CHAPTER 145

Traid Harmony: Integrating Time, Cost and Quality in Civil Retroftting Projects

Mohin Khan G. A.[1], *Anmoll*[2], *Siddhi D. Sonawane*[2] *and Chethan H. Turamari*[2]

ABSTRACT

Most Retrofitting projects are prone to cost overruns and delays that can significantly impact their profitability and quality. Identifying the root causes of these issues is critical to finding. practical solutions. It was found that project parameters like time, cost, and quality are managed separately in retrofitting projects. Greenfield construction projects have simpler approaches to planning, scheduling, controlling and managing the projects. In the case of retrofitting projects, many unseen problems surfaced during the repairs and rehabilitation work, thereby completely collapsing the planned things. This study focuses on the different construction retrofitting projects in India and identifies the main factors that lead to cost overruns and delays in construction retrofitting projects. This study will also focus on challenges in integrating time, cost, and quality in the project planning, execution, and monitoring phases. The data collection would be done through a live project, which has already been executed, and an interview with the top management would be done to understand the key reasons for time, cost, and quality errors. The study would then give insights into the Integration plans to prevent and mitigate cost overruns, delays, and quality issues.

Keywords: Retrofitting projects; Integration; Construction repairs; Construction challenges.

1.0 Introduction

In contemporary civil engineering practices, the efficient management of retrofitting projects has become increasingly paramount. Retrofitting projects aim to upgrade existing structures to meet modern standards, whether for safety, functionality, or sustainability. However, the successful execution of such projects relies on a delicate balance between time, cost, and quality management. This project endeavours to explore the integration of these crucial aspects – time, cost, and quality – in the context of civil retrofitting projects, under the framework termed "Triad Harmony." This compartmentalized approach often leads to conflicts, delays, budget overruns, and compromised quality.

[1]*Corresponding author; School of Construction, NICMAR University, Pune, Maharashtra, India (E-mail: P2370084@student.nicmar.ac.in)*
[2]*School of Construction, NICMAR University, Pune, Maharashtra, India*

DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*

Recognizing this challenge, the concept of Triad Harmony seeks to harmonize these elements, ensuring that adjustments made in one area do not adversely impact the others. Projects that are executed within budget (cost), schedule (time), and of acceptable quality are said to be successful. By integrating time, cost, and quality management, Triad Harmony aims to enhance project efficiency, effectiveness, and overall success.

2.0 Objectives

The primary objective of this project is to develop a comprehensive understanding of Triad Harmony principles and their application in civil retrofitting projects. Specifically, the objectives are to investigating existing methodologies and practices in time, cost, and quality management within the context of civil retrofitting. Additionally, analysing the interdependencies and potential conflicts between time, cost, and quality objectives in retrofitting projects. Even to propose a framework for integrating time, cost, and quality management to achieve Triad Harmony in civil retrofitting projects.

3.0 Problem Definition

The traditional approach to managing civil retrofitting projects often results in inefficiencies and compromises in project outcomes. The main problems in traditional approaches to project delivery have been in extensive delays in the planned schedules, cost overruns, serious problems in quality, and an increase in the number of claims and litigation associated with construction projects [1]. Issues include difficulty in balancing competing objectives of time, cost, and quality. Even, lacks integration between project planning, execution, and monitoring phases. Mainly, inadequate mechanisms for addressing changes or deviations during project implementation. Due to limited tools or frameworks for evaluating the holistic impact of decisions on project performance. Addressing these challenges requires a paradigm shift towards integrated management approaches such as Triad Harmony.

4.0 Brief Methodology

Relevant and necessary data were collected through questionnaires and through scheduled interviews with top management executives who are into civil retrofitting project or have worked on complex retrofitting projects. Before preparing questionnaires ample amount of literature review was carried out by referring more than 50 research papers, which included research about management of time, cost and quality in civil engineering projects in different countries. The questionnaires were distributed to chief executive officer (CEO's), vice president, general managers, project managers, senior project engineers, planning engineer, site engineers, project co-ordinator and many more industry experts. These professionals had mixed

DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*

understanding of operations across clients, consultant and contractor firms. The questionnaires were prepared with both closed and open-ended questions, where personnels had full independence to share their experiences and tackles which they encountered at their projects. These professionals were then interviewed to grasp more information about how they manage retrofitting projects at their respective firms. The interviewed people were experts in retrofitting jobs, as well had worked in contracting firm, consulting firm and client organizations. Interviewee we questioned on how they implement management techniques at their respective firm and what are special techniques they use at their respective firms. Compiling all the data which is collected to understand the importance and methods of integration of management techniques in retrofitting projects.

5.0 Limitations of the Study

The project's scope may be limited by resource constraints, access to data, and time constraints. The proposed framework may require further refinement and validation in real-world applications. External factors such as regulatory changes or market conditions may influence project outcomes.

