# Review on "Quality Control for High-Rise Building Projects"

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***Abstract-*** *Quality is one in every of the important factors within the success of construction comes. Quality of construction comes, furthermore as project success, are often considered the fulfilment of expectations of the project participants. Construction industry plays a crucial role within the development of any country. The development of construction industry depends on the standard of construction projects. The construction industry in India has been combating quality problems for several years. A major quantity of the budget is spent every year on infrastructure and different development projects. Since the quality outcomes of the projects don't seem to be per needed standards, faulty construction takes place. Consequently further investments are needed for removal of defects and maintenance work. A construction project in its lifetime goes through totally different phases. Quality of a product are often measured in terms of performance, reliableness and durability. Quality could be a crucial parameter that differentiates a company from its competitors. Quality management tools guarantee changes within the systems and processes that eventually lead to superior quality products and services. Quality management ways like Total Quality management or six sigma have a standard goal - to deliver a top quality product. Quality management is important to form superior quality products that not solely meet however conjointly customer satisfaction exceed. Though quality management at each stage of project life cycle is vital however the quality management at the execution stage contributes considerably on final quality outcome of construction projects. Due care is taken within the success of high-rise building construction project, quality is that the vital factors, and who is answerable for Managing, Performing and supportive the quality connected activities at Project site. This paper examines the literature analysis of Quality control for various high-rise building projects.*

***Keywords***- Defects, High-rise, Quality control, Total Quality management.

## I. INTRODUCTION

Construction industry plays a vital role within the development of any country. The event of construction industry depends on the standard of construction comes. Quality is one in every of the essential factors within the success of construction industry. Improvement within the quality of construction industry is connected with quality management within the project life cycle. Though quality management at each stage of project life cycle is very important however the standard management at the execution stage contributes considerably on final quality outcome of construction comes. The definition of quality depends on the purpose of read of the folks shaping it; some read it as "conformance to specification. Others read it as "performance to standards or price bought the worth. For construction firm quality is nothing however the satisfaction of consumers and fulfilling of their necessities among a nominative budget. It principally focuses the importance and factors that affects the standard management within the execution part. Quality has become a really well-liked subject in recent years because of abstract changes within the industry. Quality and quality systems are topics that are receiving increasing attention worldwide. The product in any industry ought to be manufactured to a needed normal, one that gives client satisfaction and price for cash. The necessity for achieving quality of the finished product within the building construction is extremely vital. The high price of buildings makes it necessary to make sure quality of the finished product. Quality is a necessary component for property and client satisfaction. In construction comes, quality performance is taken into account as important for client satisfaction. Quality may be outlined as systematically 'meeting' or 'Exceeding' the client expectations', or 'compliance with client specification'. Developing a high quality system is that the commencement towards rising quality in construction industry.

## II. LITERATURE SURVEY

D.AshokKumar (2014) in his paper has provided a study on, "Quality management in construction industry". The author focuses mainly on the importance and factors that affects the Quality management in the execution phase. The author also included visiting of visiting of some construction companies and conducts the questionnaire survey, then analyses the difficulties and the cost variance due to quality

defect in quality management and suggests some proactive measures for the improvement of quality in the execution phase of construction projects. The purpose of his study is to investigate the adoption and implementation of QMS in the construction industry and to develop a "measurement methodology" of construction processes for customer satisfaction and continuous improvement. The tools used in the measurement will be one or several of the "Tools of Total Quality" such as control and run charts, cause and effect diagrams, flowcharts, check sheets, Pareto diagrams, and histograms. His study creates some awareness about major factor affect the construction quality and cost of poor quality. Another important of his study is comparing the quality management between high level companies and low level companies. [1]

