

Impact of Quality Control and Management in Constructions

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Abstract - The purpose of the thesis is to find out the knowledge of quality control and management and its impact towards engineers and labors. Construction Industry plays a vital role in the advancement of any areas, Project manager has primary responsibility within the construction and the Quality control/assurance procedures are correctly administered. Quality control Circle have been found to be a simple technique of TQM and proposed implementable in construction industry. Quality management policy is not implemented or limited participation will both negatively affect the management of project. It can be said that if there is no quality control, there is no economic benefit. Meanwhile quality management helps to prevent the safety accidents to occur during the use of quality products. The paper includes the outcome of the research methodology decided by authors based on interview of project participants and analysis of data. The project includes visiting construction companies and conducts the questionnaire survey, then analyse the factors that include quality control and its management and also suggest that the improvement of quality measures in the execution of the projects.

1. INTRODUCTION

Construction Sector plays a major role in the economic growth of a country and occupies an important position in the nation's development plans. Construction projects are increased rapidly in the recent years, reflecting the interest of public and private sectors. Construction sector is one of the largest contributors to the Gross Domestic Profit (GDP) of any countries. Construction projects are extremely complex process involving a wide range. It generates substantial employment and provides growth impetus to other manufacturing sectors like cement, bitumen, iron and steel, chemicals, bricks, paints, tiles etc.

Although it has features in common with other sectors, such as manufacturing and services, it is unique in various aspects. This uniqueness is attributed to four kinds of uncertainty. They are:

- Natural uncertainty
- Task uncertainty
- Organizational uncertainty
- Contractual uncertainty

1.1 Study on Quality

During the past decades, the construction industry has been criticized for its poor performance and productivity in relation to other industries.

Many of the Management practices used to support construction organizations are being challenged. The industry's clients are moving forward and Clients demand improved service quality, faster building and innovations in technology. 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.

Quality tools are identified as part of the implementation process, like benefit-cost analysis, benchmarking, flow-charting, design of experiments, cost of quality, inspection, control charts, Pareto diagrams and trend analysis.

Quality in construction is related to

- Satisfying the specification mentioned in the contract.
- Complete the project in time
- Fulfilling the owner's requirement within budget
- Avoiding disputes claims
- Ensuring the faculties performs its intended purpose

1.2 Terminologies

1.2.1 Quality

According to ISO 8402 defines quality as the degree of excellence in a competitive sense, such as reliability, serviceability, maintainability or even individual characteristics.

1.2.2 Quality Assurance

Quality assurance is evaluating the overall project performance on a regular basis to provide a confidence that the project will satisfy the relevant quality standards.

1.2.3 Quality Control

Both ANSI (American National Standards Institute) and ISO define quality control as the operational technique and activity

1.2.4 Quality Management

Quality management refers to all activities of overall management functions, especially top management leadership, that determine quality policy objectives and responsibilities for all members of the organization.

1.2.5 Total Quality Management

Total quality management is the management approach of an organization, which concentrates on quality based on the participation of its members and aims at long-term success through satisfaction and benefits to all members of the organization and society

1.2.6 Quality planning

Quality Planning is identifying which quality standards are relevant to the project and determining how to satisfy quality standards.

1.3 Quality Improvement Techniques

- **Check-sheet** is used to record events, or non-events
- **Checklist** is used to tell the user if there is a certain thing, which must be checked.
- **Histogram** provides a graphical representation of the individual measured values in a data set according to the frequency of occurrence.
- **Pareto Analysis** is a technique employed to prioritize the problems so that attention is initially focused on those, having the greatest effect.
- **Cause and Effect Diagram** is useful in breaking down the major causes of a particular problem. The shape of the diagram looks like the skeleton of a fish.
- The relationship of two variables can be plotted in the **scatter diagrams**.
- **Flow chart** is used to provide a diagrammatic picture using a set of symbols. They are used to show all the steps or stages in a process project or sequence of events.
- **Statistics** is the study of the collection, organization, analysis, interpretation and presentation of data.
- **PDCA** is an iterative four-step management method used in business for the control and continuous improvement of processes and products.

1.4 Objective of the Work

- To determine the importance of Quality, Quality Control and its management in the construction.
- To determine the knowledge about Quality control and its management in the labor's and engineer's view.
- To determine the impact of Quality control in the constructions for the developments.

