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A Study on Quality Control Practices in Construction Management to Achieve Economy in Construction

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Abstract

The purpose of the thesis is to find out the knowledge of Quality control practices in construction management to achieve Economy in construction. The development industry has been scuffling with quality issuses for several years, and therefore the cost of our economy is dramatic. The price could potentially be reduced significantly if the industry were to embrace to concept of quality control andQualityAssurancethat has been used with great success by many other sectors of the economy. It can be said that if there is no Quality Control, there is no economic benefit. QA/QC is the most important part of any construction process to boost the standard and uniformity of the project. The requirement of QA/QCin construction projects has increased considerably in recent times because of significant changes, advancements in technology and high expectation of the users. The QA/QC maintain uniformity in construction process and ensure more economical utilization of materials leading to significant reduction in cost to the users. The paper includes the outcome of the research methodology decided by authors based on interview of project participants and analysis of data. The projects include visiting construction companies and conduct the questionnaire survey, then analyse the factors that include QA and its management and also suggest that the improvement of quality of quality measures in the execution of the projects.

Keywords: Quality Assurance, Quality Control, Cost Management, Materials Quality, Quality Management System, Construction Management.

Introduction

Construction sector plays a major role in economic growth of a country and occupies an important position in the nation’s development plans. Effective quality management ensures that construction activities meet specified requirements and standards, thereby reducing risks associated with defects, delays, and cost overruns. For many years, the building sector has been preoccupied with the question of quality, which has had a significant impact on the economy. The effect could have been considerably decreased if the industry has adopted QA/QC because many other areas of the economy have embraced the notion of quality assurance with tremendous success. In the construction sector, quality control (QC) and quality assurance (QA) are critical and cannot be overstated, as they play a critical role in preventing flaws or failures in building facilities that can be costly. Quality control is a management activity that establishes objectives for construction projects. The target is to achieve a predetermined performance and cost requirement in this situation. To get the top quality at the lowest cost, we must examine the factors that influence a product or service's quality. This article explores various methods and strategies employed in the construction sector to ensure and maintain high-quality standards throughout project lifecycles. Quality management in construction involves comprehensive planning, assurance, and control measures to achieve predefined quality objectives. Quality management in construction involves comprehensive planning, assurance, and control measures to achieve predefined quality objectives. The importance of quality assurance (QA) in construction cannot be overstated, as it focuses on preventing defects and deviations from quality standards before they occur. QA strategies typically include rigorous inspection protocols, compliance audits, and systematic reviews of design and construction processes. By implementing QA measures early in the project lifecycle, construction firms can identify potential risks and non-conformities promptly, thus minimizing rework and ensuring adherence to project specifications. This research work aims to provide a comprehensive exploration of methods for ensuring and maintaining high-quality standards in construction projects. By examining key principles of quality management, including planning, assurance, and control, alongside emerging trends in technology adoption, the research work seeks to offer valuable insights for construction professionals, researchers, and stakeholders interested in enhancing project quality and performance. Through a structured analysis of literature, case studies, and practical examples, the research work aims to contribute to ongoing discussions and advancements in the field of construction quality management.

Problem Statement

One of the most prominent problems that countries like India face with regard to their construction projects is quality of construction which is below par as compare to international standards. There is a need for finding substantial solutions to these problems quickly. Quick problem-solving leads to improved quality of construction, maintenance of schedule etc. The use of Quality Circles could prove to be an efficient problem-solving technique which can improve the quality of construction. However,

1. The temporary nature of teams formed by Quality Circles from project to project or even through the same project could affect the effectiveness of this method.
2. The change in team dynamics and thus teamwork with the change/replacement of one or more of the members of a QC team has never been considered or studied.
3. The applicability of QCs to India and considering the difference in India's organisational and cultural aspects as compared to the global scenario has never been considered. This is especially important to consider as QCs rely on bottom-up communication to take the necessary decisions.

