

A Review Study on Time Delay Factors in Construction Sectors

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Abstract - In India, the construction industry is among the largest contributors to national economic growth but ranks second only to agriculture in terms of employment and contribution to GDP. The scale and importance of this industry have resulted in continued time delays on projects, regardless of size or complexity. Time delays related to construction projects are not simply isolated incidents but reflect systemic underlying issues: inadequate planning, poor resource management, design inefficiencies, financial challenges, insufficient labour and adverse site conditions.

This paper provides a systematic review of existing literature related to time delays in construction projects and identifies delays that occur during various stages of the construction process. The review examines time delays from the beginning of the construction process (conceptual and design phase) through project execution and completion.

Key Words: Construction Delays, Time Overruns, Construction Industry and Project Management, Time Delay Factors.

INTRODUCTION

Over the last 30 years, the Indian construction industry has greatly changed and is now one of the largest contributors to India's economy. The construction industry ranks second only to agriculture in economic activity, and has contributed an average of 6% to 9% of India's GDP in the last 5 years. According to (Hemanta Doloi et al., 2011) the construction industry has grown at a consistent rate between 8% to 10% each year, which has resulted in millions of workers being employed directly or indirectly by the construction industry. Furthermore, the construction industry's importance goes beyond providing jobs, as it is also key to both urban growth & rural infrastructure. Other large government initiatives (such as the Smart Cities Mission, PMAY and the National Infrastructure Pipeline) are further increasing the amount of construction activity, which puts additional pressure on the industry to deliver all projects on time and within budget.

While the Indian construction industry continues to grow, it also faces a substantial challenge in terms of time delays. The impact of delaying a project goes far beyond just being a logistical problem; there are economic, social and contractual implications of delaying an already scheduled project. In the case of delaying the delivery of a project this increases costs, creates contract disputes, leads to the loss of

confidence in the client, as well as having a detrimental effect on the community where the infrastructure is located. Research shows that most of the construction projects in India cannot complete their originally planned schedules and experience delays of weeks to years based on how complex they are, and how large they are constructed. Delays on construction timelines are a result of a variety of different sources that affect each other in many ways. A poor feasibility study or an incomplete drawing during the conceptual and design phases of the project can create problems on the basis of scheduling that will have a ripple effect throughout the life of the project. When the project is executed, other issues arise, such as material shortages, equipment breakdowns, inefficient subcontractors, poor site coordination, and a lack of communication between all the parties involved, that can make it more difficult to adhere to the schedule. Financial constraints on construction, such as delayed client payments and insufficient funding for the project, can limit the pace of work and cause construction to stop altogether. Other external factors, such as weather, obtaining regulatory approvals, and disputes over land acquisition can also delay the schedule of the project.

The construction industry has been looking at ways to improve these continuing problems by using more efficient project management tools and newer digital technologies. The use of software applications like Primavera P6 or Microsoft Project allows for better and more precise scheduling of tasks, allocating resources correctly, and also tracking progress in relation to work completed. The used method of statistical analysis for determining delay factors from survey data is called the Relative Importance Index (RII) and is now being used in many daily applications. Another tool that has allowed for more detailed or complex quantitative analyses of project scheduling is SPSS. With the emergence of Building Information Modeling (BIM), a collaborative, data-rich method has permitted significant reduction in errors and waste through more accurate design and coordination of both the design and construction phases of a project. As emerging technologies like Artificial Intelligence (AI) and Machine Learning (ML) come into play, project managers will gain access to predictive capabilities that will allow them to foresee delays and react appropriately before the delay actually happens.

The objective of this paper is to carry out an extensive evaluation of current literature available regarding delays in construction projects within India, determine the major

causes of delays that are most often seen and also consider the effectiveness of modern project management techniques at reducing delay. This review will combine data collected through various studies, and compare those results in a structured manner, trying to provide valuable information for researchers, practitioners, and policy-makers involved with producing and completing timely construction in India.

