

Identification of the Factors Affecting the Quality in High Rise Building

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Abstract- Quality is one of the critical factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfilment of expectations (i.e. the satisfaction) of the project participants. The construction industry in India has been struggling with quality issues for many years. A significant amount of the budget is spent each year on infrastructure and other development projects. Since the quality outcomes of the projects are not according to required standards, faulty construction takes place.

Consequently additional investments are required for removal of defects and maintenance work. A construction project in its life span goes through different phases. Quality of a product can be measured in terms of performance, reliability and durability. Quality is a crucial parameter which differentiates an organization from its competitors. Quality management tools ensure changes in the systems and processes which eventually result in superior quality products and services. Quality management methods such as Total Quality management or Six Sigma have a common goal - to deliver a high quality product. Quality management is essential to create superior quality products which not only meet but also exceed customer satisfaction.

Keywords – Quality , Importance , Quality factors

I. INTRODUCTION

Construction industry plays an important role in the development of any country. The development of construction industry depends on the quality of construction projects. Quality is one of the critical factors in the success of construction projects. Improvement in the quality of construction projects is linked with quality management in the project life cycle. Although quality management at every stage of project life cycle is important but the quality management at the execution (construction) stage contributes significantly on final quality outcome of construction projects. The definition of quality depends on the point of view of the people defining it; some view it as “conformance to specification. Others view it as “performance to standards or value paid for the price. For construction firm quality is nothing but the satisfaction of customers and fulfilling of their requirements within a specified budget. It mainly focuses the importance and factors that affects the quality management in the execution (construction) phase.

II. Need of Quality

Quality is one of the critical factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfilment of expectations (i.e. the satisfaction) of the project participants. The construction industry in India has been struggling with quality issues for many years. A significant amount of the budget is spent each year on infrastructure and other development projects. Since the quality outcomes of the projects are not according to required standards, faulty construction takes place. Consequently additional investments are required for removal of defects and maintenance work. A construction project in its life span goes through different phases. The main phases of a project can be described as: conceptual planning, feasibility study, design, procurement, construction, acceptance, operation and maintenance. Quality of construction projects is linked with proper quality management in all the phases of project life cycle.

III. LITERATURE REVIEW

D.Ashokkumar(2014)[1] :- Construction industry plays an important role in the development of any country. The development of construction industry depends on the quality of construction projects. Quality is one of the critical factors in the success of construction projects. Improvement in the quality of construction projects is linked with quality management in the project life cycle.

Although quality management at every stage of project life cycle is important but the quality management at the execution (construction) stage contributes significantly on final quality outcome of construction projects. This author mainly focuses the importance and factors that affects the quality management in the execution (construction) phase. This author proposes to investigate the adoption and implementation of QMS in the construction industry and develop a “measurement methodology” of construction processes for customer satisfaction and continuous improvement. The main concept of this research project will be to identify “what” processes can be measured and “how” to measure them. To identify the above objectives, literature search, questionnaire and interviews will be used. 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. For the local construction industry, this project has the potential of demonstrating benefits of using TQM in their organizations. This will be carried out by showing that quality improvement efforts can be quantified, measured, and analyzed - thereby showing the construction company to continuously improve in products and services to meet and even exceed customer needs.

In India especially Tamilnadu lack in quality management so creating awareness about quality management is more important. It creates some awareness about major factor affect the construction quality and cost of poor quality. Another important of this paper is comparing the quality management between high level companies and low level companies.

This include visiting of some construction companies and conducts the questionnaire survey, then analyse the difficulties (major factors) 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.

M. Abas1, S.B. Khattak2*, I. Hussain2, S. Maqsood2, I. Ahmad2(2015)[2]:- Quality is one of the important aspects of all projects. The level of success of construction projects greatly depends on the quality performance. The Pakistan construction sector is facing quality related issues, which lead to ineffective and inefficient projects in terms of cost of overrun, delays and excessive rework. This research is carried out to scrutinize the factors, that have triumphed and adverse effect on the construction projects. A questionnaire was developed based on identified factors to take opinion of construction experts. After their feedback a statistical analysis tool such as chi-square and weighted mean method (WMM) were used to rank the significance level of these factors.

