

Quality Management System at Construction Project: A Questionnaire Survey

P.P.Mane*, J.R.Patil*

*(Department of Civil Engineering, RMD Sinhgad SOE, Savitribai Phule Pune University, Pune- 58 (India))

*(Department of Civil Engineering, RMD Sinhgad SOE, Savitribai Phule Pune University, Pune- 58 (India)

ABSTRACT

The best quality, time and cost are the important aspects of successful construction project which fulfills the main goal of construction industry. The quality management has to provide the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a construction project. The role of quality management for a construction company is not an isolated activity, but intertwined with all the operational and managerial processes of the construction project. The quality management system (QMS) in construction industry refers to quality planning, quality assurance and quality control. The paper includes the outcome of the research methodology decided by authors based on interview of project participants and analysis of scrutinized interview data.

Keywords – construction project, quality management system.

I. INTRODUCTION

Quality is one of the main factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations (i.e. the satisfaction) of the project participants. Quality, cost and time have been recognized as the main factors concerning the client. However, for the majority of projects, the cost and time parameters are the main pre occupying factors for construction project. The authors emphasize more attention towards quality. The quality in the construction industry is linked with client's satisfaction and the implementation of a quality management system is a key tool in consistently and reliably managing the goal of client satisfaction. Quality management system (QMS) could be implemented either at the organization level or at the project level itself.

For the implementation of quality management in construction projects, the concepts of quality planning (identification of quality standards), quality assurance (evaluation of overall project performance) and quality control (monitoring of specific project results) in the quality management processes were defined by Project Management Institute (2000). Several tools and techniques were identified as part of the implementation process, like benefit-cost analysis, benchmarking, flow-charting, design of experiments, cost of quality, quality audits, inspection, control charts, pareto diagrams, statistical sampling, flow-charting and trend analysis.

Taylor et al. (2003) concluded that senior manager's involvement, understanding and customer focus are essential antecedents of construction project success. Samson et al. (1999) described that

leadership and human resources management are among strong predictors of performance quality management (QM) practices. On construction related research, Low et al. (2004) commented that top management commitment is one of the elements that would reflect QM performance measures in construction firms. Chin et al. (2003) found that top management commitment is the most critical factor for the successful implementation of ISO 9000.

Hakim et al. (2006) Quality management system (QMS) is defined as "all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system". To ensure the continually improvement of Quality Management System, it is essential that the top management to give their full support and commitment especially to the development and implementation of construction project/s.

The paper includes five-point scale based questionnaire survey for study of QMS at construction projects. It includes questions based on quality control tools and quality measures used on construction sites.

II. LITERATURE REVIEW

According to AbdulAziz et al. (1999), quality systems involve internal and external aspects. An internal quality system covers activities aimed at providing confidence to the management of an organization that the intended quality is being achieved. This is called a "quality management system". Successful implementation of quality

management system can contribute to an increase in product quality, improvement in workmanship and efficiency, a decrease in wastage, and increase profit. Meanwhile, an external quality system covers activities aimed at inspiring confidence in the client that the supplier's quality system will provide a product or service that will satisfy the client's quality requirements. This is called a "quality assurance system".

An effective planning requires the organization to plan for the resources and the construction work by providing the work programme, cost programme, project quality plan, labour, material and plant schedule, construction method statement and inspection and test plan. Consequently, it will become as the core reference for the construction process control and conformance and performance measurement processes. According to Lydia (2010), the guidelines to ensure the quality in planning are: (i) Ensure that all relevant parties involved including consultants, subcontractors and suppliers are included in the task of quality planning for the project; (ii) Establish and define the purpose of the quality system; (iii) In the plan, minimize the effort required to amend copies of documents; (iv) Set up a quality system development team so that the team can produce an effective plan; (v) Ensure that throughout the quality planning task constantly focused on the customer requirements.

Construction is a multifarious process involving many organizations on a single project; however, the contractor's, consultant's and client's roles are pivotal for the success of any project. Contractors work as the interface between the public and the industry and they demonstrate the real performance of the industry. They are the public face of the construction industry. Their performance, focuses, policies, processes and methods have a direct impact on all stakeholders in the industry. The Egan Report (1998) also focuses on contractors. Any process that makes the performance of the contractors efficient and effective will have a positive impact on the whole industry. Quality control is very pivotal in achieving acceptable performance on construction sites. The significance of this research lies in the possibility of adding to the wealth of information on quality control plans and practices by contractors. An evaluation of the contractor's quality control practice will help contractors develop strategies to improve construction quality; it will aid consultants and clients in pre-contract evaluation of contractors and will help the general public in measuring the success or otherwise of a project vis-à-vis the contractor.

Yasamis et al. (2002) refers to the definition of quality of performance as encompassing the reliability of the original product and/or service as

well as the competence, integrity and promptness of staff and support services. For owners to receive more value for their investment definitions of quality in construction need to be expanded to include the performance of the company as a whole and the client satisfaction derived from that performance. There is a shift in business thinking from compliance mode to performance mode. While contractors are striving to improve their overall performance, the control and monitoring mechanisms that clients practice on contractors and their work should also be reengineered (Wilson and Pearson, 1995).