LITERATURE STUDY

The literature review draws on a large number of published studies, case studies, and questionnaire research conducted within India and other developing countries in order to identify repeated causes of time delays and their relative ranking. In addition to using the Relative Importance Index (RII) and SPSS statistical software, the authors have also considered a variety of delay analysis techniques - An analysis of the results from several studies is presented so that common themes, research methodologies and differences between regions in relation to delays in construction projects can be identified within the Indian context. In addition to the above highlighted points, this publication also places significant importance on the role of new project management tools and technologies for reducing delay in construction projects; this is done through an evaluation of the practicality of software applications like Primavera P6 and Microsoft Project, as well as advanced technologies such as Building Information Modeling (BIM), Procure, Artificial Intelligence, and Machine Learning, in improving the ability of construction projects to meet their scheduled time frames.

Ultimately, the integration of these new tools into construction workflows will play an important role in reducing the time lost due to schedule overruns and therefore, improving both coordination among stakeholders involved in construction projects and the overall performance of project delivery systems within the Indian construction industry.

1. Sharmila et al. (2024)

According to the authors of this study, the most significant causes of time delays in construction projects include poor planning, poor coordination between stakeholders, and delays in obtaining materials, as shown by pre-existing questionnaire surveys and statistical analyses. They highlight the necessity of systematically applying all the above factors to the beginning of the construction phase in order to manage construction projects effectively and deliver them on time.

2. Kowsalya and Abdu Rahoof (2023)

In this research, the authors evaluated the causes of construction project delays in India using mixed methods, including interview, questionnaires, and case studies. They concluded that the major causes of delays were poor site management, lack of available

labour, and poor communication. They suggested using Building Information Modeling (BIM) with the construction management software to assist with project planning and coordination as well as to enable real-time monitoring of project progress.

3. Aravindhan et al. (2023)

Paper that looks at delay analysis using using both Primavera P6 as well as SPSS software. In addition to exploring delay analysis, this research used the RII (Relative Importance Index) to determine a ranked order of the contributing risk factors associated with schedule delays. The authors' research findings indicate that some of the major contributing risk factors associated with schedule delays are: 1. Poor resource planning. 2. Delayed approvals. 3. Inadequate scheduling. Another portion of the research established that time (savings) = cash (savings) and illustrated how Primavera P6 solves common scheduling problems found in most construction projects.

4. Amin Sherif et al. (2023)

The study summarizes three basic stages of construction delays: mobilization, construction, and closeout. There are several methods for analyzing delays. This study examined them and found that TIA is the best method for analyzing the impact of delays on future projects because it is a forward-looking analysis that allows construction project managers to predict and avoid delay impacts depending on when they occur and at which phase of a project they occur.

5. Zayyanu Mohammed and Umar Bello (2022)

Asia and Africa were identified as the most prolific contributors to literature about construction delay. Australia and North America have not produced nearly as much literature on this area. There are many gaps in the literature that need to be researched, and the authors of this article recommend that researchers improve their methods so that they will be able to completely address the reasons for delays in construction projects in all types of construction environments.

6. Honnappa and Padala (2022)

This study shows that the number of design changes made during the design process can have an exponential effect on both time and cost. The authors also suggested that BIM should be implemented as a proactive method of tracking design changes, minimizing rework, and enhancing compliance with the project's schedule during the entire life cycle of the project.

7. Dixit and Kudari (2021)

The research delineated delay-causing factors into seven classifications and assessed these categories

relative to each other with respect to degree of severity of impact. The authors recommended improved project/technical management practices, as well as modern technology integration, stating that in their opinion, traditional management practices are inadequate for addressing complexity associated with delay issues within today's construction projects.

8. Paray and Kumar (2021)

After conducting the research, there were five key elements identified as the biggest influence on performance and timely delivery of a project. The results showed that early identification and prioritization of delays allowed for better allocation of resources and interventions by Project Managers.

9. Majnoor and Joy (2020)

The authors noted that effective planning can reduce the cost of labour, avoid disputes over contracts, and facilitate a continuous flow of work. The authors also emphasized the need for technological upgrades along with better management of human resources in the working environment because of the growing competitiveness of the construction industry.