Alpa S.Maisuria et.al in their paper has provided a study on, "Evaluation of the factors affecting the quality of construction for residential projects". The authors suggested that Quality Management Systems are being operated in some sectors in Turkey but it is rare to meet these systems in construction industry. There are many hindrances that make it difficult to apply these systems effectively due to the nature of construction and therefore, no objective way of measuring the effectiveness of these systems exists in construction industry. Their study aims to light the way for the studies and further researches in finding a way to measure the effectiveness of QMS. Matrix model will develop as a way to measure the effectiveness of QMS. Towards this goal, firstly a questionnaire survey will be conducted to a sample of construction firms that have or have not passed through these systems. Appraising some findings from the survey results; the number of QMS operating firms and their way of implementing QMS factors are determined by using the Statistical Method These principles are evaluated on a case study by means of developing quality measurement matrices for QMS operating firms and different results conclude. [2]

Dheeraj A Bumb, D. M. Ghaitidak have provided a study on, "Study of Quality Assurance and Quality Management System in Multistoried RCC Building". According to the author quality plays an important aspect in construction projects. Quality management provides the environment within related tools, techniques, procedures that can be deployed effectively leading to success of construction project. He stated that quality management is important at every stage of the project but quality management at execution stage contribute significantly on final quality construction projects. The QMS in construction refers to quality planning, quality assurance and Quality control. [3]

K.S.Shobana, D.Ambika (2015) the authors have provided a study on, "Evaluation of Factors Affecting Quality in Construction Projects". Their research mainly focuses on identifying and scrutinizing the factors that affects quality in construction. The identified factors from the literature are design codes & standards, financial issues, planning & scheduling, materials & equipment's, human resources, coordination, inspection, risks, types of organization and customer satisfaction. Based on the identified factors a questionnaire is developed and it is surveyed to collect opinion from the construction experts. The collected data are analyzed using average index method and it is ranked to get the top most values. The results are based on the survey including 138 respondents which gives the most affecting factor in construction. [4]

R.Lakshmi (2015) has provided a study on, "Quality Control and Quality Assurance in Building Construction". The purpose of her paper is to evaluate the use of Quality Function Deployment as a management tool to benefit project managers. The project manager has primary responsibility within the construction, to ensure the design both fulfils user's requirements and is prepared correctly, and that quality control/assurance procedures are correctly administered. QFD was developed and to improve quality and lower costs in industrial and business related fields, by assuring all of building construction operational decisions are driven by owner needs. It uses a set of matrices to relate owner wants and needs with project specifications and requirements.QFD assists project managers to clearly identify and prioritize owner and labour requirements in development of the conceptual and final design. It is best suited to projects involving repetition of units or when higher-than-average quality is demanded. Managers are able to make better informed decisions made during the delivery process, resulting in a better owner satisfaction. To testing of required building construction materials and to determine the quality and quantity of our required area of the building construction The CQAP details the systems and controls that GE has put in place so that the quality of the project will meet the requirements specified in the report. GE provides definition and overall management of the quality approach to be followed by its contractors and consultants. The quality of the RA implementation will be ensured through an integrated system of quality assurance performed by the Construction Manager and quality control provided by the contractors. GE's Construction Manager is responsible for the day-to-day Coordination of quality assurance and quality control measures in the field. [5]

Dharani K, Ganapathy Ramasamy N (2015) has provided a study on study on, "Negligence of quality

assurance and proposing an effective framework for total quality management". Their paper focuses on various negligence of quality assurance practices in the construction industry. The objective of their project was to analyze the various factors that affect quality and quality assurance and to provide an effective framework for the total quality management which helps to increase the quality performance of the construction industry. Their project included a set of questionnaires about quality, quality assurance and total quality management prepared and distributed to various companies and then analyzed. With the help of analyzed data's a total quality management framework has been proposed to reduce the negligence of quality assurance in the construction industry. [6]

Orji Solomon E, et.al (2016) has provided a study on, "Quality Management Practices in Construction; a Key to Successful Building Project Delivery". Their paper explores the factors that positively influence quality in building construction works, the effect of not adhering and the benefits of adhering to quality standard for building construction projects. The objective of their paper was achieved through a review of existing literature and field survey. Survey questionnaires were directed to building construction professionals through convenient sampling technique in Enugu State. Descriptive analysis tools were used for the analysis. [7]