2. LITERATURE REVIEW

- **"Quality Control Circle And Performance On Construction Industry"** reported by **OFILA IRHAMNA, RAHMAT NURCAHYO (2018)**, suggest that, Quality is a key element that cannot be ignored in the competition and is one of the critical issues for the success of the company, including in the construction industry. On the other hand, if the quality management policy is not implemented or limited participation will both negatively affect the management of the project and competitiveness of the firms. This will also decrease the

survival potential of construction firms within the industry. Achievement of performance can be better if the implementation of integrated quality management is supported by the company. Quality Control Circles (QCC) have been found to be a simple and productive technique of Total Quality Management (TQM) and proposed implementable in construction industry. This paper aims to influence of quality control circle implementation on company performance in construction industry.

- **"Application and assessment of Quality management in Construction Projects"** reported by **HESHAM ABDEL KHALEK, REMON F AZIZ, ESRAA A SHARABASH (2016)** suggest that, Quality Management is one of the important elements of any construction project as cost and time, the role of it for any construction company is not an isolated activity, but intertwined with all the operational and managerial processes of the company as it attract customer satisfaction which would bring long term competitiveness and business survival for the companies. This paper focuses on evaluating the Practices of quality management in construction projects from the perspective of tools and techniques applied, identifying the level of commitment towards the implementation of quality management in construction projects and find the solutions to all problems that companies faced in the industry and put a set of proposals and recommendations aimed to improve this industry to the best level and to the development of implementation the quality management in the construction sector management in construction projects.
- **"Quality Control and Quality Assurance In Building Construction"** reported by **R LAKSHMI (2015)** suggest that, The purpose of this thesis is to evaluate the use of Quality Function Deployment (QFD) as a management tool to benefit project managers. The United States building construction of Engineers is one of the largest construction management organizations in the world, annually performing over 3.5 billion dollars worth of work. The project manager has primary responsibility within the construction, to ensure the design both fulfils user requirements and 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.

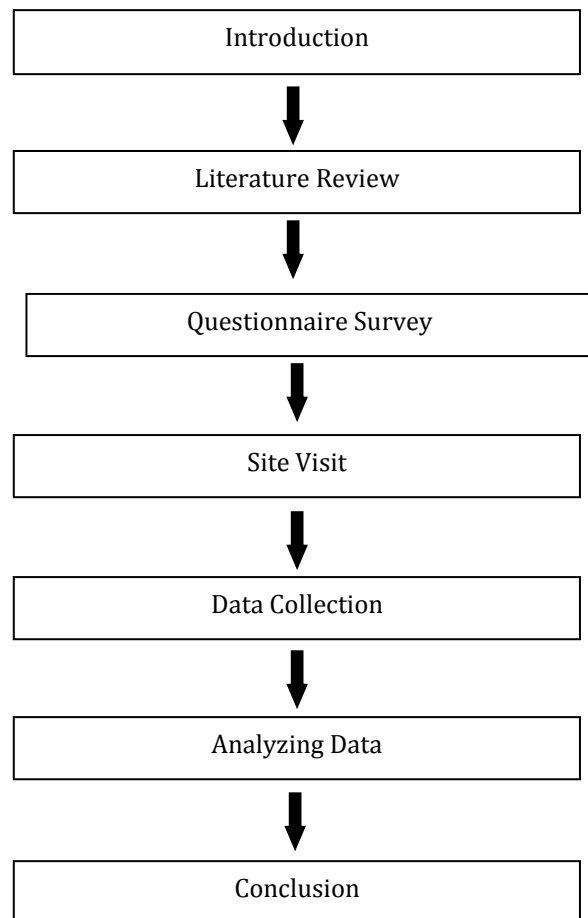
- **“Project Management and its Effects of Quality Control in Construction Sector”** reported by **PREETHI S, MONISHA MANOHARAN (2017)** suggest that, Quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the business. It can be said that if there is no quality control, there is no economic benefit. Construction projects are an extremely complex process, involving a wide range.
- **“Necessity of Quality Control in Construction Industry”** reported by **AMIT A MAHADIK, et.al., (2014)** suggest that, Quality Management is a managerial approach that views quality to be a result of integrating all organizational activities e.g. engineering, manufacturing, marketing and administration work. It aims broadly at maintaining and improving quality standards and to achieve customer satisfaction.
- **“Study on Construction Quality Control of Urban Complex Project Based on BIM”** reported by **Junying Lou, et.al.**, suggest that, Urban complex of high efficiency, complex, intensive determines its modernization, urbanization, internationalization of the inevitable product and it will become the city's landmark buildings and promotes local economic and cultural development. In the construction of urban construction should be quality-oriented, because of which BIM information sharing, features and functions for the construction of the project providing a lot of help to provide quality protection to ensure that construction quality standards.