6.0 Scope of Work

This project focuses specifically on the integration of time, cost, and quality management in civil retrofitting projects. It will primarily explore conceptual frameworks and theoretical principles, supplemented by case studies or simulations. However, the project does not aim to provide exhaustive guidance on project management practices or address broader issues beyond the scope of Triad Harmony integration.

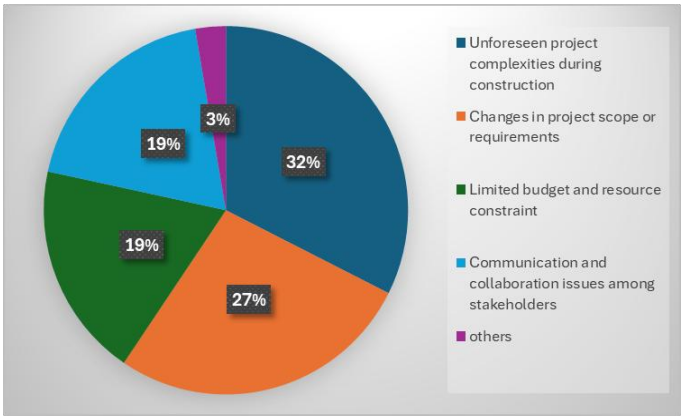
7.0 Time, Cost and Quality Integration in Civil Retrofitting Projects

Integration of Time, Cost and Quality in retrofitting projects in the India have always been a tedious work, due to many factors. Managing time, cost and quality in a retrofitting project as a separate entity is more practical and achievable. This is what all project stakeholders believe and are practicing. But many projects fail due to this harmonic disbalance that is it causes either a time overrun, or a cost shuts up. If in case both cost and time is managed the quality of the project gets hindered. Similarly, if the project stakeholder tries to deliver a quality work, then they compromise on time. If a project is of time is an essence, then to manage the time of completion, the cost of the project is compromised, and the contractor bares losses. As per our study 80% of the projects in India, fail to balance all the three factors. In our study we have listed out all the factors which affect this harmony and create project profit losses. Also, the key influence factors which have adverse effects. As per our survey and interviews few of the challenges that a civil retrofitting project face are (see, Figure 1):

DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*

- Unforeseen project complexities during construction
- Changes in project scope or requirements
- Limited budget and resource constraints
- Communication and collaboration issues among stakeholders

Figure 1: Challenges in Civil Retrofitting Projects: A Pie Chart Analysis



The above pie chart shows the percentage of industrial experts who agreed upon the challenges they faced.

7.1 Key factors which affect project time of completion

Time is always viewed as an important factor since it is very important in gauging the success of the project. Time of completion is directly linked with the profits earned. If the project time increases it is directly linked with the expenses to be incurred due to the increase in project duration, in most of the cases if there is increase in project duration, the contractor is bound to pay the liquidity damages as per contract terms. As per survey among top industrial professional, it was evident that complexity in project execution is the main criteria that affects project time and schedule. By complexity it means the method of retrofitting jobs and challenges faced to execute the job. It was also found that there was a repetitive change in the scope of project and methodology of execution. To execute all these complex jobs, it was evident that there was a lot of delays in material delivery at site locations. Once, materials were deployed at site there would be huge challenge in the availability of skilled manpower and machinery. During the project planning stage, complete project budget is fixed, having a fixed project budget would restrict any extra expenses to incur at site level, thus would restrict the site professionals to have a free hand in taking new and innovative ideas. Knowledge about the scope of project plays an important role in project completion. Many a times the site professionals are unaware about the scope of the project. During execution of the project the

DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*

project professionals should incorporate a good functional communication system among there sub ordinates to have proper communication. In case of improper communication there would be a lot of delays in project schedule. A proper analysis of project risk that is project risk identification and assessment of risk which are possible to occur is to be forecasted. So that a mitigation plan is ready to tackle the problems. In many projects the quality inspection, approvals and authorization get delayed since the client engineers take time for processing all those.

7.2 Key factors which affect project cost

Cost is a vital factor on which the entire project success depends on. Cost of project depends upon the size, quality and location of the project that is higher the quantity higher is the project cost and vice versa. Cost of project includes material, manpower, machinery and other resources. Cost fluctuation is bound to happen in an ongoing project; the most probable cost changes is due to the escalation of material cost. Material availability and demand for the material also increases the cost of materials, thus shoot-up the cost of material and thus escalating the price. To manage the material price's escalation, in the tender document rates escalation clauses is to be incorporated to control the rate escalations that are raised by the contractors. Due to inflation in the nation and many other factors the labour cost also influences the cost of construction and the budgeted cost of project. Cost of a project also changes by the demographic influence to discuss more about demography, the cost of construction at an urban setup is usually costlier than in the rural setup where construction material is easily available, and cost of labour is comparatively lower. Due to poor management operation, at some cases the delivery of wrong material also occurs where in the cost of transportation, material packing cost and many other miscellaneous charges are to be incurred. The material wastage occurred at sites contribute a huge cost on the budget cost. It was found that at many construction siye the cost of monitoring a project is never accounted in the budget calculation. These monitoring cost have a huge impact on the budgeted cost of operation. Having trained professionals to estimate the budget of the project is necessary, the cost estimation should also be realistic and logical so that it bares all the cost incurred at the site and its expenses.

