

A REVIEW ON QUALITY MANAGEMENT OF CONSTRUCTION INDUSTRY

Sujeet Kumar Ram¹, Pinaki P. Nayak²

¹ Student [M.Tech (CTM)], Department of Civil Engineering, Sharda University, (India)

² Assistant Professor, Department of Civil Engineering, Sharda University, (India)

ABSTRACT

The construction sector plays an important role in the development of the infrastructure of any country. The development of the construction industry depends on the quality of construction projects. Quality is one of the critical factors in the success of construction projects. Improving the quality of construction projects is linked to quality management in the project life cycle. Although quality management at every stage of the project life cycle it is important, but quality management in the execution phase (construction) contributes significantly to the Quality result of construction projects. In this paper the techniques of quality management along with its validity with the ISO standards is done and has been analysed. The quality of construction material (cement, sand, aggregate, brick, stone etc.), quality of concrete, workability of concrete, grade of concrete that are being used at the site are checked as per the ISO standards. The costing of materials and transportation cost of each RMC plant are then managed and analysed along with the other factors that gives us the optimum cost.

Key word: *Workability, Grade of concrete, Costing of materials, Transportation cost, ISO-9000.*

I INTRODUCTION

Quality has become a very popular topic in recent years due to conceptual changes in the industry. It is one of the critical factors of success in the construction industry. The need to achieve the quality of the finished product in the construction of the building is very important. The high cost of buildings makes it necessary to guarantee the quality of the finished product. Quality is an essential element for sustainability and customer satisfaction. In construction projects, quality performance is considered vital for customer satisfaction. The objective of this study is to provide customers, project managers, designers and contractors with the information needed to better manage the quality of construction projects, identify the factors that influence the quality of the construction process and classify them by class of importance.

Quality can be defined as "meeting" or "exceeding" customer expectations "or" respecting customer specifications. "Regardless of the definition we follow for quality, it becomes very complex when we try to put it into practice. For the implementation of Quality management in construction projects, the concepts of quality

planning (identification of quality standards), quality assurance (evaluation of the general performance of the project) and quality control (monitoring of specific project results). Several tools and techniques will be identified as part of the implementation process, such as cost-benefit analysis, benchmarking, flowcharts, experiment design, quality cost, quality audit, inspection, control charts, Pareto diagrams, statistical sampling, flow charts and trend analysis.

ISO (the International Organization for Standardization) is a global federation of national standardization bodies (ISO member bodies). The quality system was introduced by ISO on March 15, 1987. ISO is compatible with proprietary approaches to quality management such as those recommended by Deming, Juran, Crosby and non-proprietary approaches such as TQM, Lean Six Sigma, FMEA, COQ and other techniques of continuous improvement (PMI, 2008). The successful implementation of the QMS is to take as a strategic decision for the organisation. The objective of the quality management system can be to reduce the possible errors in all phases of the projects through an adequate control, quickly identify errors / errors, measure to avoid repeated errors and determine and initiate corrective actions / preventive measures (Aized, 2012). According to the latest ISO survey (2014), 1,609,294 ISO certificates were issued and most of them belonged to the QMS standard or ISO 9001 certificates issued 1,138,155 which fulfilled the requirements of the QMS under external revision of a third party or certification body (UNIDO, 2012). In 2014 about 1,600 ISO 9001 certificates issued for various sectors in the Philippines

II OVERVIEW OF QUALITY MANAGEMENT

ISO (ISO / TC 176 technical committee) published five editions for ISO 9000 certification. ISO 9000: 1987 included three standards for quality assurance: ISO 9001, ISO 9002 and ISO 9003 to be a model for quality assurance in only inspection and final tests. The first version of the QMS or ISO 9000: 1994 standard emphasized quality assurance through additional preventive actions. ISO 9001: 2000 has been integrated with ISO 9001, 9002 and 9003 in a standard or ISO 9001 and a new standard has been established, its main objective was to switch from "quality assurance" to "quality management" (UNIDO, 2012). As a result, he made a radical change in thinking based on process focus, structure (8 clauses) and customer satisfaction. The third version was published in November 2008 with minimal changes made by the 2000 version, but with a greater emphasis on customer approach and satisfaction (ISO, 2010). The main objective of ISO 9001: 2008 is to clarify existing requirements and improve the consistency of the approach with other management standards such as GHS. Recently, ISO 9001: 2015 (5th ed.) was published in September 2015. The latest edition generates a radical change in thinking based on risk identification and risk control, a structure with 10 clauses. Furthermore, this version can be much better integrated with other management standards (ISO, 2015d).