3. METHODOLOGY

The Methodology involves following steps:

- Identifying the factors that to consider in the Quality Control by reviewing the literature and through company practitioners, including Engineers and contractors.
- Preparation of questionnaire were based on the Literature Study.
- Questionnaire survey and personal interview with engineers, contractors and labour's.
- Analyzing the questionnaire.
- Providing practical suggestions and recommendations pointing toward upgrading the uncertainty in construction and to improve the performance of construction industries.
- Conclusions were to be drawn and future recommendations need to be suggested.

3.1 FLOW CHART



4. INSPECTION AND QUALITY CONTROL

4.1 Need of Inspection and Quality Control

Every operation is connected with the quality of the product. In the case of construction the quality of construction is to be maintained as per project specifications.

The satisfaction of the owner of the project is mainly derived by the quality of the work. Stiff competition in the national and international level of construction sector demands a high quality oriented attitude of engineers.

However, the management is required to achieve the satisfaction of the owner by completing the project within the cost constraints for the project.

4.2 Principles of Inspection

Inspection means the checking of material or product at various stages of manufacture or construction of an object. It is done with respect to some pre-defined parameters and it tries to detect the faulty nature of the object. When we inspect something, we try to see the past history of construction and try to learn from our past

experiences. Faulty objects are sorted out and are rejected. Inspection should not be confused with quality control. Inspection is a way or method of maintaining the quality of the object being constructed or produced. Controlling the quality is what is termed as quality control. Quality control is a wide term which involves inspections at various stages of construction.

Table 4.1 Effects due to Inadequate Quality Control

Cause/Effect	Ponding of Water Taking Place in a Slab
Remedy/Precaution	The effect of ponding may be due to insufficient slope provided in the slab. This may create problems while washing floors. If ponding takes place in the topmost slab, it may be even more troublesome in the rainy season.
Cause/Effect	Cracks Appearing in Concrete Structural Members in a Structure
Remedy/Precaution	The reinforcement detailing in the structural members of concrete should be correctly provided as a precaution. In any case, cracks should be properly sealed so that corrosion of reinforcement inside does not occur.
Cause/Effect	Peeling Off of Plaster, Crumbling of Concrete of Structural Members
Remedy/Precaution	Plastering of the surface should be redone in the area where the peeling off has taken place. Fresh concrete cover from where crumbling of concrete has taken place in the structural elements should be provided.
Cause/Effect	Efflorescence in Walls, Peeling of Plaster, Corrosion of Cement Plaster of the Walls
Remedy/Precaution	Efflorescence may be due to seepage in the walls. The seepage in the walls should be arrested. Portions, where

	plaster has peeled off, should be re-plastered. Wall portions where plaster has lost its strength may be subject to gunting or may be reconstructed.
Cause/Effect	Walls of Great Thickness Showing Rupture, along the Length of Wall, in the Middle Portion
Remedy/Precaution	Walls may be provided with through stones or reinforcement bars going along the thickness of walls. This gives them safety in vibratory situations such as earthquakes.
Cause/Effect	Walls having Less Strengths in certain Portions, such as Near Corners, Walls of Large Slenderness Ratio
Remedy/Precaution	Proper bond should be provided in the walls, especially where two walls meet. Walls of large slenderness ratio should be strengthened as under earthquakes or under impact loads these may fail and cause accidents. Such walls may preferably be reinforced.
Cause/Effect	Leakage Due to Water Tank, Seepage at the Top of Mumty Slab Especially in Rainy Season
Remedy/Precaution	Leakage of water from the water tank should be arrested. Pipe joints should be checked and faulty ones should be repaired. Mumty slabs should be repaired to avoid ponding of water.
Cause/Effect	Falling Hazards Due to Parapet Walls and Water Tanks at the Top
Remedy/Precaution	Parapet walls should be repaired to give them added

	strength. The pillars of water tanks should be made of adequate strength so that they can take the shear stresses during earthquake conditions.
Cause/Effect	Seepage from Water Tank Walls
Remedy/Precaution	The walls of the water tanks should be repaired suitably. Ferrocement treatment may be given to the walls of tanks to make them impervious to water

