ANALYSIS OF DELAY IN CONSTRUCTION PROJECT IN INDIA

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ABSTRACT

The building industry in India is an important sector because of its tremendous contribution to the country's economic development. However, due to the country's geographical, political, social, and financial status, many building projects are prone to delays. These delay causes can only be prevented by first recognizing the issues and their sources. The primary goal of this research was to identify the major reasons of construction project delays in India. The study design was quantitative, with data collected from clients, consultants, and contractors via questionnaires. The questionnaire, created with Google form technology, included a list of delay-causing elements that respondents were asked to score on a 5-point Likert scale. The collected data were analyzed with the Statistical Program for Social Scientists (SPSS). According to the findings, the top primary reasons of delay were material shortages, erroneous time calculation, and building faults. Furthermore, the top major consequences of delay were cost overruns, time overruns, bad social consequences, and lawsuits. Furthermore, the top major hazards connected with construction delays were: excessive pressure on project stakeholders, disagreements among project participants, project abandonment, total cost rise, and income reduction.

Keyword: - *Causes of delay, Construction Project, Construction Industry*

1. INTRODUCTION

A construction project is essentially a short-term endeavor with a set time and budget that is started to produce a special good, service, or outcome and usually comes in restricted quantities. To produce that one-of-a-kind development on a specific location under circumstances that will never be duplicated, the project team gets together. Construction can start despite numerous uncertainties, but they may be complex and require high levels of coordination of permissions, people, products, plant, and materials. As a result, delays are frequent. Additionally, the use of cutting-edge technologies and owner-requested alterations makes it even harder to maintain a project on schedule. Inherent uncertainties and sophistication in the physical, financial, and economic environments in which most projects are carried out go hand in hand with this state. Such circumstances have made it challenging to complete projects on time and under budget, frequently resulting in requests for cost reimbursements and time extensions. Construction delays are defined as a time difference between the start and finish of an activity relative to the baseline timetable, or as a late start or late completion of an activity, directly affecting the stipulated cost.

Construction delays are frequently the result of poorly managed event(s) and can be seen as a risk for the projects if identified, analyzed, and managed in a systematic process at inception. This would allow for the management, minimization, sharing, mitigation, or acceptance of the risk to produce some positive results and reduce the likelihood of further delay. In terms of the development of antagonistic relationships, mistrust, litigation, arbitration, and cash-flow issues, delays in construction projects have a detrimental impact on clients, contractors, and consultants. Until a building project meets the financial, time, and quality constraints imposed on it, it cannot be considered a successful undertaking. However, it happens frequently for a construction project to fall short of completing its task within the required budget, timeframe, and level of quality. The field of "Project management" is used to oppose the unanticipated delays in advance, which aids in mitigating the delays. Application of knowledge,

skill, tools, and techniques to project activities in order to fulfil project requirements constitutes project management, which necessitates efficient management of the project management processes.

Construction industry delays are a common occurrence on a global scale. Regardless of how difficult the project is, delays happen in the majority of construction projects. Delay in construction projects is the lengthening of the project's completion time. In other terms, a delay is when a project isn't finished on schedule and within the allocated money, as specified in the contract.

One of the most frequent issues in the construction sector, construction delays frequently have a negative impact on the timeliness, cost, and quality of projects. The effect of consultants, contractors, and owners on project performance is typically a major factor in project failure. Delays have an expensive impact on all parties involved and frequently lead to disputes, cost overruns, arbitration, litigation, complete abandonment, and project impossibility. The construction process is influenced by a number of internal and external elements, making it a risky sector with unknowns.

Errors in design or misrepresentation of the client's requirements by consultants are one of the main causes of time and cost overruns in projects. These mistakes typically don't surface until the construction phase. As a result, the time and money needed to fix the mistakes will increase. In addition, because the initial cost estimates were made based on the wrong designs, design flaws could result in time and expense overruns. As a result, there can be omissions or unnecessary work, which would result in additional work or alteration orders. Additionally, the delay is a result of the consultant's slow reaction and the contractor's lack of cooperation. These will undoubtedly have an impact on the project's total delivery time and cost. Inadequate field investigation, design and specification flaws, plan errors, design alterations, etc., are the most frequent causes of design errors. Therefore, to minimise design errors, excellent project planning, controlling, and monitoring are crucial. This includes good communication within the project team, which includes the owner, consultants, and contractors.