The ISO 9000 family for the QMS is included (ISO, 2010):

- ISO 9000 - Quality management systems - Foundations and vocabulary;
- ISO 9001 - Quality management systems - Requirements;
- ISO 9004: management for the continuous success of an organization: a focus on quality management;

- ISO 19011 - Guide for internal and external audits of quality management systems.

ISO 9000 or "quality management principles" are a set of beliefs, norms, rules and fundamental values that are accepted as true and can be used as a basis for quality management (ISO, 2015c). It is a framework to guide organizations towards better performance. ISO 9000: 2005 has eight principles of quality management. Recently, a new version of the quality management principles has been published, such as ISO 9000: 2015, which has only seven principles such as (ISO, 2015c): 1) Customer Focus; 2) Leadership; 3) People's commitment; 4) approach to the process; 5) improvement; 6) Decision-based decision-making process; 7) Relationship management.

All organizations use processes to achieve their goals, a process defined by the ISO as a series of related or interacting activities that use inputs to deliver a desired result (ISO, 2015d). Therefore, ISO 9001: 2008 and 2015 are both based on the process approach. The intention of the process approach is to increase the effectiveness and efficiency of an organization to achieve the defined objectives and customer satisfaction. It also helps organizations control the links between processes and interfaces between the functional hierarchies of the organization (ISO, 2008). As can be seen in Table 1, the process approach in ISO 9001: 2008 incorporates the PDCA cycle and preventive action based on the identification and elimination of root causes of problems (eg errors, defects, lack of process controls) (ISO, 2008), while ISO 9001: 2015 incorporates the PDCA cycle and the "risk-based thinking" (ISO, 2015d). As a result, the main changes to the ISO 9001: 2015 standard compared to the ISO 9001: 2008 standard are as follows (IAF, 2015):

- The adoption of HLS as established in Annex SL;
- An explicit requirement for risk-based thinking to understand a better approach to the process;
- less emphasis on documents and less prescribed requirements;
- Greater emphasis on the organizational context (Environment);
- Greater leadership requirements and; more emphasis on achieving the desired results to improve customer satisfaction.

Furthermore, ISO 9001:2008 and 2015 have approximately the same requirements. Table 2 depicts the clauses of two different versions of ISO 9001.

Table 1: The interpretation of PDCA methodology in ISO 9001:2008 & 2015

Version	ISO 9001:2008 (ISO, 2012)	ISO 9001:2015 (ISO, 2015d)
Plan	Establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies.	Set the objectives of the system and processes to deliver results ("What to do" and "how to do it").
Do	Implement the processes.	Implement and control what was planned.
Check	Monitor and measure processes and product against policies, objectives and requirements for the product and report the results.	Monitor and measure processes and results against policies, objectives and requirements and report results.

Act	Take actions to continually improve process performance.	Take actions to improve processes performance.
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Table 2: The comparison between the clauses of ISO 9001:2008 & 2015

Clause	ISO 9001:2008	ISO 9001:2015
1	Scope	Scope
2	Normative references	Normative references
3	Terms and definitions	Terms and definitions
4	Quality Management System	Context (Environment) of the organization
5	Management Responsibility	Leadership
6	Resource Management	Planning
7	Product Realization	Support
8	Measurement, Analysis and Improvement	Operation
9		Evaluation
10		Improvement

There are five sections in the ISO 9001:2008 indicating activities that need to be considered when the organizations implement the quality management system, such as:

- Overall requirements for the quality management system and documentation (Clause 4);
- Management responsibility, focus, policy, planning and objectives (Clause 5);
- Resource management and allocation (Clause 6);
- Product realization and process management (Clause 7), and;
- Measurement, monitoring, analysis and improvement (Clause 8).