10. Jayawant and Kudari (2020)

Utilising the Relative Importance Index (RII) as a tool for quantifying the effects of each delay cause and ranking them according to severity allowed for strategic planning of future projects with an aim to reduce both the number of delays and the cost overrun associated with those delays. These results support the usefulness of a data-driven approach in the management of construction schedules.

11. Jayawant and Kudari (2020)

In their research, Tayade and Mahatme examined reasons for construction delays and ways to reduce them by surveying 23 contractors, 19 consultants and 15 owners about their experiences related to construction delays. They identified 73 sources of delay across nine categories and reported that all three groups identified the same major contributing factors to delayed construction: change orders; labour related issues; and inefficiencies in the contractor's performance. The authors then presented a structured mitigation plan that can be used as a roadmap for mitigating delays based on each primary category of source of delay.

12. Paray and Kumar (2020)

According to Paray and Kumar's study of 46 causes of construction delays (using a literature review and construction professional survey), they used RII and 80/20 analysis methods and discovered several major causes of delay. These included: strikes; unexpected site situations; natural disasters; soil investigation errors; and slow issuance of government permits. Their study concluded that timely identification of root causes is essential in order to minimize delays effectively.

13. Desai and Purohit (2022)

The author of this research study is Desai & Purohit (November 2013). Their focus was on analyzing the causes of "delays" specific to building construction projects in India, particularly residential projects. They identified the following, as the five primary causes of "delays" through both a Contractor and Consultant analysis of the Relative Importance Index (RII) method: Material (Shortages), Adverse Subsurface & Ground Conditions (Unforeseen), Poor Procurement Planning, Rework on Construction, & Equipment Failure. To mitigate these causes, the authors recommended two key measures: advance arrangements for equipment and better supervision of construction sites.

14. Gourav Shakya and Gupta (2022)

Surveyed over seventy construction stakeholders (engineers, contractors, developers, architects and Government Officials), after analysing forty seven factors associated with time, cost/quality/productivity; the results showed that the main causes of time & cost overrun in the Indian construction industry are changes in design, inadequate planning, price variances/price fluctuations, and estimation errors.

15. , Mahatme, and Sabihuddin (2020)

The research examined the reasons for the delays experienced during the construction projects of bridges located in India by using the relative importance index (RII) to rank these reasons. The results showed that the three most important reasons for delays are lack of procurement, delayed support from trades, and subsequent revisions of design. Comparative analysis from the perspectives of contractors, consultants and clients showed that all three parties had very different perspectives on who should take the blame for the delays.

16. Kadu, Narwade, and Nagarajan (2021)

Kadu et al. studied delay causes in railway construction projects in India. They found that the three most significant reasons for delay in the construction of railways were land acquisition, delayed approval of the design documents, and shortage of skilled labour. Additionally, the findings of Kadu et al. identified specific delay characteristics for linear infrastructure projects and noted the value of developing integrated approval mechanisms and advanced workforce planning as remedies to address these issues.

17. Sharma and Paul (2023)

The conclusion of this article was that the authors felt that there needed to be major policy changes by the government with respect to funding and managing their road infrastructure projects.

18. Gupta (2025)

Cronbach's Alpha and RII Analysis, this study explored the causes of delays in cost and time overrun for Indian Pipeline Infrastructure Projects.

Additionally, a Machine Learning Model was developed with Eleven Algorithms to help predict the project's total cost and its estimated completion date. Through our analyses, we specifically identified Three Major Causes of Delay, namely; Design Changes, Poor Planning, and Price Fluctuations, indicating the use of Predictive Analytics can greatly improve the accuracy of project planning.

19. Shikalgar, Ravi, and Patil (2022)

The correlation between time overruns and wasted materials on construction projects was examined. Results from both descriptive and inferential statistics showed that poor management of materials is highly correlated with delays in the schedule of construction. In addition to poor management of materials, the existence of construction defects due to poor management of materials also created a substantial secondary contribution to delays. Consequently, it was recommended that additional quality control have to be implemented at the procurement and/or delivery stages of materials to allow for the dual reductions in undone work orders and delays. Utilising the Relative Importance Index (RII) as a tool for quantifying the effects.