5. QUALITY & SAFETY POLICY

5.1 Quality Policy

- **Leadership** - Leadership is accountable for effectiveness of process embedded in QMS, Quality Policy and achievement of quality objectives
- **Customer Focus** - It must committed to enhance customer satisfaction by understanding and consistently meeting their current and future needs by complying with all applicable statutory and regulatory requirements to deliver superior value.
- **Process Approach** - It must, while achieving business results, integrate QMS with business & operational processes to achieve organizational objectives in an efficient manner. Our processes are responsive & adaptive for continual improvements technology up gradation etc., and thereby make JMC a learning organization.
- **Planning & Monitoring** - It must committed to plan business activities & operations with appropriate work breakdown mechanism while identifying risks and mitigating them structurally and optimizing resources.
- **Supplier Relationship** - Suppliers/vendors being essential business stakeholders of companies and accountable for develop nurturing mutually beneficial professional relationships in ethical manner to enhance capabilities of both and thereby create value for our customers.
- **Continual improvement** - By design it must committed to ensure improvement in our effectiveness of performance to enhance the quality of our deliverables. We identify improvement opportunities through learning from academia, markets, customers, consultants, our own employees etc., and also through correcting, preventing and reducing undesired effects of our deliverables.

5.2 Safety Policy

- Institutionalization of EHS Management process with an effective EHS organization
- Regularly communicating educating & imparting training on safety health, hygiene and environment to all employees, contractors, contractor's staff and consultants or visitors
- Specifying and ensuring high standards of Environment Health and Safety at our site during construction of building, Infra & plants etc
- Evaluating the EHS performance of our employees & contractors against the EHS requirements.
- Foster continual improvement bench mark our EHS performance through adopting best practices with commitment to compliance of all applicable legal & other requirements.
- Committed to conserve our natural resources & minimizing potentially harmful effects resulting from our construction activity and to implementing improvements associated with the prevention of pollution, injury and illness
- Conducting periodic Audit & Risk assessment by competent team.
- Ensuring that workers & their representatives are consulted & encouraged to participate in all elements of the management systems.
- Making the EHS Policy widely known to employees, contractors & interested parties & will be made available to the public upon request and periodically reviewing the same for improvement.

6. DATA ANALYSIS

6.1 Analysis by Engineers

6.1.1 Factors Affecting Quality

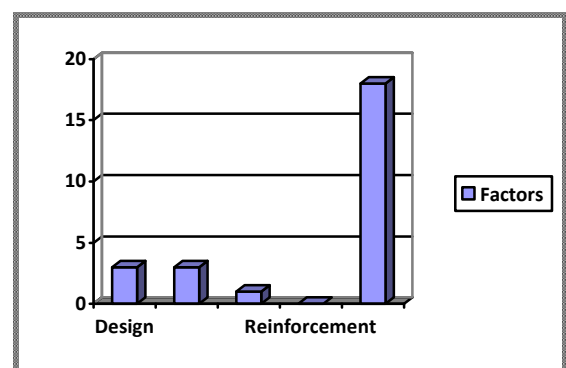


Chart 6.1: Responds for Factors

In the above graph, The factors represent the Quality Affect. Among these factors when compared to one another (Design, Concrete, Equipment, Reinforcement, Workmanship) the **Workmanship** Factor is the one mostly affected the quality in construction.

For Engineers

- By the Impact of Quality Control, Decision Making skill is developed for the Engineers.
- Quality Control reduce the problems of Engineer in different ways.
- Engineer experience is the key factor for the construction of building. They are not depend on the Quality Control procedures.
- For Engineers, Quality Control helps to improve the Qualities of the construction to make a project in a given time.
- Engineers can retrieve their decision with the Quality Control and its Management.
- Engineers only have a theory knowledge about Quality Control not a Practical Knowledge. So they need a experience of QC. QC Department helps to train the engineer for not making any mistakes in the upcoming construction projects.
- Engineers need to understand the Labours knowledge about Quality Control because of the working procedure.

For Labours

- They need not to know about the knowledge of Quality Control. Because of their experience, Labours can construct the buildings.
- Labours must supervised by the Engineer to work in the procedure of Quality Control.
- By the decision of Quality Control, Labours may be affected. According to the Labours, they want to work like a normal procedure. So, they don't want any insist from a Engineer or Quality Control Departments.

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