Aim

The purpose of this research work is to assess the value of Quality Assurance and Quality Control implementation, as well as analyzing all elements that influence Quality Assurance and Quality Control Management, as well as their implications for building projects.

Objectives

1. To identify the way that ISO-9000 principles are currently being operated in Indonesian construction companies.

2. To examine the performance of companies particularly during the implementation of their QMSs.
3. To examine the relationship between ISO-9000 principles and the KPIs identified previously and seek to evaluate how well the independent variable (ISO-9000 principles) is able to predict likely values of the dependent variable (KPIs).
4. To determine the impact on construction projects of noncompliance with quality assurance and quality control criteria.
5. To determine how unanticipated changes or conditions that may affect construction quality can be addressed during the construction process.
6. To offer methods for implementing quality assurance and quality control on building projects.

Literature Review

1. To determine the impact on construction projects of noncompliance with quality assurance and quality control criteria. To determine how unanticipated changes or conditions that may affect construction quality can be addressed during the construction process. To offer methods for implementing quality assurance and quality control on building projects.
2. Quality Management in construction projects is crucial for ensuring that structures meet specified standards, are safe, and satisfy client expectations (Jarkas & Davis, 2016). The construction industry faces unique challenges due to the complexity of projects, involvement of multiple stakeholders, and the need to adhere to regulatory requirements (Abdul-Rahman & Wang, 2017). This literature review examines various aspects of quality management in construction, focusing on methodologies, challenges, and best practices to maintain high standards throughout project lifecycles.
3. According to Mane & Patil (2015), among the principal criteria in the fortune of building projects is quality. The quality of a construction project, like the accomplishment of a project, can be described as matching the supposition of project partakers (i.e. contentment). According to the study's findings, check lists are utilized as a quality tool, quality control, and quality assurance methods in building projects, and they should be given due attention to customer satisfaction.

Methodology

First, a literature review was conducted to find factors causing construction project delays. This helped to conduct a survey to find out the causes related to the situation in Karnataka state. Achieving these goals require a research methodology. These are the main stages for conducting this study.

- Identifying the problem
- Specifying research objectives
- Specifying research scope
- Data collection
- Literature research
- Questionnaire
- Data analysis
- Results
- Conclusion and Recommendation

Designing and collecting data through a questionnaire survey

The questionnaire consisting of 44 questions was designed based on factors identified as majorly added to the causes of delay, the effects of delay and the methods to minimize delay with reference to the literature reviewed and analyzed. A questionnaire survey was adapted towards assessing the insight of contractors and clients of the relative importance of causes and effects of construction delay. A questionnaire survey was conducted as a source of primary data. A cross-sectional survey method was chosen due to the time limitation of this study. Information collected through the literature review was used to generate questionnaire surveys. The survey was conducted by using 'Google form', and this was forwarded to the potential or identified contractors via email or WhatsApp to save time and money, Face to-face interviews with contractors were also conducted in few cases wherever the contractor was interested to give concrete response and feedback.

Data collection

We have forwarded the questionnaire to 45 contractors across Karnataka. However, we have received the responses from 38 contractors regarding delay in the work and delay in the payment.

Rating scale

Each statement in these questions should be rated on a scale from strongly agree to strongly disagree, starting with the rating system was given as follow;
Strongly Agree – 5, Agree – 4, Can't Say – 3, Disagree – 2, Strongly Disagree – 1

Table 1: Questions asked to Contractors

Q. No	Questions
1	Are you familiar with the term quality control in construction?
2	How important do you consider Quality Control in construction projects?
3	Do you believe QC contributes to reduce overall construction costs?
4	In your view, does good quality mean higher cost or cost effective? (High cost, cost effective, can't say)
5	Do you maintain quality checklists for construction activities?
6	Are material tests conducted before usage in your projects?
7	Are third-party quality audits used in your projects?
8	Is site supervision adequate to ensure quality?
9	Are Inspection and Test Plans (ITPs) followed?
10	Are quality reports prepared regularly?
11	Are non-conformities recorded and corrected promptly?
12	Is rework due to poor quality a common issue at your site?
13	Are lessons learned from previous quality failures documented?
14	Is there a dedicated QA/QC department in your organization?
15	Have you experienced cost overruns due to poor quality?
16	Do you agree that investing in QC reduces rework and material wastage?
17	Does your organization track cost savings through QC efforts?
18	Are economic benefits from QC considered during project planning?
19	Does better quality control improve client satisfaction and reduce disputes?

