

Factors Affecting Time and Cost Overrun – Indian Scenario.

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Abstract - In the Indian construction industry, time and cost overruns are an ongoing issue, especially for major road infrastructure projects. Using information from primary data gathered through structured surveys as well as literature, this study examines the main causes of these overruns. Finding the most significant causes, evaluating their relative effects, and making useful suggestions for minimizing them were the goals of the study.

To determine the fundamental factors causing delays in projects and cost increases, a thorough literature review was carried out. A questionnaire survey was created and distributed to industry professionals working on road infrastructure projects in light of these findings. In order to rank the degree to which each aspect affected time and cost performance, the responses that were gathered were examined.

The findings revealed that the main causes of project overruns were changes to the scope during execution, construction mistakes, problems with bill settlement, construction accidents, and rising fuel and material costs.

In order to reduce overruns, the study's conclusion highlights the necessity of better planning, effective stakeholder communication and contractual risk allocation. Policymakers, contractors and project managers looking to improve the effectiveness and sustainability of infrastructure development in India will find the findings to be a useful resource.

Key Words: Time overrun, Cost overrun, Indian construction Industry, Likert's scale.

1. INTRODUCTION

One of the main generators of employment and GDP in India, the construction sector is essential to the country's economic growth and infrastructural development. It includes initiatives related to housing, business, industry and infrastructure, such as roads, bridges, railroads, airports, and urban development.

Delay and cost escalation are regular phenomena in undertakings globally. However, problems are especially serious in developing countries. Cost overrun can be simply defined as when the actual cost of the project exceeds the original forecasts. Delay is one of the most common, substantial and critical difficulties affecting the time factor in construction projects in civil engineering. Time overload is a major aspect, even with technical developments and greater understanding of project management by project managers, time overrun is a critical factor. Delays are caused by issues like as postponement of material supply to the site, breakdown

of equipment, political problems, and numerous weather conditions. In certain situations, delays make things considerably more challenging. A complete assessment must identify the reasons behind delays and choose accurate and appropriate actions to reduce their negative impact on project duration.

An unanticipated modification to the project budget that ultimately raises the overall project cost is known as a cost overrun. There are three main causes for it:

- a) Economic factors brought on by inaccurate project details or cost.
- b) Technical factors, such as inaccurate data collection or estimates.
- c) The existence of scope creep or any decline in project commitment levels are examples of psychological factors.

1.1 KEY FEATURES OF THE INDIAN CONSTRUCTION INDUSTRY

1. Economic Contribution:

- a. The sector contributes about 9% of India's GDP.
- b. It is the second-largest employer after agriculture, providing jobs to millions.

2. Major Segments:

- a. Infrastructure (roads, railways, metro, airports, power plants, etc.).
- b. Real estate (residential and commercial buildings).
- c. Industrial projects (factories, warehouses, SEZs).

3. Challenges Faced by the Industry:

- a. Time and cost overruns due to poor project planning, regulatory approvals and financial delays.
- b. Land acquisition and legal disputes slowing project execution.
- c. Labor shortages and skill gaps affecting productivity.
- d. Dependence on traditional construction techniques, with slow adoption of technology.

4. Government Initiatives and Policies:

- a. Make in India & Atmanirbhar Bharat: Promoting local materials and industries.
- b. Smart Cities Mission: Focus on urban development.
- c. PM Gati Shakti Plan: Boosting multimodal infrastructure connectivity.

- d. Affordable Housing Schemes: Addressing housing deficits.

5. Future Growth and Trends:

- a. Increased public-private partnerships (PPP) in infrastructure projects.
- b. Technology adoption like BIM, AI and automation to improve efficiency.
- c. Greater emphasis on green buildings and sustainable construction.

1.2 TIME AND COST OVERRUN IN CONSTRUCTION INDUSTRY

In the construction sector, time and expense overruns are a recurring problem that impact both small and large-scale projects. Financial losses, project delays, legal issues and damage to stakeholder's reputations can result from these overruns. Successful project management requires an understanding of the reasons behind schedule and expense overruns, their effects and mitigation techniques.