A quality assurance system has been developed by an international standard organization (ISO) for improving quality and overcoming the quality related problems. For quality ISO 9001 series have been developed and can be applied to all type of organization. Quality is affected by shortages of materials, equipment's, design changes, error in cost estimation and lack of budget. The other factors affecting quality are deficiencies in scheduling, inappropriate planning and unclear evaluation standards. The significance of these factors depends on type of projects, working environment and local culture.

The basic aim of this paper is to identify the success and adverse factors that have significant effect on quality performance of construction projects.

José Manuel Conde Hernada,*, Cristina González Gayab(2013)[3] :-A Methodology for implementing Document Management Systems to support ISO 9001:2008 Quality Management Systems requirements is proposed in this paper. This methodology consists of six steps that executed in a cycle allows to obtain the optimal Document System. This paper begins with the definition of ISO 9001:2008 document requirements; followed by the evaluation of the existing Document Management System in the organization; the identification of document strategies; the design of the Document Management System; its implementation, and finally the definition of the continuous improvement plan to guarantee the fulfillment of the initially detected requirements.

Although there are different methodologies to implement Quality Management Systems, and they all agree on the importance of the proper document treatment to ensure its success, none of them explains in detail how to design and implement the suitable Document Management System to handle this documentation, nor defines its associated document processes.

Based on the analysis of the document requirements stated on "ISO 9001:2008 Quality management systems" and in the study of "ISO 30301:2011 Information and documentation -- Management systems for records", document processes associated with Quality Management Systems have been identified, and taking advantage of the current existing tools in any organization, the necessary steps to implement proper ISO-supporting Document Management Systems has been proposed.

This paper consists of six steps, which customize the steps outlined in ISO 30300: Information and Documentation for the documentation associated with the QMS.

Step1. Definition of document requirements

Step2. Evaluation of existing systems

Step3. Identification of document management strategies in the organization

Step4. Design the Document Management System

Step5. Implementation of the Document Management System

Step6. Maintenance and continuous improvement of the Document Management System.

This author is focused on filling this gap by developing a methodology that serves as a reference and tool to support those organizations aiming to implement a Document Management System that meets the requirements of ISO 9000.

Niyom Suwandeja*(2015)[4]:- The purpose of this paper were to investigate the factors influencing total quality management modeling for a sub- district municipality, and to create a suitable total quality management model for a sub- district municipality. This research utilized a qualitative method by use of in-depth interviews. The respondents were 30 leaders from the sub- district municipality offices. Seven factors were used in the measurement, which included [i] leadership; [ii] training; [iii] organizational structure; [iv] communication; [v] incentives; [vi] measurements and evaluation; and [vii] teamwork. The demographic findings revealed male respondents as the majority who had an average age between 40- 49 years, and had between 6- 10 years of working experience. The findings on the significant factors for modeling the total quality management for a sub- district municipality explained that successful public organizations required leaders who possess the seven factors, whereas management of strong teamwork appropriate trainings, incentives and evaluation, and effective communication contributed to public organizational success.

Okuntade Tope Femi[5]:- The success of a building project depends on its performance, which is measured based on the cost of maintenance and the quality and standard of workmanship. Hence, the maintenance cost of a building during its functional life could outweigh the initial cost of a new building if maintenance has not been incorporated 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. This paper seek to identify the defects caused by faulty construction on maintenance, a total of 115 structured questionnaire were randomly distributed to three (3) groups of respondents Builders, Architects and civil engineers eighty(80) were completed and returned. 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 non-compliance with specification as the most severe defects. This author says that ensuring quality during construction process is dependent on teamwork and also the performance of contractor's should be monitored to avoid defects, mistake or spot inspection.