Teena Joy (2014) has provided a study on a study on, "Factors influencing quality of construction projects". Her study was intended to provide clients, project managers, designers, and contractors with necessary information needed to better manage the quality of a construction building projects by identify the factors that affect process quality of construction projects and to rank them by degree of importance. Certain construction companies identified and a questionnaire survey was carried out there. Then the data's from the company was collected. The ranking of the factors is done by using Relative Importance Index. Using that data's the major factors that affecting the quality have to be identified. Then from the results suitable suggestions was given to the companies for improving their product quality. [8]
Md Afsar Ali, Masoom Reza (2017) have provided a study on study on, "Quality assurance and quality management in high-rise building construction projects". The main objective of the paper is to identify and evaluate the major factors effecting quality control measure of building construction projects in India. For analyzing the major factors for quality control measure in building construction project, adopting literature review and questionnaire surveys are used to assemble data. For the questionnaire survey Likert Scale (five point scale) is used for rating the opinions. The five point scale is transferred to Relative Importance Index for each factor. Afterward adopting Pareto analysis to evaluate the major factors for improving the quality in building construction project. [9]

AnupW S, et.al (2015) has provided a study on study of, "Quality management system in construction." The author has conducted exploratory research primarily to give insight about quality practices, tools, techniques, management commitment towards quality implementation in construction projects. It also explores the issues faced during the implementation of Quality Management Systems. The research uses a qualitative questionnaire approach to gather data. A case study which substantiates the questionnaire is conducted using content analysis method. Conclusions are drawn based on the results of the analysis and the case study data. Suitable suggestions on how to overcome the issues of implementation of QMS has been made by consulting the experts through an unstructured interview. [10]

Okuntade Tope Femi has provided a study on, "Effects of faulty construction on building maintenance". According to the author the success of a building project depends on its performance, which can be measured on the cost of maintenance and the quality and standard of workmanship. Therefore the maintenance cost of a building during it's during its lifecycle could outweigh the initial cost of a new building if maintenance has not been included during the planning stage of the project. It is therefore of paramount importance to note that any decision made at the planning and construction stage of the project could have a substantial effect on the cost of maintenance. His paper seem to identify the defects caused by faulty construction on maintenance. The severity index (SI) was used to rank the most severe defects on maintenance. While, the kruskal Wallis test, show that there were comparison and no significance difference in the opinion between the respondents. The results reveal according to the rank by the architects and builders that insufficient reinforcement bar concrete cover is the most severe defects while the civil engineers rank noncompliance with specification as the most severe defects. This author says that providing quality during construction process is directly dependent on the teamwork and also on the performance of contractor should be supervised to avoid defects, mistake or spot inspection. [11]

Rifat N. Rustom and Mohammad I. Amer has provided a study on, "Identification of the factors affecting quality in building construction projects in Gaza strip". The research was intended to provide clients, project managers, designers, and contractors with the necessary information needed to better manage the quality of building construction projects in Gaza Strip. The paper reports the findings of a research study, which was undertaken to determine the

underlying factors affecting quality of building construction projects in Gaza Strip. Nominal Group Technique (NGT) was used at the preliminary stage to identify these factors and to assist in developing a questionnaire to identify and rank these factors and the associated sub-factors. The NGT yielded 8 main factors and 16 sub-factors. Combining the results of previous research studies and NGT results yielded 14 main factors and 60 sub-factors. The perception of practitioners is obtained by means of this questionnaire. 65 contracting companies and 24 consulting offices participated in responding to the questionnaire. The sub-factors that influence the quality of building construction projects and their relative importance were identified and used in identifying the main factors using the weighted average sum method. Pareto analysis showed that 10 main factors contribute 74% of the weight of all factors. Among the most significant factors identified are: experience of site staff, consistency of design documents, and the financial power of the contractor, availability of construction materials, subcontractors, and the control systems used. [12]

H. Mallawaarachchib, S. Senaratne (2015) has provided a study on, "Importance of Quality for Construction Project Success". Construction projects are always expected to create a balance between cost, time and quality. It is possible to have high quality and low cost, but at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not always the primary objective for the client; however, it is extremely important to a successful project. An appropriate level of quality could be determined during all phases of the construction project. Specially, construction and commissioning are two critical phases where the project could impact by its operability, availability, reliability, and maintainability of a facility. Ultimately, a facility with a good construction quality program and minimal defects is more likely to have a smooth and trouble free transition into the commissioning and qualification phase of the project. This creates a great potential for quality improvements in construction projects, as the poor quality could negatively effect to project failures. Therefore, the purpose of the research is to investigate the importance of quality for construction project success. Accordingly, quality and related key literature were reviewed and a framework of quality for construction project success was developed. [13]