20	Do you think better QC improves long-term operational cost efficiency (life cycle cost)?
21	Is there a trade-off between speed and quality in your projects?
22	Do you use any software or digital tools for quality monitoring?
23	Are mobile apps used to report site quality issues?
24	Have you adopted building information modeling (BIM) for QC?
25	Does your team receive training in digital QC tools?
26	Do you use drone inspections or AI tools for monitoring construction quality?
27	Do you believe digital tools improve QC efficiency and cost control?
28	Do you have quality manual at your organization?
29	Do you carry out quality audit every year?
30	Are site workers trained in QC procedures?
31	Is there enough awareness about quality standards among labours?
32	Are project engineers trained in quality management systems?
33	Is staff competency in QC linked to better economic outcomes in your experience?
34	Would you recommend mandatory QC certification for site engineers/supervisors?
35	At what project stage is QA/QC most essential (Planning, Execution, Finishing)
36	Who do you think is mainly responsible for ensuring QA/QC (Contractor, Consultant, Client.)?
37	In your view, does good quality mean higher cost or cost effective (High cost, cost effective, can't say)
38	Do you associate QC more with technical standards or workmanship?
39	What percentage of cost overruns do you attribute to QC issues?
40	How often does quality-related rework delay your projects?
41	In your opinion, how much can a project save (percentage) by implementing effective QC
42	What is the biggest barrier to using QC technology (Cost, Training, Resistance to Change,)?
43	How often is QC training conducted in your organization?
44	What are the main barriers to implement QC in your projects?

