

QUALITY MANAGEMENT SYSTEM (QMS) AT RESIDENTIAL CONSTRUCTION PROJECT

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Abstract- Construction projects and its complexities are increasing in recent years along the demand of customers towards the quality of construction projects in its high level. The implementation of quality management system (QMS) has been a solution to achieve the required level of quality as per ISO 9001 standards. The paper includes major factors affecting the quality of residential buildings during the construction particularly in execution phase and the level of management commitment towards the implementation of quality management at residential construction projects. The data was collected through questionnaire; interview and document review which includes visiting of some construction companies and conduct the questionnaire survey then analysis in quality management to find the results and conclusion. The findings have shown that the companies need of a higher level of management commitment with respect to critical parameters towards the implementation of quality management at residential construction projects.

Keywords: Quality Management System (QMS), Factors affecting the quality of construction, Management commitment, Construction Projects.

1. INTRODUCTION

Quality is one of the most aspects of project success and for a long term it has been a problem in the construction industry and it can be defined as meeting the effectual requirements of the project. Quality management system in construction projects is to keep up the quality of construction as per the required standards so to reach the customer's satisfaction that would take long term competitiveness and business endurance for the companies [1].

According to Taylor et al. (2003) concluded that senior manager's involvement, understanding, and customer focus are important factors for the success of the project. The top management commitment is very important for the successful implementation of QMS. The high levels of management commitment would lead to reduce problems on construction sites [2].

In today's world quality is the most important factor for the survival and success of companies, and customer demands are for durable and better services [11].

Quality management system (QMS) is a key instrument to achieve the goal of customer satisfaction. QMS is a set of all activities of management function that determine the quality

objectives, policy and responsibilities, and apply them by way such as quality planning, quality control, quality assurance and quality improvement inside the quality system. To assure the continual improvement of the QMS, it is important that top management should have a high level of management commitment toward the quality of construction projects [7].

The paper includes the questionnaire survey for study of QMS at construction projects based on a five-point scale rating system. It includes questions based on quality control and management commitment towards the quality of construction projects.

1.1 Problem Statement

Every building construction project needs to be completed with high quality and achieve customer satisfaction; therefore Quality Management System (QMS) is seen as a solution for improving the quality of projects within the construction industry.

1.2 Scope of the Project

The project purpose is to improve the quality in high rise building construction project and recommend an appropriate Quality Management System.

1.3 Objectives

1. To determine the major factors that are affecting the quality of residential building during the construction particularly in execution phase.
2. To analyze the level of commitment of management towards the implementation of quality management at residential construction projects.

2. LITERATURE REVIEW

According to H. Mallawaarachchi and S. Senaratne (2015) Quality is what has been planned to fulfill the requirement for the successful of the project. A suitable level of quality could be found out during all phases of the construction project; especially construction and operation are two critical phases. Poor quality in construction project is a general issue in the world and the required level of quality in construction. In construction industry quality management is to control and keep the quality of construction at the required standard to meet customer satisfaction and the

market competitiveness. Therefore, the implementation of quality management and standards will prevent high cost and time over run of the project and can meet the requirements of owns and other parties involved in the project. The commitment and the support at the management are important to continue the process and the awareness and training are essential to lead the construction project success.

According to Tan Chin-Keng Ph.D Kulliyyah (2011) The quality management is to meet the required level of quality as per planned and organized. In construction project means maintaining the quality of construction work as per standards to meet the customer’s requirement and also maintaining the company at high level in the market competition. The problems for implementing the Total Quality Management (TQM) on construction sites; excessive use of paper work, transitory of work force, no commitment of employees towards TQM problems in measuring results, low bid sub contracting, and suppliers not interested in TQM also lack of communication, not support and commitment of the top management. TQM is not a common practice and ISO registration is mostly for marketing purpose. The companies are generally using traditionally methods such as experiments and inspections. The financial and human resource should be increased for implementation of quality management system.

As reported by Anup W.S, Arun kumar H, SNA saghi (2015) Quality System is defined as the organizational structure, procedures, processes and resources needed to implement quality management and ISO 9001 specifies certain set of quality system to be followed to meet customer requirement but unfortunately now a days the companies are having ISO 9001 certifications only for marketing purpose. The required level of quality cannot be achieved only by having ISO certificate but it should be monitoring and controlling through all the phases of the project.