Quality Management System (QMS) have many applications in the construction industry. QMS could be implemented either at the company level or at the project level. From the perspective of a construction company, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customer's satisfaction that would bring long term competitiveness and business survival for the companies.

III. RESEARCH METHODOLOGY

The methodology for the work consists of three step model. The first step is quality planning, second step is quality control and third step is quality assurance. In the first step the questionnaires have been prepared by authors considering quality aspects of construction project. Three types of questionnaires have been prepared by author for work. This paper describes the rating aspects based on importance on five-point scale. In second step the interviews of participants of construction project have been conducted by the author. The brief details of respondents and their experience are shown in "Table 1". The third step includes analysis based on views of respondents.

Table 1 Respondents and their experiences

Sr. No.	Respondents	Experience in years
1	Project Manager (Owner)	15
2	Project Manager (Contractor)	20
3	Project Manager (PMC)	15
4	Project Engineer (Owner)	10
5	Project Engineer (Contractor)	12
6	Project Engineer (PMC)	10
7	Architect	10
8	Designer	15
9	Quality Manager	11
10	Project Manager	9

The “Table 1” shows the information about the respondents from various participants of the construction projects such as owner, contractor, project management consultancy (PMC) and various consultants of the construction project and their experiences. The interviews have been taken with concerned participants of project (owner, PMC executive, contractors, various consultants and suppliers) with respect to rating type questionnaire survey. The various optional points for each questions are provided. The respondents has to rate these points on five-point rating scale. The scale description is as “5= Very Strong, 4= Strong, 3= Moderate, 2= Less, 1= Very less”.

The number of questions will be asked to them and only three important questions have been selected for this paper work. The following questions have been selected for the work:

- Research question A: Which Quality tool used at construction projects?
- Research question B: Which Quality control measures used on site?
- Research question C: Which aspect is most important for maintaining quality management System at construction projects?

In the analysis of data all the options of questions have been studied and the findings have mentioned in the subsequent section of paper.

IV. DATA COLLECTION & ANALYSIS

The number of persons interviewed is 150. The options of all questions and its percentage rating are shown in “Table 2”, “Table 3” and “Table 4” respectively.

Table 2 Research question A

Sr. No.	Which Quality tool used at construction projects?	Rating				
		5	4	3	2	1
i	Pareto analysis	30%	40%	20%	10%	0%
ii	Fish bone diagram	60%	40%	0%	0%	0%
iii	Check lists	80%	20%	0%	0%	0%
iv	Flow chart	30%	60%	10%	0%	0%
v	Scatter diagram	10%	10%	50%	20%	10%
vi	Control	20%	30%	40%	0%	10%

	Charts				%	
vii	Histogram	30%	40%	10%	20%	0%
viii	Statistical analysis	0%	0%	50%	30%	20%
ix	Check sheets	20%	40%	30%	10%	0%

Table 3 Research question B

Sr. No	Which Quality control measures used on site?	Rating				
		5	4	3	2	1
i	Study duties and responsibilities	35%	40%	10%	15%	0%
ii	Coordination with the project purchase department	10%	10%	80%	0%	0%
iii	Do proper sampling and testing	75%	20%	5%	0%	0%
iv	Set procedures to control quality	80%	15%	5%	0%	0%
v	Follow the prescribed curing and deshuttering schedules	60%	25%	15%	0%	0%
vi	Quality of workmanship in all construction activities	90%	10%	0%	0%	0%
vii	Quality Control laboratory at site	30%	40%	10%	20%	0%
viii	Maintain sequence of construction	30%	10%	30%	20%	10%
ix	Site review meetings with staff	80%	20%	0%	0%	0%
x	Observe regular schedule	65%	15%	5%	5%	10%

The analysis includes calculation of percentage wise waitage of the aspects of construction project given in questions by the

respondents. There are several methods for analysis of data but for this work authors used simple logical method. The method comprises of first see more percentage in very strong rating column for any option. If the percentage of very strong column is equal for two or more options then the strong rating columns are compared. Based on the above method the findings of study are mentioned in the discussion section.

Table 4 Research question C

Sr. No	Which aspect is most important for maintaining quality management System at construction projects?	Rating				
		5	4	3	2	1
i	Competitive markets	70 %	20 %	10 %	0 %	0 %
ii	Customer satisfaction	90 %	5 %	5 %	0 %	0 %
iii	Client satisfaction	80 %	5 %	0 %	15 %	0 %
iv	Stakeholders satisfaction	75 %	20 %	5 %	0 %	0 %
v	Management commitment	70 %	30 %	0 %	0 %	0 %

V. DISCUSSIONS

As stated in research methodology the author distributed 150 set of questionnaires among the participants of construction project configuring experiences and positions mentioned in “Table 1”. After scrutinizing the data of responses of respondents the following findings have been mentioned in detail.

As per the responses of respondents the most important quality tool used at construction site is check lists followed by fish bone diagram, flow chart, pareto analysis, histogram, check sheets, control charts, scatter diagram and statistical analysis.