7.3 Key factors which affecting quality of retrofitting project

Quality of retrofitting projects is to be very carefully monitored as it is a very critical activity as the work carried out is for either repair, strengthening or a rehabilitation. No compromise in quality of the project is to be entertained. Construction quality is directly tied to time and cost and conversely [2]to achieve a quality product skilled manpower is at most important, because the workman ship of the workers influence the quality. A skilled workman executes work at higher quality and a better pace vice versa an unskilled workman executes work with low quality and at a slower pace. Not only the workmen who work, also the knowledge and competency of the project team also plays an important role in execution of

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quality product. Use of apt machinery and tools also play a key role in attainment of quality product. The resources that are used in the product generation is to be of a good quality range that is the specification of the material is to satisfy the scope of the project. A wrong material will generate a bad quality product. Since different materials have different technical specification choosing a wrong material for execution of job will lead to non-attainment of the desired product.

7.4 Integration of time, cost and quality of retrofitting project

Based on the interviews and our survey regarding integration of time, cost and quality in retrofitting project, it was evident that to generate true harmony the change management is to be very strong, that is any change that a project faces should be handled in a more practical manner and the site professional are to be trained to handle those change. During the planning stage all the challenges that are liable to occur is to be identified and are to be resolved at the earliest. The project duration is to be realistic and achievable by considering all the probable risks and challenges that can occur at the project. Incorporating intermediate milestones in the tender document and adding bonus clause and liquidity damage clause for intermediate milestones will have a sense of fear and awareness in completion of project on time. Even addition of rate escalation clause in the projects which last for many years provides a full independence in managing the cost of projects. Rate escalation clauses can be omitted in short duration projects and a bonus clause can be incorporated for timely completion.

Many complex projects can be carried out by using heavy machineries in order to complete it on time and to achieve a better-quality product. To add up machinery instead for labour workforce a proper rate analysis and comparative study to be carried out to minimize the cost and for decision making. During the tender phase a competent contractor who can manage all the challenges and tackle all the risk at project is to be decided and awarded the contract. Competent and experienced individuals are to be hired for execution of jobs in the engineer's team be in it contracting firm, consulting firm or client's organisation. Full optimization of labour manpower must be achieved by close monitoring. These can be achieved through close monitoring or by using special IOT tools that monitor labour productivity at workplace. A good supply chain management is to be achieved on site for material management be it material selection, identification, sourcing and timely delivery. Having a good management would lead to no delays or cost loss at the workplace and even a desired and specified material would be achieved. Keeping all this in mind one can achieve a triad harmony at workplace and in projects.

8.0 Conclusion

The study based on the information presented and analyzed in the assessment of TRIAD HARMONY (time, cost, and quality management) during retrofitting projects concludes that, to achieve impressive results in construction, all parameters governing the project success

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be it time, cost and quality should work together. Some factors which are to be kept in mind during management of time are, better supply chain management, better understanding of scope, recruitment of trained professionals, employees, workers for execution of work, continuous monitoring of schedule that is "tracking" is a crucial factor. In case of cost, since it is one of the governing factors at most care is to be taken during budget allocation, cost management plans, and strategy to develop best model to minimize expense and increase output. Value engineering is one of the most suggested concepts to achieve cost to expense benefit. Finally, when it comes to quality, since material quality and workmanship comes first, one should take care of the material quality by having trained professionals to look after it. Utmost care should be taken in briefing the workers about the scope of work. As per our study, to achieve a Triad harmony it's essential to have strong communication between all the divisions and a proper system in an organization is to be practiced. Even looking into the fast-moving competitive world with lots of digital tools, incorporating such IT tools would help in better management of projects.

9.0 Recommendations

Through the study carried out in this paper, to achieve integrated management between all parameters for a successful project completion we recommend doing the following:

- Streamlines supply chain management
- Recruit trained and skilled professionals
- Continuous Schedule monitoring
- Allocate budget meticulously to cover all project expenses
- Develop cost management plans
- Adopt value engineering

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DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*

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DOI: 10.17492/JPI/NICMAR/2507145 *ISBN: 978-93-49790-54-4*