Bhnam Neyestani (2016) QMS provides the procedure, guidance and requirements for achieving the required level of quality in order to minimize the cost increased productivity, to meet the customer satisfaction and increase the value of company in the market.

Pravin P. Mane, Dr. Jalindar (2015) QMS is the management and control of all the activities which include the quality policy, objective, responsibilities and implementing as quality planning, quality control, and quality assurance and quality improvement within the quality system. The keys to continuous improvement are commitment and team work. The commitment must be from top managers to all within the organization.

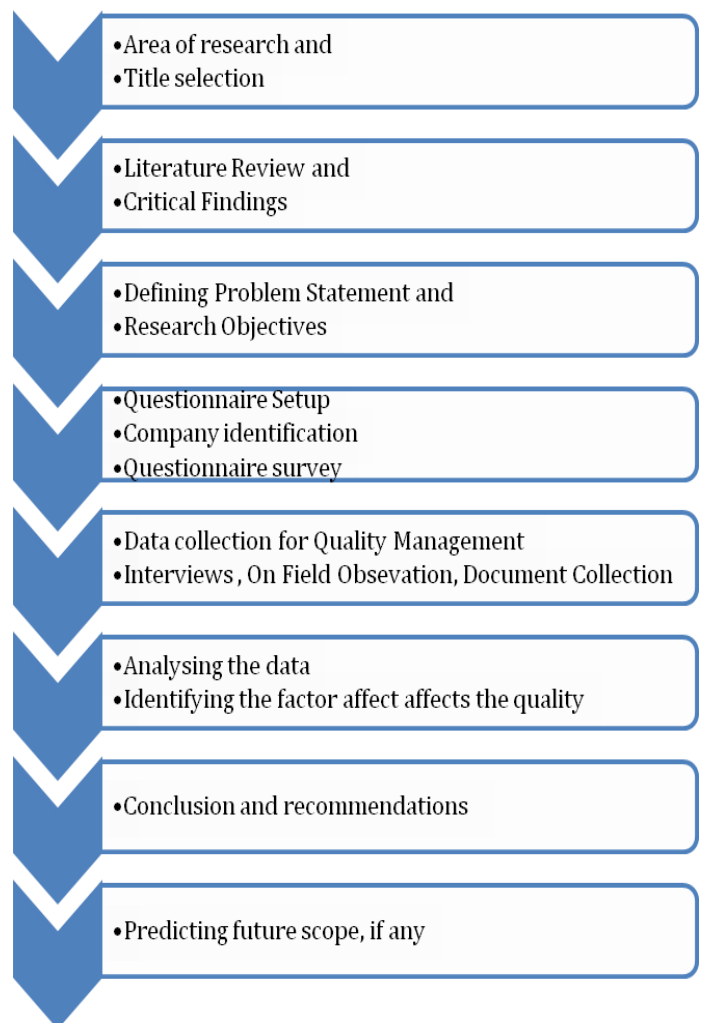
Dr. Daw Alwerfalli, Dr. Aslihan Karatas (2016) the organization should adopt the system approach of QMS and the four main clauses of the standards must be covered which are; Management responsibility, Resource Management, Product realization, Analysis and

Improvement. QMS is the quality system that clearly helps the organization to fulfill the customer’s quality level. An effective working QMS indicates the organization’s commitment to safety, quality, Delivery, Cost and Morale.

3. RESEARCH METHODOLOGY

Important research papers relating to quality, quality management, and quality management procedures in construction industry were reviewed in order to determine the importance of quality for construction projects.

3.1 Methodology



The “Table 1” shows the information about the respondents and their experiences which the interviews have been taken with respect to five-point rating type questionnaire survey.

Table 1: Respondents and their experiences

Sr. No	Respondents	Experie nce in years
1	Project Manager	24

2	Project Manager	17
3	Project Manager	10+
4	Senior Engineer	10+
5	Senior Engineer	10
6	Senior Engineer	9
7	Senior Engineer	8+
8	Senior Quality Engineer	8

3.2 Factors that are affecting the quality of construction

The quality of construction is regulated by various factors which are mentioned below:

1. Project Requirements

- a. Owner
 - Completion of project on time and within budget
 - Adequacy in functions
 - Life cycle cost
 - Operation and maintenance
- b. Constructor
 - Contract plans and specifications, documents, other details
 - Up to date decisions from owner and designers
 - Fair and timely inspection of the staff
- c. Design Professional
 - Well defined scope of work
 - Budget for allotting and employing staff and workers
 - Budget to get field information before design procedure
 - Timely decision from owner and designer
 - Contract to fix the project fee and time
- d. Regulatory Agencies
 - Protection to public property
 - Laws applicable must be conformed
 - Codes, policies and regulations must be followed
 - Public safety and health

2. Construction Organization

Based on various research studies it is concluded that the commitment and the leadership criteria of a construction organization will affect the quality of the project.

