnering projects in the public sector. Engineering, Construction and Architectural Management, Volume 14 (2), pp. 119-130.

Corresponding Author

Pensalwar Shalaka Dileeprao*

PhD Student, Kalinga University, Raipur, Chhattisgarh, India

Email - isobesin@gmail.com