IV. EXPERIMENT AND RESULT

A construction defect may include any problem that reduces the value of a home, condominium, or building. Construction defects can be the result of design error by the architect, the contractor's flaw, defective materials, improper use or installation of materials, lack of adherence to the blueprint by the contractor. However construction defect includes activities such as compaction and consolidation not done to the provided specification leading to subsidence(ground movement) and eventual early deterioration of foundation, structural defects resulting in cracks or collapse, defective or poor electrical wiring and/or lighting, defective plumbing installations, inadequate or faulty drainage system, inadequate ventilation, cooling or heating system, inadequate sound proofing and fire proofing suppression systems.

A) Defects arising on the site:-

1) *Inaccurate measurement:-* Inaccurate measurement is a serious problem contractors or builders face on a construction site, this problem may arise as a result of the designer under-measuring or over- measuring the exact size of a building component in a building plan. When a contractor increases the water content in the mix which causes porous and results in corrosion of steel bars and cracking of the concrete structure. Such example is based on the mistake from the construction aspect while the designer also have a blame when he under-measure.

2) *Movement or changes in the position of formwork :-* Concrete when first mixed is a fluid and therefore form any concrete member , that any movement of the formwork which occurs between that the concrete set will cause cracks to appear in the structure. The results of these cracks is that they form an invisible water pocket in the concrete mass which when freeze will expose the concrete surface to corrosion of reinforcement.

3) *The use of damaged formwork :-* Some contractor or builders are so greedy that they use damaged planks for construction of their formwork or false work to save cost that will later put them in trouble, The results is that it

affects the quality of the concrete by producing a honey comb like structure which allow moisture to penetrate the exposed steel bars, hence, the basic principle of formwork is to resist the imposed, dead and hydrostatic pressure.

4) *Painting on unsuitable surface*:- According to BS 6150(painting of building) preparation of the surface to receive paint is of utmost importance since poor preparation is one of the chief causes of paint failure. The major purpose of paint is for surface protection and surface decoration but the purpose may be defeated when painting is being carried out on a wet surface or salty surface or even in a bad weather condition i.e. humid. These will results in the peeling of the paint, crazing, and chalking e.t.c

5) *Vibration*:- It is generally noted that formwork should be strong than is traditional in order to withstand vibration, inability of the formwork to withstand vibration can results in a crack .

6) *Insufficient reinforcement bars concrete cover*:- The recommended standard for concrete cover is usually between 50-75mm depending on the building components. Inability of the contractors or builders to comply with the specification provided for concrete cover usually results in the rapid rate of reinforcement bar corrosion and cracks when exposed.

7) *Improper construction of joints*:-Joints are lines of weakness which will leak unless carefully designed and constructed which should be simple in concept and easy to construct. Improper construction of joints usually occurs between a new and old concrete (cold joints) and if such Joints are not properly treated it will results in cracks and water penetration.

8) *Early or premature formwork removal* :-With modern pressure for speed and economy in construction, there is a tendency to remove the formwork before the concrete has attained sufficient strength. When this occurs, the concrete often cracks, sometimes severely. This can cause permanent deflection and cracking of the structure which will allow moisture to reach the steel and cause continuous corrosion and cracking of the building elements .

9) *Poor soil compaction*:-Poor soil compaction is a serious problem that can cause settlement when backfilling it required for the backfilling to be compacted at each layers usually at every 150mm. most contractors backfill the soil in one layer rather than several layers, therefore, they only compact the top layer. Since, the bottom soil is not well compacted or not even compacted, it will settle at a later stage and cause settlement in the building which can results in a continuous cracking of wall and foundation failure.

10) *Inadequate provision for water proofing and drainage* :- Most contractor usually construct building component without taking cognizance with the joints which is usually the critical points. This usually results in water seepage via the roof or walls and down to other part of the building since roof drainage was also not part of the construction.