There is a gradual decrease in productivity, if the management practices are poor.

3. Quality Team

An organized environment is provided by having quality teams for the project. Practises are implemented structurally and continuously with regular quality checks. Quality teams will have structural engineers, electrical engineers, environmental, civil engineers, architects and owners to achieve quality goals.

4. Participation of team members

Quality team is productive and effective when its members are participated not only in the planning stage but also during the construction phase of the project.

3.3 Factors interviewed from experts:

- The class of materials used in construction
- Method of execution of work
- Advance equipment's used in construction
- Skills of the manpower
- Training policies
- Lack of co-ordination among departments
- Testing and documentation
- Site set up (labor camp, steel yard, RMC plant, QC lab, Skill labors)

4. DATA COLLECTION AND ANALYSIS

A questionnaire was designed to provide us the information to study the level of commitment of management towards the implementation of QMS which impact on success of project and will help us to obtain the solutions for it in further studies. The respondents have to rate the points on five-point rating scale which various optional points are provided for each questions.

The scale order is as "5=Very Strong, 4=Strong, 3=Moderate, 2=Less, 1=Very less

The analysis includes calculation of percentagewise of the aspects of construction project given in questions by the respondents. There are different methods for analysis of data but for this work simple logical method of calculating percentage for each point and choosing the questions which contain minimum two options of moderate from the respondents.

The Table 2 shows the detailed analysis of questionnaires asked to respondents and weighted average.

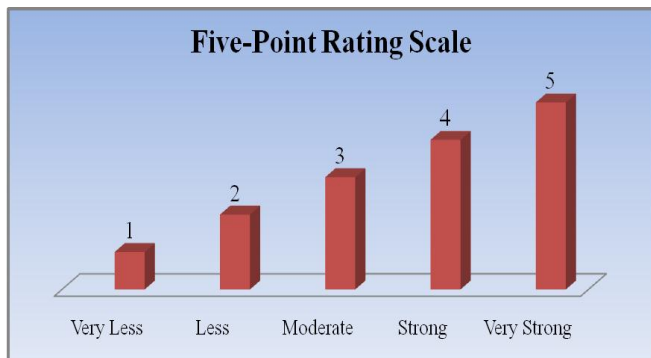


Fig-1: Five-Point rating scale description

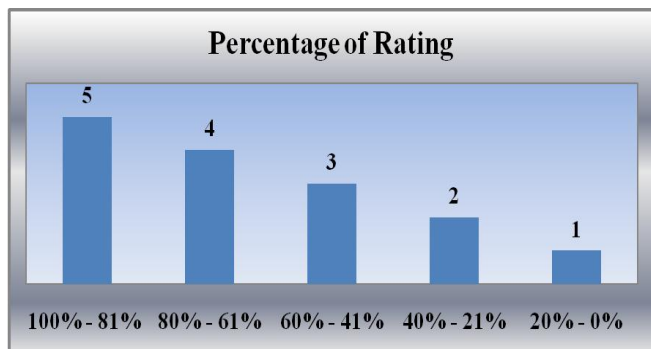


Fig-2: Percentage of each point of rating scale

Table 2: Data collected with weighted average

1	construction drawings									5	
1	2	Site review meetings with staff	5	4	5	4	3	5	4	5	4.375
1	3	Maintaining regular schedule	5	5	4	4	4	5	3	4	4.25
1	4	How much important is the competitive markets	5	4	5	4	5	3	4	4	4.25
1	5	Importance of customer satisfaction	5	5	5	5	5	3	5	5	4.75
1	6	Management commitment	5	5	5	4	4	5	5	5	4.75
1	7	Implementation of quality management plan on your site	5	5	4	4	4	4	5	5	4.5
1	8	Internal testing of materials	5	5	5	4	4	5	4	5	4.625
1	9	Test report from supplier	4	5	5	4	3	4	3	3	3.875
2	0	Materials used at site	5	5	5	5	4	4	4	3	4.375
										4.33125	