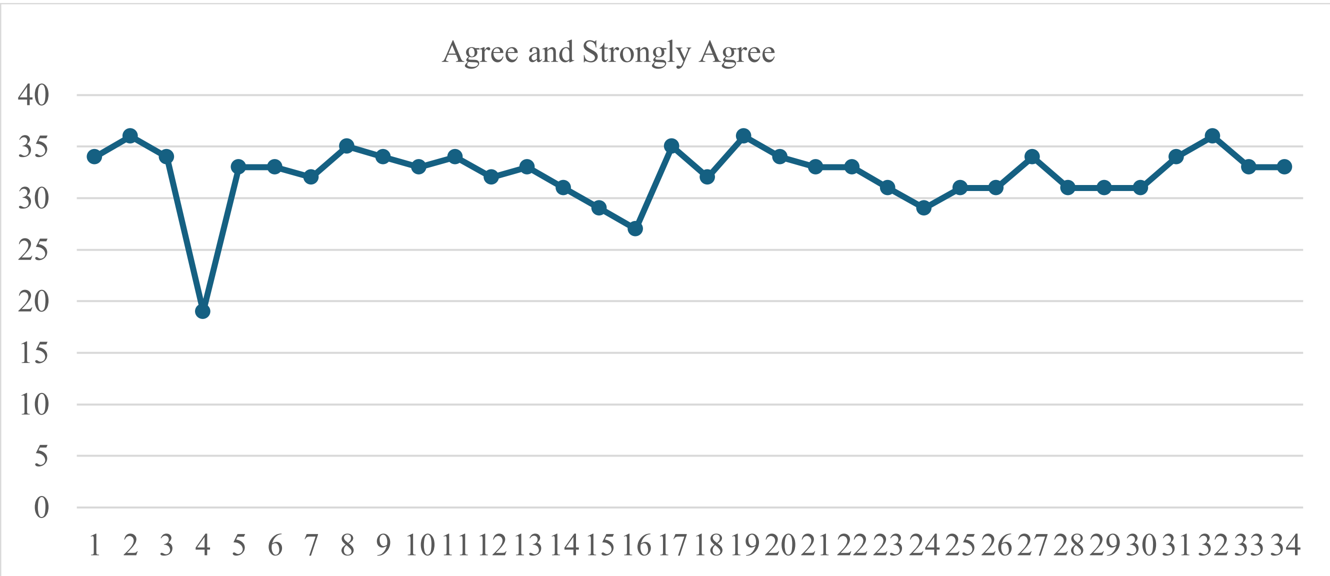
Result and Analysis

Table 2: Result Analysis Chart

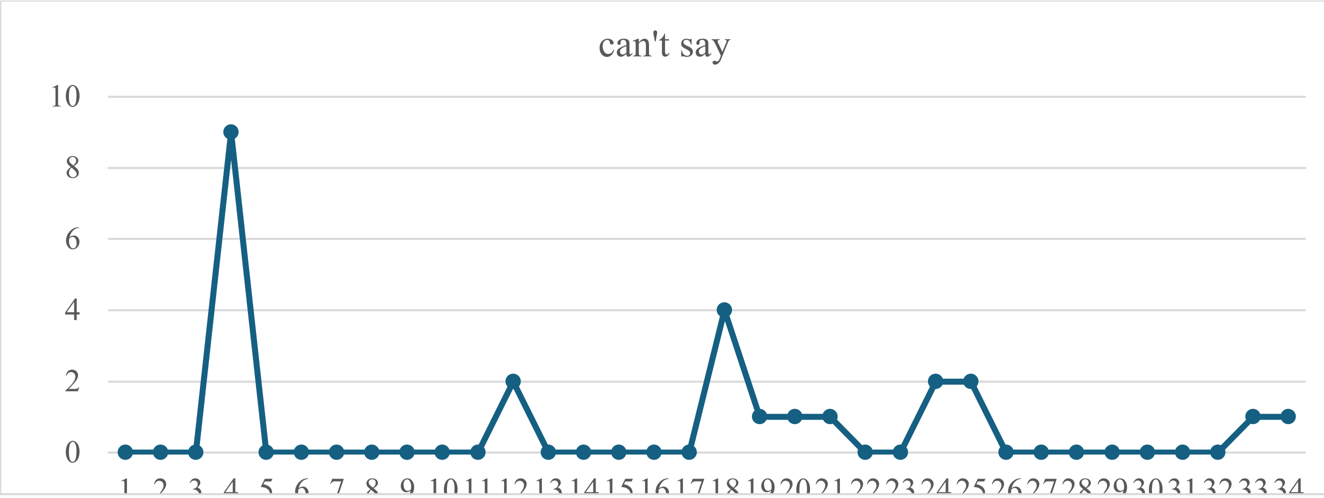
Q. No.	Number of contractors 5 & 4 (Agree)	Number of contractors 3 (Can't say)	Number of contractors 1 & 2 (Disagree)
1	34	0	4
2	36	0	2
3	34	0	4
4	19	0	10
5	19	9	5
6	33	0	5
7	32	0	6
8	35	0	3

9	34	0	4
10	33	0	5
11	34	0	4
12	32	2	4
13	33	0	5
14	31	0	7
15	29	0	9
16	27	0	11
17	35	0	3
18	32	4	2
19	36	1	1
20	34	1	3
21	33	1	4
22	33	0	5
23	31	0	7
24	29	2	7
25	31	2	5
26	31	0	7
27	34	0	4
28	31	0	7
29	31	0	7
30	31	0	7
31	34	0	4
32	36	1	2
33	33	1	4
34	33	1	4