## III. METHODOLOGY OF WORK

1. 1.Extensive literature surveys has been carried out by referring books, technical research papers, journals etc. to understand the basic concepts about the topic.
2. Next step is to identify the need of the research or fulfilment of research gap.
3. Collection of data required for efficient Quality control for the high-rise building construction projects. This data collection is based on questionnaire survey and in-depth interviews with a variety of industry stakeholders.
4. Analytical work is to be done. It means that analysis of data collected above is carried out i.e. details obtained from the above work are formulated and then comparative study of this data is to be done with the help of pareto analysis 80-20 rule based on the review obtained by various respondents at site. Likert scale was used as a measure to rate the questionaries.
5. Finally interpretation of results is to be done and conclusions are to be made.

## IV. DISCUSSION

This paper aimed at presenting literature relevant to study quality control for high-rise building projects. D. Ashokkumar (2014) found the main factors that affect the construction quality and also increase in cost of construction due to quality defect. His study will create the quality management awareness to all level of construction companies specially small scale company. His study is useful to minimize the material wastage, workmanship wastage and indirect cost. Alpa S. Maisuria et.al in study focused on using quality management system in construction industry. There are many obstacles that make it difficult to apply these system efficiently due to nature of construction and no ways of measuring the efficiency of the system exists. Dheeraj A Bumb, D.M. Ghaitidak studied quality assurance and quality management system in multi-storeyed Building. The QMS in construction refers to quality planning, quality assurance and Quality control. K.S.Shobana, D.Ambika (2015) provided the factors that influence quality in construction which includes design codes and standards, financial issues, customer satisfaction, planning and scheduling, materials and equipments, type of organisation, human resources, inspection, risks, method of execution and coordination. Through inspection at work place during each of these activities is required to improve quality. R.lakshmi (2015) has provided the use of Quality Function Development a management tool to benefit project managers. Dharani k, Ganapathy Ramasamy N studied the negligence of quality assurance and proposing an effective framework for total quality management. From their framework the negligence factors under quality assurance include inadequate supervision and verification on site, use of suspended drawing and specifications, poor workmanship during construction. The advent of total quality management can be seen as timely in research for productivity improvement and customer satisfaction. Orji Solomon E et.al (2016) studied quality

management practices in construction through a review of existing literature review and field survey. Survey questionnaires were directed to building construction professionals through convenient sampling technique in Enugu state. Md Afsar Ali, Masoom Reza (2017) studied quality assurance and quality management in building construction projects. Their research is done by adopting pareto analysis 80-20 rule found that 80% quality problem measure or improve by implementing 20 major factors on site. Further 20% quality problem improve by implementing remaining factors. H.Mallawaarachchi and S. Senaratne studied importance of Quality for construction project. They stated quality is required to meet project requirements of owner, constructor and other parties involved with great satisfaction. Moreover poor quality could lead to unnecessary cost to the organisation where it could create cost due to failure, appraisal and prevention.

## V. CONCLUSION

From the above review it is concluded that lot of research have been carried out on the study of quality control for high-rise building projects. For the analysis purpose, the basic information and data is to be collected by using questionnaire survey and in-depth interviews with the various industry stakeholders. The main objective is to provide a system and resources to deal with quality problems and defects that may arise due to poor quality. The guidance is relevant to all construction projects, small and large, and aimed at all with a role in developing, managing and applying quality standards on site. Construction quality needs to be managed from the earliest stages of design and procurement and needs to address the risks to owner, contractor and various parties involved. The improvement in quality will lead to customer satisfaction and in turn will avoid disputes and unnecessary rework or maintenance cost. The Quality Management system shall be adopted all the construction industries including the preparation of quality manual prior to construction process.

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