The quality control measure used on construction site is the quality of workmanship in all construction activities followed by site review meetings with staff, set procedures to control quality, do proper sampling and testing, observe regular schedule, follow the prescribed curing and

deshuttering schedule, study duties and responsibilities, quality control laboratory at site, maintain sequence of construction, coordination with the project purchase department.

The analysis of third and most important question for survey indicates that customer satisfaction is very important followed by client satisfaction, stakeholders satisfaction, management commitment and competitive markets.

The research also indicates that quality planning, quality control and quality assurance are the main elements of QMS and for success of construction project it is necessary to give attention towards all these elements.

VI. CONCLUSIONS

Based on the study reported in paper the following are the conclusions:

- The 80% respondents very strongly believe check lists and 60% preference to fish bone diagram are quality control tools used at construction projects.
- The 90% respondents very strongly believe that quality of workmanship in all construction activities and 80% to site review meetings with staff are main quality control measures used on site.
- The 90% respondents very strongly prefer customer satisfaction and 80% client satisfaction are the most important aspect for maintaining QMS at construction projects.

REFERENCE

- [1.] Taylor, W. A., & Wright, G. H. (2003). *The impact of senior managers' commitment on the success of TQM programmes—An empirical study*. International Journal of Manpower, 24(5), 535-550.
- [2.] Abdul Rahim, A.H et al. (2004). *Integration of Safety, Health, Environment and Quality (SHEQ) Management System in Construction: A Review*. Jurnal Kejuruteraan Awam, Vol. 16(1): 24-37, pp. 14.
- [3.] Low, S. P., & Teo, J. A. (2004, January). *Implementing total quality management in construction firms*. Journal of Management in Engineering, 8-15.
- [4.] Samson, D., & Terziowski, M. (1999). *The relationship between total quality management practices and operational performance*. Journal of Operational Management, 17, 393-409.
- [5.] Abdul Hakim and Mat Naim (2006). *Quality Management System in Construction*. Unpublished Conference Paper in ICCI 2006.

- [6.] Lydia (2010). *The Integration of Quality Management System in Construction Industry. Submitted version Master's Thesis*, Universiti Teknologi Malaysia, Malaysia. pp. 32-38.
- [7.] Yasamis, F., Arditi, D. and Mohammadi, J. (2002). *Assessing contractor quality performance*. Construction Management and Economics, 20(5): 211–223.
- [8.] Savage, G.T., Nix, T.W., Whitehead, C.J. and Blair, J.D. (1991). "Strategies for assessing and managing organizational stakeholders". Academy of Management Executive, Vol. 5 No. 2, 61-75.
- [9.] Chin, K. S., & Choi, T. W. (2003). *Construction in Hong Kong: Success factors for ISO 9000 implementation*. Journal of Construction Engineering and Management, November/December, 599-609.
- [10.] Cooper, D. R., & Schindler, P. S. (1998). *Business research methods* (6th ed.). Singapore: McGraw-Hill Book Co., 212-252.
- [11.] Dissanayaka, S. M., Kumaraswamy, M. M., Karim, K., & Marosszeky, M. (2001). *Evaluating outcomes from ISO 9000-certified quality systems of Hong Kong constructors*. Total Quality Management, 12(1), 29-40.
- [12.] Rodgers, R., Hunter J. E., & Rogers, D. L. (1993). *Influence of top management on management program success*. Journal of Applied Psychology, 78(1), 151-155.
- [13.] Chan, Y.K and Nealey, K. (1998). ISO 9004-2 Quality Management System - *The way to World-Class Service*, 6, (395-401).
- [14.] Chew.Y.S and Chai.L.N. (1996). ISO 9002 *In the Malaysian Construction Industry Guide and Implementation*, MacGraw-Hill Book Co.
- [15.] Giles, R. (1997). ISO 9000 Perspective for Construction Industry in the UK. Training for Quality, Vol. 5, No. 4, (178-181).
- [16.] Lee, S. F et.al (1992). Survey on ISO 9001 *Quality Management System Implementation in Hong Kong*, 14, (77-88).
- [17.] Arditi, D. and Gunaydin, H. (1997). *Total quality management in the construction process*. International Journal of Project Management, 15(4): 235–243.
- [18.] Barrett, P. (2000). *Systems and relationships for construction quality*. International Journal of Quality and Reliability Management, 17(4/5): 377–392.
- [19.] Beecroft, G.D. (1999). The role of quality in strategic management. Management Decision, 37(6): 499–502.
- [20.] Abdulaziz A.B. and Tawfiq, H.A. 1999. ISO 9000 quality standards in construction. Journal of Management in Engineering, Nov/Dec, pp 41-45.
- [21.] Al Nakeeb, A.AR. and Mustapha, F.H. 1994. Quality assurance in construction – does it really work? *Quality Management in Building and Construction: Proceedings of Eureka Conference*, Hamar/Lillehammer, June, pp 242-248.
- [22.] Low, S.P. and Hennie, F.O. 1997. *The effective maintenance of quality management systems in the construction industry*. International Journal of Quality & Reliability Management, Vol. 14 No. 8, pp 768-790.