1.3 CAUSES OF TIME AND COST OVERRUNS

1. Poor Project Planning and Scheduling

- a. Inadequate initial estimates
- b. Unrealistic timelines
- c. Inefficient resource allocation

2. Design Changes and Scope Creep

- a. Frequent alterations in project design
- b. Expansion of project scope
- c. Poor communication between stakeholders

3. Unforeseen Site Conditions

- a. Geological surprises (e.g., unstable soil, hidden utilities)
- b. Environmental factors (e.g., floods, landslides)

4. Regulatory and Legal Issues

- a. Delay in obtaining permits and approvals
- b. Changes in government policies or regulations
- c. Disputes over land acquisition

5. Contractual Disputes

- a. Poorly defined contract terms
- b. Conflicts between contractors, subcontractors, and clients
- c. Payment delays

6. Shortage of Skilled Labor and Material

- a. Insufficient availability of experienced workforce
- b. Fluctuations in material prices
- c. Supply chain disruptions

7. Inflation and Economic Conditions

- a. Rise in raw material costs
- b. Currency fluctuations
- c. Interest rate variations affecting financing costs

8. Project Management Inefficiencies

- a. Poor risk management
- b. Lack of coordination between teams
- c. Inadequate monitoring and control mechanisms

1.4 CONSEQUENCES OF TIME AND COST OVERRUNS

1. Financial Losses: Increased costs lead to budget overruns, reducing profitability.
2. Delayed Project Delivery: Failure to meet deadlines can result in penalties and reputational damage.
3. Legal Disputes: Unclear contract terms and delays may result in arbitration or lawsuits.
4. Loss of Stakeholder Confidence: Investors, clients, and the public may lose trust in project teams.
5. Impact on Economic Development: Delayed infrastructure projects can hamper economic growth and public services.

2. RESEARCH DESIGN

The research follows a mixed-methods approach, incorporating both qualitative and quantitative techniques. The study involves surveys, interviews and case studies to analyze the causes, consequences and mitigation strategies for time and cost overruns.

2.1 DATA COLLECTION METHODS

The data for this study is collected from both primary and secondary sources:

1. Primary Data:

- a. Surveys: Questionnaires distributed to project managers, contractors, engineers, and government officials.
- b. Interviews: Structured and semi-structured interviews with industry experts.
- c. Case Studies: Examination of major Indian infrastructure projects affected by time and cost overruns.

2. Secondary Data:

- a. Government reports and policy documents
- b. Published research papers and industry reports
- c. Project records and financial statements from relevant organizations

2.2 PROCESS OF PREPARATION OF QUESTIONNAIRE SURVEY

The questionnaire survey is designed to collect quantitative and qualitative data from key stakeholders in the construction industry. The process involves the following steps:

1. **Defining Objectives:** Identifying key research questions related to time and cost overruns. These objectives guide the structure and focus of the questionnaire.

2. **Literature Review:** Reviewing existing literature, industry reports, and case studies to formulate relevant and insightful questions. This helps in ensuring the questionnaire is comprehensive and well-informed by past studies.
3. **Drafting the Questionnaire:** The questionnaire consists of both closed-ended (multiple-choice, Likert scale) and open-ended (descriptive) questions to capture both quantitative and qualitative data.
4. **Expert Validation:** The draft questionnaire is shared with industry professionals, including project managers and academic experts, for validation. Their feedback helps refine the clarity, relevance, and effectiveness of the questions.
5. **Pilot Testing:** A small-scale test is conducted with a limited number of respondents (e.g., 10-15 professionals) to identify ambiguities, redundancies, or difficulties in understanding the questions. Based on feedback, necessary modifications are made.
6. **Finalizing the Questionnaire:** The refined version of the questionnaire is reviewed to ensure it aligns with research objectives, is easy to comprehend, and eliminates potential biases.
7. **Survey Distribution:** The finalized questionnaire is distributed through multiple channels, including:
 - a. Online Platforms: Google Forms, SurveyMonkey, and email-based surveys for wider reach.
 - b. Physical Distribution: Hard copies distributed at construction sites, industry conferences, and professional meetings.
 - c. Interviews and Focus Groups: Some respondents are engaged through structured interviews to gather in-depth responses.
8. **Data Analysis Methods:** Data analysis is conducted using a combination of statistical and thematic analysis:
 - a. Quantitative Data Analysis: Statistical tools such as Anova and MS Excel are used for data interpretation.
 - b. Qualitative Data Analysis: Thematic analysis is conducted to identify common themes from interviews and case studies.

2.3 LIKERT SCALE

The Likert scale is a widely used rating scale in surveys and questionnaires designed to measure people's attitudes, opinions, or perceptions toward a specific topic or statement. It was developed by Rensis Likert in 1932 and is commonly used in social sciences, business, and research studies.

1. Structure of a Likert Scale

- a. A Likert scale typically presents a statement and asks respondents to indicate their level of agreement or disagreement using a fixed range of options.
- b. The scale usually has five or seven points, but it can have more, depending on the research objective.

2. Common Likert Scale Options (5-point example)

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

Other variations may include:

- Levels of satisfaction (e.g., Very Unsatisfied to Very Satisfied).
- Frequency (e.g., Never to Always).