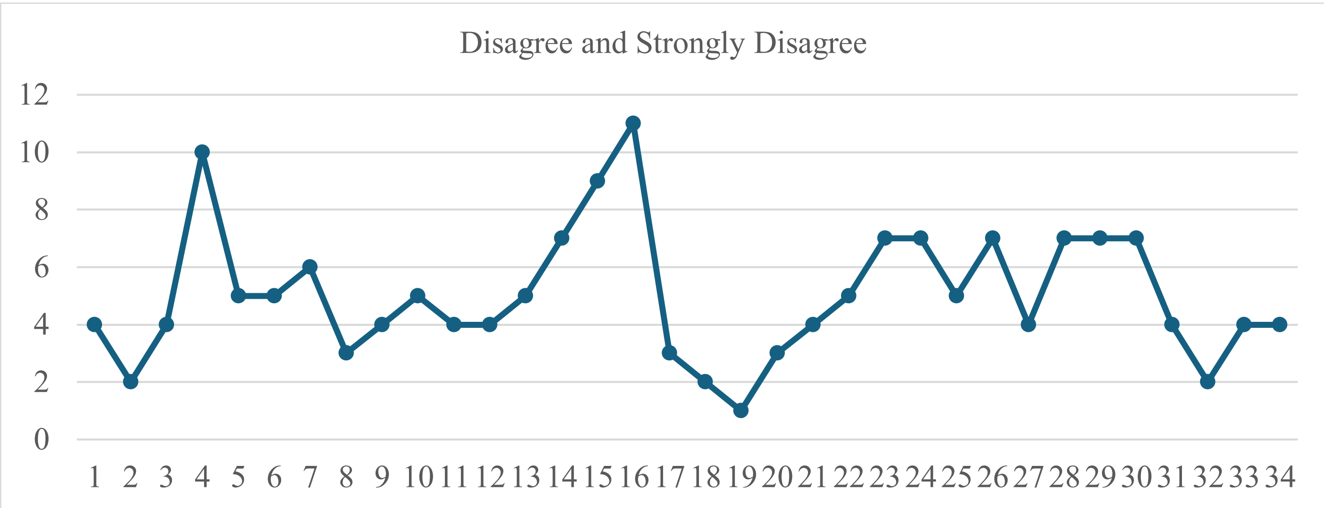
Graph No.1: Number of contractors agreed for questions



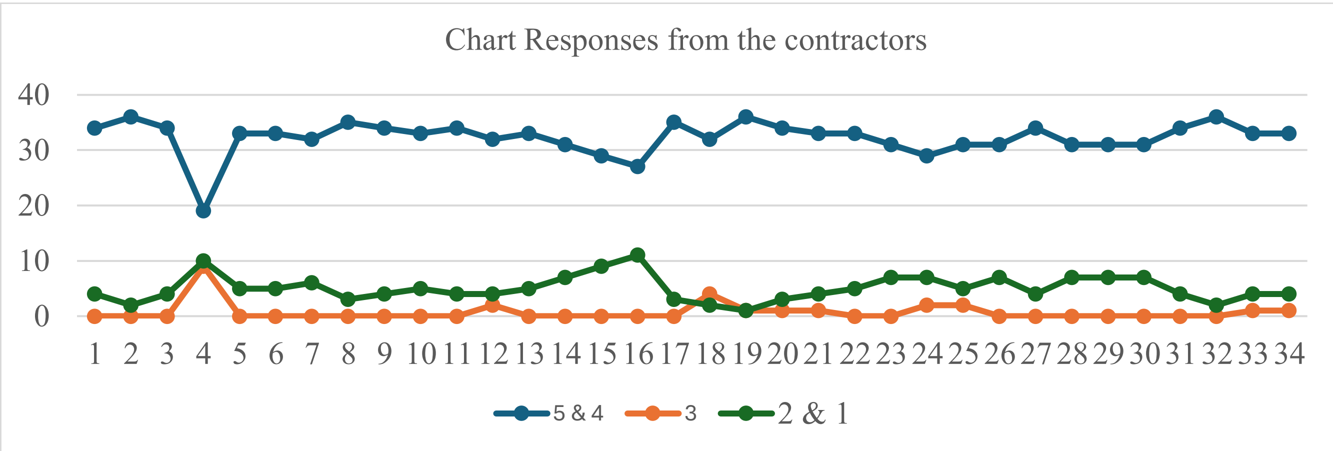
Graph No.2: Number of contractors mentioned as can't say