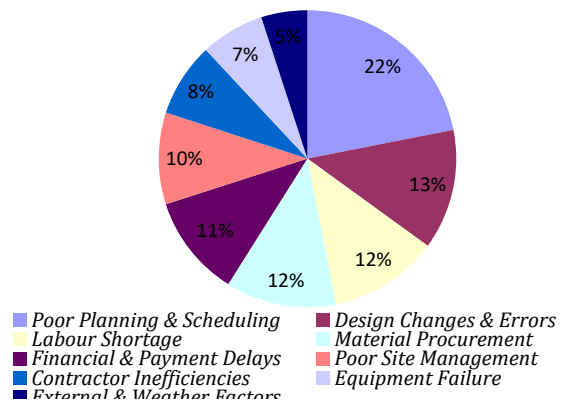
20. Jaiswal and Kshirsagar (2021)

Jaiswal & Kshirsagar reviewed causes for cost overruns in the real estate construction sector in India. Their findings indicate that there is a strong correlation between scheduling and the occurrence of time delays in addition to being a common cause of both cost & time overruns (i.e., poor scheduling changes in scope, financial instability of contractor). They recommend implementing improved financial planning prior to project execution and monitoring of costs at predetermined milestones as essential measures for preventing both cost and time overruns.

RESULTS AND DISCUSSION

Delays happen in the construction process often due to poor planning, gaps in resources, and lack of coordination among stakeholders. This review provides a structured framework to improve adherence to a schedule, based on best industry's practices. These practices include: conducting pre-execution audits, continuous monitoring of scheduled completion date, using standardized evaluation criteria, milestone related payments, buffering of materials, design freezes, mandatory stakeholders' meetings, and proactive risk registry. By including these practices, projects can develop an accurate timeline and complete within budget appropriately.

Chart 1 - Identification of Construction Delay Factors



Tab. 1 - Construction Project Delay Factors

| S.No. | Delay Factor | Percentage | Severity |
|-------|----------------------------|------------|----------|
| 1 | Poor Planning & Scheduling | 22% | High |
| 2 | Design Changes & Errors | 13% | High |
| 3 | Labour Shortage | 12% | High |
| 4 | Material Procurement | 12% | High |
| 5 | Financial & Payment Delays | 11% | High |
| 6 | Poor Site Management | 10% | Moderate |
| 7 | Contractor Inefficiencies | 8% | Moderate |
| 8 | Equipment Failure | 7% | Moderate |
| 9 | External & Weather Factors | 5% | Low |

- **Pre-construction planning:** Before work starts, an audit should be done to make sure schedule, resource, work breakdown structure, labour hours, activity duration and production are achievable.
- **Continuous delay monitoring:** The site coordinator needs to monitor the project schedule; if they notice any possible delaying event, they need to notify the decision-maker of the potential delay as soon as possible.
- **Standardised contractor evaluation:** Before awarding contracts, a performance evaluation system should be used to measure the contractors performance in the past with regard to schedule adherence, proper use of resources, etc.
- **Payment based on milestones:** Payment terms must be based on completion of the verified milestone to reduce cash flow disruptions caused by delays in administrative processing.
- **Critical materials sched. buffer stock:** Maintain an inventory of critical material stock based on historical lead time for procurement.
- **Mandatory design freeze policy:** all designs should be frozen prior to commencing execution, and any post-freeze changes will require evidence of schedule delay or cost increase.
- **Weekly inter-stakeholder meetings:** Weekly inter-stakeholder meetings (client, consultant, contractor and sub-contractor) shall be part of the contract requirement.
- **Risk register usage:** Maintain a project risk register from the planning stage, and assign mitigation to the named stakeholders.

CONCLUSIONS

construction projects, including poor planning, improper allocation of resources, financial irregularities and lack of coordination between stakeholders. A review of reviewed studies found that planning and scheduling were the two most important reasons for delays (22%), followed by design changes, labour shortages and material procurement problems. The recommendations proposed in this paper are intended to address these issues by improving planning discipline, holding contractors accountable, developing appropriate financial structures and establishing structured communication. Implementing these measures will provide a pragmatic way to reduce time overruns and increase project delivery performance across the Indian construction sector.

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