3. Analysis of parameters taken on Likert scale

1. Multiply the number of responses for each option by its corresponding numerical value.
2. Sum these products to get a total score for each item.

4. Formula

$$\text{Weighted Score} = \sum (\text{Frequency of Responses} \times \text{Assigned Value})$$

Example for one question:

- Strongly Disagree (5 responses \times 1) = 5
- Disagree (10 responses \times 2) = 20
- Neutral (15 responses \times 3) = 45
- Agree (20 responses \times 4) = 80
- Strongly Agree (10 responses \times 5) = 50
- Total Weighted Score = 200

To compare items with different sample sizes, normalize the scores:

$$\text{Normalized Score} = \frac{\text{Total Weighted Score}}{\text{Total Number of Responses}}$$

This gives an average score for each item.

2.4 RANK THE ITEMS

1. Arrange the items in descending order of their total or normalized scores.
2. The item with the highest score ranks first, indicating the highest level of agreement or important.
3. Items rank first can be considered as most.

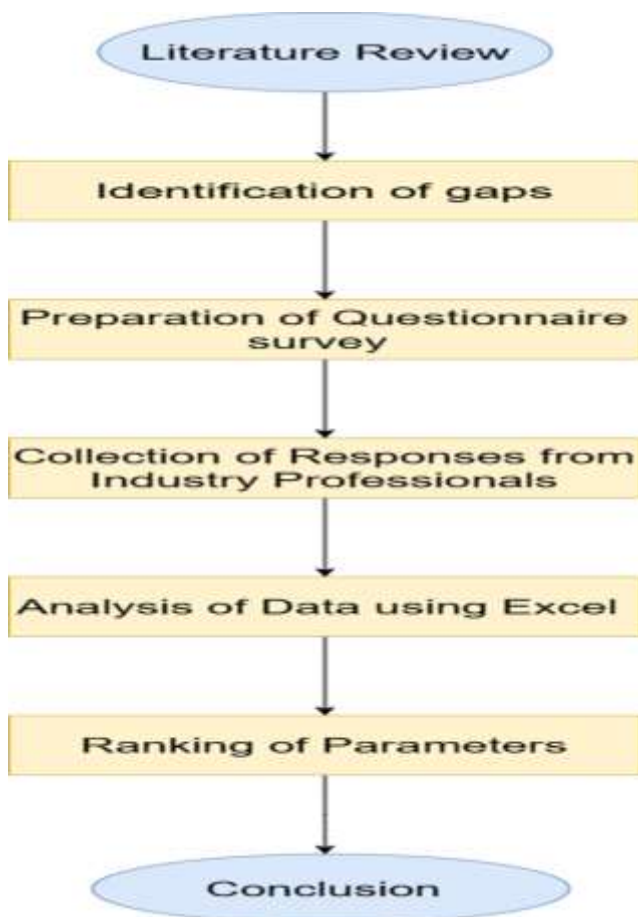


Fig. -1: Methodology

3.QUESTIONARY SURVEY FOR TIME AND COST OVER RUNS

1. Name of industry / organization
2. Name of signatory
3. Designation
4. Date
5. Place
6. Number of projects completed till the date
7. Number of projects ongoing

(Rank the following factors from 1 to 5 for both time and cost over runs. If felt particular factor has no influence write as “Nil”).

Questionary survey for time and cost over runs

1. Ambiguity in tender document
2. Contractual claims for extension of time and cost
3. Issues on bill settlement
4. Force Majeure
5. Fraudulent practices
6. Frequent changes in design
7. High quality expectation from owner
8. Lack of co-ordination between construction parties
9. Long period between design activity and tendering time
10. Mistake during construction

11. Lack of financial control on site
12. Price escalation of raw materials
13. Improper communication between site management and labour
14. Scope changes during execution
15. Wastage during execution
16. Changes in government policies
17. Delays in the approvals from authorities
18. Construction accidents and injuries
19. Change in design during execution
20. Delay in payments
21. Faults in construction equipment's
22. Shortage of construction materials
23. Labour strikes
24. Increasing fuel prices

4. RANKING OF PARAMETERS

Factor	Time Overrun Rank	Cost Overrun Rank
Scope changes during execution	1	1
Mistake during construction	2	2
Construction accidents and injuries	3	3
Issues on bill settlement	3	4
Delay in payments	4	5
Lack of co-ordination between construction parties	5	6
Change in design during execution	6	7
High quality expectation from owner	7	8
Long period between design activity and tendering time	8	8
Frequent changes in design	9	9
Delays in the approvals from authorities	9	10
Contractual claims for extension of time and cost	9	11
Price escalation of raw materials	10	12
Faults in construction equipment's	11	13
Shortage of construction materials	12	14
Lack of financial control on site	12	15
Improper communication between site management and labour	13	16
Increasing fuel prices	14	16
Ambiguity in tender document	15	17
Fraudulent practices	16	20
Changes in government policies	17	19
Force Majeure	18	19
Labour strikes	19	20
Wastage during execution	20	20