ISO 19011 (2011 version, 2nd ed.) is the only QMS standard, which is exclusive to audit (internal and external) QMS and EMS. Effective audits ensure that an implemented QMS meets the requirements specified in ISO 9001.

III CRITICAL ELEMENTS WITHIN CONSTRUCTION PROJECTS

Kerzner (2010) explained the project can be considered to be any series of activities and tasks that being completed within certain specifications and consuming resources throughout several functional lines for getting specific objectives. One important aspect of project management is analyzing the information related to the optimum balance among the project's objectives (Hajiagha et al., 2015). These goals should be based on the organization and business objectives to survive in the market and competing with other companies, project management has a significant role to achieve these objectives. As in any other business, construction projects are aiming to achieve success, and the project success depends on its expectations and how they are fulfilled (Proust, 2011), in order to meet the project requirements successfully (PMI, 2008). Extremely, it is essential to identify and focus on construction project objectives as the results of project. A survey was conducted among

international organizations in Gaza Strip-Palestine by Enshassi et al. (2014), revealed that the vital factors cooperate to a successful post-evaluation system in construction projects, and these elements are namely cost, time, quality, project efficiency, owner's satisfaction, project effectiveness, safety, risk, HR, communication, procurements, and environment. Some authors like Kerzner (2010) specified the project' success as the one that assesses both primary and secondary factors (customer's satisfaction). Primary factors include meeting deadlines, budget limit and the level of expected quality (iron triangle) in construction projects (Varajão et al., 2014), these factors to be criteria for real and balanced achievement of construction projects objectives (Golob et al., 2013).

Many studies and literature have been identified and determined the benefits of QMS that affect positively on the organizational performance and market in different industries. For example, a survey was performed by Thilakarathne and Chithrangani (2014) for identifying the benefits of implementing QMS in the ISO 9001-certified firms in Sri Lanka, the results of their research indicated that the customer satisfaction, reduces production time, increases quality awareness, improves product/service quality, improves employee productivity, and improves employee relations, were respectively, as most important perceived benefits of the QMS implementation within different companies in Sri Lanka. Based on the findings of several empirical studies, the most aim of QMS standards is to promote the customer's satisfaction, and many studies have been shown that it seems QMS is successful for achieving this aim by improving and stimulating the processes of ISO 9001-certified construction projects. In Malaysian construction companies, the majority of the respondents believed that the functionality and clients' satisfaction are respectively the most influences of QMS implementation into construction projects (Ali, and Rahmat, 2010). In addition, Mane and Patil (2015) found the 90% of the respondents asserted customer satisfaction and 80% client satisfaction are the most important aspect for maintaining QMS for construction projects in India.

Therefore, money (cost), time (delay), and quality (process, performance, products, etc.) are reliable, countable, and controllable notions that managers and practitioners are used to considering as main criteria of project success. These three factors are predominant in the management of usual construction projects (Proust, 2011). Doubtlessly, iron triangle is more significant, due to their significant effect on obtained results for being successful in project management that cost and time of the project is minimized while the project quality is maximized (Hajiagha et al., 2015). Also, the critical success processes (CSPs) research model is explained the success project can be affected by: schedule overrun, cost overrun, project performance, and funder's satisfaction (Zwikael and Smyrk, 2011; Neverauskas et al., 2013). Accordingly, the vital elements of the projects can be defined as the organization objectives (Internal factors), and business objectives (external factors) that are related to client's satisfaction (customer's satisfaction) and market.

IV CONCLUDING REMARKS

The paper focuses on the principal factors that influence the quality of the construction and also increase in the cost of construction due to a quality defect. This study will create awareness of quality management at all level

in construction companies, especially on a small scale companies. From this paper we obtain the main factors and problems that affect the quality of the construction industry and that create an opportunity to find out the corrective measure. The paper will be very useful in analysis the factors such as minimizing the waste of material, labour waste, loss of time and indirect costs, etc that focuses on the qualitative aspect of construction techniques thus increasing the customer satisfaction and company reputation.

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