Graph No.3: Number of contractors disagreed for questions



Graph No.4: Graph showing pattern of agree, disagree and can't say mentioned by contractors



Conclusion

We have approached 45 companies out of which 38 are responded. After collecting the data, we have analysed the inputs received from the contractors. In the project point indicator was used- strongly Agree, Agree, Can't Say, Disagree Strongly Disagree. After going through all the questions related to Quality Control practices in construction management, all the questions were found to be agreed by the contractors as per their real situation which was highlighted in the project work and questionnaire. Very few contractors were in dilemma, hence responded Can't Say. In this project, in the questionnaire, focus was given to Quality Control practices in Construction Management to Achieve Economy in Construction, because if proper practices are not achieved in the construction projects, then the Direct, Indirect and Overhead cost of construction will increase multiple times which will increase the overall project cost. Also, it may affect the Quality of Workmanship and quality of Construction, which may affect project duration in addition to cost. Hence Quality Control practices are very much necessary to have a better control over the resources and Implementation of the project as per the planning.

- More than 88% of the contractors have agreed for using Quality Control practices in the projects to reduce overall construction costs. Effective site supervision, Inspection, Material tests, Quality reports, can reduce the overall cost in the construction projects and enhance the better quality
- More than 75% of the contractors have agreed that, by regular monitoring of documents, adoption of life cycle cost analysis, use of Building Information Model (BIM), Good planning, Execution, Finishing, Digital and Mechanized tools, can achieve economy in the construction.
- 80% of the contractors are willing to adopt Quality Control procedures, quality standards, quality management system for increasing efficiency and to achieve economy in construction. this in turn will solve the problem with shortage of skilled labour and the time and cost involved in the training of unskilled labours.
- Around 79% of the contractors have agreed that planning is more essential, 8% agreed that execution is more essential,13% agreed that QA/QC is more essential in finishing stage.
- 76% of the contractors agreed that contractors are mainly responsible for ensuring QA/QC in the construction projects. In addition to this 38% of the contractors said that QC is more associate to technical standards, 36% said that QC is more associate to workmanship, 11% said that QC is more associate to materials, and 15% have agreed that QC is more associate to all the three.
- Quality Control in construction is widely recognized as essential, yet it is often difficult to implement effectively. Here the contractors have mentioned some barriers seen across the construction projects.
  1. Lack of management commitment- 25%
  2. Inadequate skilled workforce and training- 24%
  3. Poor communication and co-ordination- 18%
  4. Time and Cost pressures- 21%
  5. Weak or Ineffective Quality Management Systems- 12%

Recommendations

Below are the recommendations based on the data analysis of our research work focused on the construction companies in the state of Karnataka:

- In order to achieve overall economy, all the contractors should adopt life-cycle cost analysis, use of Building Information Modelling and utilization of digital and mechanized tools for the construction activities.

- To achieve economy, all the labors/worker should be given skilled training which will avoid re-work and errors in work.
- All the contractors should ensure QA/QC in selection and purchase of materials and equipment as per the technical standards.
- Focus should be given on improving lack of management commitment, poor communication and co-ordination, time and cost pressures, weak or ineffective quality management systems.

Hence, it concludes that effective quality control is essential for reducing project costs and improving overall performance. By implementing systematic inspection, proper material testing, skilled supervision and adherence to established standards, construction projects can minimize errors, rework and delays. These practices not only ensure structural reliability and long-term durability but also contribute to significant savings in time and resources. Therefore, strong quality measures play a vital role in achieving economy, enhancing productivity, and delivering successful construction outcomes.

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