Table -1: Ranking of Parameters

5. CONCLUSIONS

1. Scope Changes During Execution as a Major Cause of Time Overruns:

The analysis highlighted scope modifications during project execution as the most significant factor to time overruns. Regular changes to building techniques, material specifications, or design throws off due dates

and result in rework, additional approvals, and postponed decision-making. These modifications are frequently brought about by changing customer requirements, unanticipated site circumstances, or errors in the design, all of which greatly lengthen project durations.

2. Construction Mistakes Severely Affect Both Time and Cost:

Construction errors were the leading cause of cost overruns and the second leading cause of time overruns, indicating a clear correlation between poor project execution and inefficiency. These mistakes, which can range from poor workmanship to inaccurate measurements, frequently call for expensive rework, the purchase of extra supplies, and an alteration of manpower, which puts a burden on finances and causes delays in the timeline.

3. Administrative Delays and Safety Incidents Disrupt Project Progress:

Among the top three reasons for time overruns were problems with bill settlements and construction accidents. Delays in bill settling impair cash flow and have an impact on subcontractor payments and procurement. Simultaneously, site accidents delay work, necessitate investigations and may even lead to legal claims. Due to indirect costs and lost productivity, both issues increase overall costs and delay completion.

4. Rising Fuel Prices Drive Significant Cost Escalation:

The second most significant contributor to cost overruns was rising fuel prices. Because fuel is essential to the functioning of machinery, material transportation, and logistics, changes in fuel prices have an adverse impact on costs across a variety of activities, particularly in major road and infrastructure projects.

5. Material Price Escalation Impacts Project Viability:

Price increases for raw materials (such as steel, cement, and bitumen) have a major impact on cost performance; they rank fifth in terms of cost overrun and thirteenth in terms of time overrun. Unexpected changes in market prices put a pressure on budgets, requiring contractors to either renegotiate contracts or employ escalation provisions to seek a refund. Projects lacking these provisions are more susceptible to procurement delays and cost overruns.

6. Payment Delays Disrupt Workflows and Demoralize Teams:

One of the top five reasons for schedule overruns was delayed payments from funders or clients. Resources are demobilized, material orders are delayed, and subcontractor engagements are disrupted as a result of these delays. Prolonged delays can still result in claims and legal challenges, even though they may have an indirect effect on the final cost.

7. Coordination Failures and Design Instability Compound Overruns:

For time and financial consequences, frequent design modifications and a lack of collaboration among stakeholders were continuously listed in the top ten. Conflicting decisions, misunderstandings on the job site, and ineffective execution are the results of poor communication between architects, engineers, contractors, and owners. Incomplete or unstable designs result in more drawings, revisions, and approval delays.

8. High Quality Expectations Can Extend Time and Inflate Costs:

High-quality standards set by owners, particularly in the middle of a project, may necessitate rework, particular materials, or more skilled workers, all of which increase costs and time. To prevent unforeseen project setbacks, quality must be balanced with reasonable schedule and financing.

9. Uncontrollable Events Still Require Mitigation Strategies:

Although not being the most critical concerns, labor strikes and force majeure events are significant due to their unpredictable nature and possible severity. Projects frequently lack adequate contingency preparations, and these occurrences have the potential to completely stop work. Their ranking suggests that they happen infrequently but have a significant impact when they do.

10. Site-Level Communication is Key to Execution Efficiency:

Time and expense overruns were shown to be moderately impacted by poor communication between labor teams and site management. Ineffective utilization of resources might result from misunderstandings over plans, timelines, or material management. To reduce these problems, effective site leadership and communication procedures are crucial.

11. Wastage During Execution Perceived as Less Critical:

According to responder data, material waste had a surprisingly small effect on time and expense overruns, despite being a widespread issue. This implies that either the impact is viewed as insignificant in comparison to bigger systemic problems like delays and design faults, or contractors may have already put measures in place to manage waste.

12. Tender Document Clarity is Important but Not the Main Cause:

In terms of time and cost overruns, tender document ambiguities scored poorly. This implies that other dynamic and execution-phase concerns typically have a greater influence on overruns, even though initial documentation clarity is crucial for project success.

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