Table 3: Data collected with Percentage analysis

Parameters	T. R	V.Strong (%)	Strong (%)	Moderate (%)	Less (%)	V. L (%)	Total
How much effective is the existing quality tool used at construction project	8	38%	63%	0%	0%	0%	100%
Rules and obligation for quality control measures used on site	8	50%	50%	0%	0%	0%	100%
How is the coordination with the project purchase department	8	25%	63%	13%	0%	0%	100%
How is the sampling and testing of materials	8	50%	38%	13%	0%	0%	100%
Process to quality control	8	63%	0%	38%	0%	0%	100%
Curing and deshuttering as per schedules	8	25%	63%	13%	0%	0%	100%
Quality of workmanship in all construction activities	8	38%	50%	13%	0%	0%	100%
Training provided for staff and labors	8	25%	50%	25%	0%	0%	100%
Quality control laboratory at site	8	88%	13%	0%	0%	0%	100%
Advance equipment's used at site	8	13%	38%	50%	0%	0%	100%
Keep up sequence of construction drawings	8	63%	13%	25%	0%	0%	100%
Site review meetings with staff	8	50%	38%	13%	0%	0%	100%
Maintaining regular schedule	8	38%	50%	13%	0%	0%	100%
How much important is the competitive markets	8	38%	50%	13%	0%	0%	100%
Importance of customer satisfaction	8	88%	0%	13%	0%	0%	100%
Management commitment	8	75%	25%	0%	0%	0%	100%
Implementation of quality management plan on your site	8	50%	50%	0%	0%	0%	100%
Internal testing of materials	8	63%	38%	0%	0%	0%	100%

Sr. No	Parameters	R1	R2	R3	R4	R5	R6	R7	R8	Average
1	How much effective is the existing quality tool used at construction project	5	5	5	4	4	4	4	4	4.375
2	Rules and obligation for quality control measures used on site	5	4	5	5	4	4	4	5	4.5
3	How is the coordination with the project purchase department	4	5	4	4	5	4	3	4	4.125
4	How is the sampling and testing of materials	5	4	5	5	4	4	3	5	4.375
5	Process to quality control	5	5	3	5	3	5	3	5	4.25
6	Curing and deshuttering as per schedules	4	5	5	4	4	4	4	3	4.125
7	Quality of workmanship in all construction activities	5	4	5	5	3	4	4	4	4.25
8	Training provided for staff and labors	5	4	4	4	3	4	3	5	4
9	Quality control laboratory at site	5	5	5	5	5	5	4	5	4.875
10	Advance equipment's used at site	5	3	4	4	3	3	4	3	3.625
11	Keep up sequence of	5	5	5	5	4	3	3	5	4.37

							%
Test report from supplier	8	25%	38%	38%	0%	0%	100%
Materials used at site	8	50%	38%	13%	0%	0%	100%

The analysis consist calculation of percentagewise of each aspects of construction project given in questions by the respondents. The critical parameters are mentioned in the conclusions.