11) *Inadequate curing procedures*:- Curing is usually needed in concrete to reduce water loss especially in hot climate hence, failure to cure concrete will results in a weak concrete and a spontaneous development of cracks on the surface.

12) *Not complying with specification*:- Contractors tend to do things their own way and few of them follow the construction specification. As a result all the effort spent during the design stage is ignored. Such problem will increase the maintenance work required during the operation of the building depending on the contractor's experience

13) *Uneven mixture of aggregates*:- This also occurs when the ratio of aggregate to cement in a head pan is different, not uniform e.g. the aggregate in a head pan may be heaped while that of the cement may be compressed. These can affect the workability of the concrete and produce a result such as cracks later. This problem is unknown by most contractors.

14) *Using unwashed aggregate for construction*:- Most especially gravel. Gravel contains some large amount of clay and sand which is always advisable to wash and sieve before usage. But most contractor make the mistake of using it without washing it to sieve away the clay and the sand particles but a well experienced contractor will reduce the ratio of sand to aggregate to accommodate the percentage of sand contents in the mix ratio. Using the aggregate without washing it can result in a weak concrete and a substantial cost of maintenance that is if the concrete is still durable

15) *Improper soil analysis*:- One of the steps in building projects is to perform soil analysis to help the builder to know the right strategy to use in preparing the land prior to construction. Soil not properly analyzed and not developed properly can have damaging effect on the structure. An example of this is building a house on an expansive soil, a type of soil that swells when it get wet and shrinks upon drying. In order to prevent damages to the structures built upon expansive soil, a building would be able to withstand the changes in soil consistency. Builders who unknowingly build upon expansive soil can experience crack throughout the structure and the outside pavement.

16) *Defective material*:-Using defective materials can be the cause of many construction defects on structure an example could be a building built with defective roofing materials that allow water to leak into the structure. The result could be a number of defects such as the wood rotting, mold an building for mildew and, moisture stains on

the walls and ceiling before construction, a builder should thoroughly inspect building for defects Making sure materials is up to current code and is a quality materials.

B) Defects caused by contractor administration and staff

1) *Poor communication with the design firm:-* This is a major concern in a construction project. The problem of who leads a construction project (usually between the builders and the architects) can results in a gap in communication between the professionals. And also the frequent recruitment of workers on construction site can make it difficult for the workers to know whom to report to which can results in the worker performing the job based on their own understanding.

2) *Hiring incompetent supervisors:-* Basically most site workers tend to test the intelligence of the so call supervisor and if found wanting in any technical aspect he will be deemed to lose an absolute control on the workers. the contractor is the main controller of the construction quality. Hiring a qualified supervisor or contractor will help in reducing defects during construction.

3) *Hiring incompetent unqualified workers or workforce:-* The major uniqueness of a project to the client and the end users is quality. In project management the uniqueness of every project has to do with the end product such as quality. The kind of worker employed to work on a project must be experienced and technically sound to help achieve the total quality of a building because if the building product is bad or defective it is mostly affected by the site engineer and the workforce. If the supervision is adequate but the implementation of TQM is not, defects will increase during the operation.

4) *Inability to interpret drawing:-*This is also one of the substantial problems in most construction site. You discover that the supervisor or contractor cannot interpret a drawing to the workers on site due to his poor technical background. With such, deficiencies are incorporated for the client to inherit.

5) *Speedy completion of work :-* Corruption, impatient and greediness most times can be traced to the reasons why jobs are carried out as quick as possible not considering the consequences.

V.CONCLUSION

1) To achieve the quality on the construction projects, first to identify the factors which affect the quality of construction work and then adopt suitable precautions to avoid them .

2) Quality assurance QA/QC should be implemented during the design and construction stage to avoid defects and mistake, hence quality of building should not be limited only to a particular person but the responsibilities of all parties involved in construction.

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