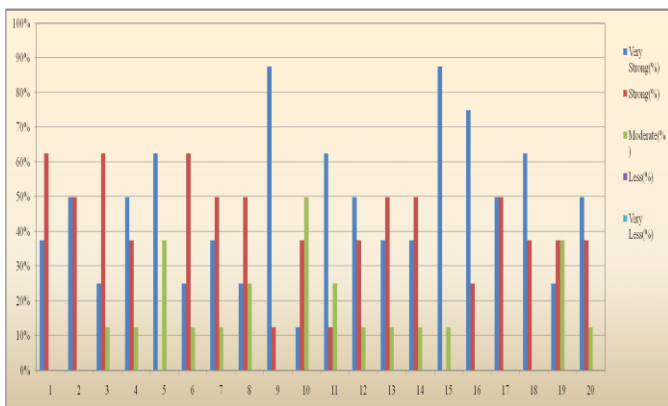


Fig-3: Percentage of each parameter asked to respondents

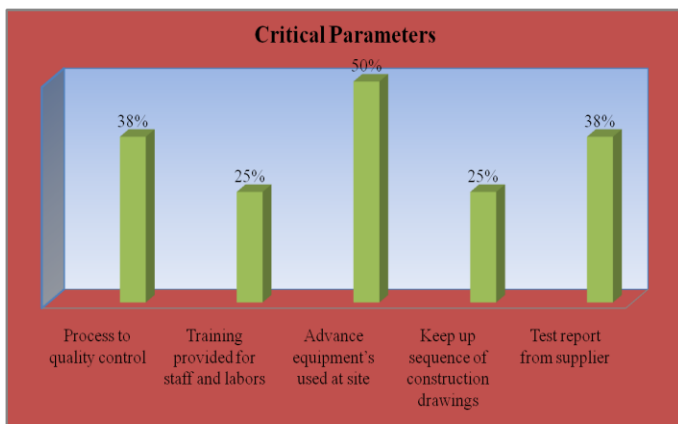


Fig-4: Critical parameters after analysis of data

As per the responses the critical parameters are:

1. Advance equipment's used at site
2. Process to quality control
3. Test report from supplier
4. Training provided for staff and labors
5. Keep up sequence of construction drawings

These respondents require higher level of management commitment with respect to above parameters mentioned.

4.1 Respondent's reasons for the critical parameters

1. **Advanced Equipment used:** According to the respondents there is a lack of advanced equipment used at site which could improve the speed and the quality of work such as;

- For painting using putty sanding machine and putty spray machine.
- For gypsum work using meter instruments to check the moisture content and for applying using the panhandler mud pan and also for lifting using gypsum board dolly. And a proper mix ratio for adding water to gypsum.
- For external painting providing the scaffolding increases the working space, stability and more efficiency.
- For concreting using boom placer to place concrete accurately and also using rebound hammer for immediate compressive strength of concrete.
- For tiling work using tile leveling system and tile trowels.

2. Process to Quality Control

- Lack of engineers to the quality control team as the processes are too much for better achievement of quality.
- Lack of the supervision can bring less efficiency in the process of quality.
- Miscommunication between the team
- Damaged and low quality materials such as too much water or sand in concrete mix.
- Suppliers and vendor failures which create problems in the process to quality control by replacing the requested building supplies with other brands.
- Subcontractor mishandling due to labors without right skills and fails to train them.

3. Test Report from Supplier

- Lack of coordination with supplier (3rd party) delays the final report of 28 days of concrete for a month.
- High number of participants and lack of formal process for coordination.
- Low reliability of suppliers and poor OTIF (On time and in-full) delivery performance.
- Most of the suppliers do not give the test reports of wires, tiles and raw materials.

4. Training Provided for Staff and Labors

- Lack of skilled labors and failure to train them.
- Lack of familiarity of labors to the advanced equipment.
- The need for more skilled labors at site.

- Inadequate supervision and lack of communications.
- Need of Top-Level management support.

5. Keep Up Sequence of Construction Drawings

- Maintaining the sequence of construction drawings improves the efficiency of work.
- Lack of coordination between departments can delay the work process.
- Last-Minute changes in the design from consultant affects the sequence of the construction drawings.
- Late receiving the construction DWG package to the contractors.
- Changes from customers also affect the sequence of the drawings.
- Late update of the drawings at construction site.

5. CONCLUSIONS

The implementation of QMS without top management commitment, control of processes and proper communication the desired quality cannot be achieved in construction. The ISO certification has become a marketing tool rather than a QMS implementation tool. This study has identified the major factors that are affecting the quality of residential building during construction particularly in execution phase and management commitment towards implementation of QMS which will provide the quality management awareness to all level construction companies particularly small scale companies.

As per the responses of the respondents the most critical parameters with respect to management commitment are; Advance equipment's used at site, Process to quality control, Test reports from supplier, Training provided for staff and labors, keep up sequence of construction drawings. The mentioned parameters affects the quality of construction, therefore the companies require higher level of management commitment which will help the organization to achieve the desired level of quality as per requirements.

6. SUGGESTIONS

- The organization should develop the importance of QMS, training and awareness within the organization.
- Proper training should be provided to staff and labors and the importance of implementation of QMS has to be communicated to the lower management in order to change their perception about quality.
- Proper communication and coordination between departments regarding the quality failures has to be made to the top management.
- A monitor and control model should be set up during the planning and execution phase which has to be followed by the quality representatives.

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