Every detail of a business connection, including as pricing, payment conditions, types of services or goods, etc., must be stated in a complete contract. In order to avoid disputes between the parties engaged in the project, unclear contracts that do not explicitly outline the complete project scenario should be avoided. A dispute could develop as a result of consultants' or contractors' unhappiness with extra scopes that were not specified in the original contract, for instance, if the contract does not completely describe every relevant part of the scope of work. Negotiations, arbitration, and/or mitigation efforts, as well as a request for a revision of the contract with revised budgets and schedules, are unavoidable when such a conflict arises. Unsurprisingly, this will cause a significant delay that surpasses the original time and budgeted cost. Additionally, choosing the right contractor is crucial to a project's success. Poor planning and scheduling by the contractor has an impact on project length. Lack of experience also has an impact on one's capacity for decision-making, which may cause both delays and costly rework.

Time and cost overruns may also be caused by the project's complexity. The size of a project, the variety of stakeholders, and the extent of scope revisions can all affect how complex it is. For instance, compared to minor initiatives, most mega projects often have rather extensive implementation periods. A longer construction period increases the likelihood that the project's initial budget won't be enough to finish it. This can be the result of changes in exchange rates, material prices, and inflation. Any scope adjustments made during the building phase could make the project itself more complex. It will be necessary to reassess the project's budget and schedule, which will require more time and money. Not to mention the drawn-out procedure of taking into account the stakeholders' interests and viewpoints.

In the post-construction phase, there are other underlying reasons that could result in time and expense overruns. When handover activities are delayed because of problems including inadequate rectification work, the client's acceptance, disagreement with the final account, and unresolved modification orders, unanticipated delays and costs frequently result. Similar disputes and delays could arise from paying consultants and contractors too slowly after the project is finished. These elements might make it harder to fire the project crew and raise overhead costs.

Continuous and effective planning, controlling, and monitoring are needed throughout the project life cycle to ensure that the project is always moving in the proper direction. The project manager must decide on and incorporate into the project planning the project scope, milestones, critical activities, delivery date, stakeholders, and other crucial elements. By figuring out the causes before anything else, delays can be minimized. In addition to hiring qualified consultants and contractors, the project manager needs to set up a control mechanism to keep an eye on the problems that have been recognized as being the cause of the delay. However, a project's success significantly depends on the project team. As a result, the goals and scope must be clearly stated in the early stages so that the project team is aware of its purpose. Only then can a good project team be formed with the success of the project as its top priority.

2. TYPES OF DELAYS IN CONSTRUCTION PROJECTS

Before assessing construction delays, it's crucial to comprehend the sorts or categories into which a delay might be divided. A thorough grasp of the different forms of delays is required in order to start the additional mitigation measures and turn it into a merit. There are four main categories or classifications for the delays:
A) Serious or non-serious delays B) Justifiable or irrational delays C) Parallel delay
D) Compensation-eligible or non-eligible delays
Prior to assessing the effects of delays on the project, it is necessary to comprehend how the categories are assimilated.

- It is important to establish whether the delay is critical or not.
- In addition, all delays are either acceptable or not.
- Concurrent or non-concurrent delays can be described as both excused and unexcused.
- Delays can also be classified as compensable or non-compensable.

According to economic historian Robert E. Wright, asymmetric knowledge, bid manipulation, change order artistry, and post-contractual market power are to blame for building delays. Many custom construction projects will continue to come in over budget, late, or below contract specifications unless those core concerns are addressed. The forms of delays are briefly discussed below;

A) Critical or non-critical Delays:

A crucial delay is one that causes the project's length to increase. Several outcomes are listed below:

- Extended Field Overhead
- Unabsorbed home office overhead
- Liquidated Damage
- Idle labor & equipment cost
- Labor & Material Cost Escalation and many more

A non-critical delay is one that does not result in the project taking longer than expected to complete, but it still affects when tasks are done. As reaffirmed below, these activities will also have an impact on project cost estimates: a) Idle labour and equipment costs b) Labor and Material Cost Escalation, among other things.

B) Excusable & non-excusable Delay

Excusable delays occur when the contractor is entitled to a deadline extension, payment, or both under the terms and conditions of the contract. In this instance, the contractor has no control over whether the activity is delayed. There could be
Force Measure Clause

1. Natural Calamities
2. Political/Social Unrest
3. Terrorist Attacks
4. Delay from Client (Approvals, Decisions, etc.), etc.

Non-excusable delays are those when the contractor is solely to blame for the activities that were delayed and led to an increase in project length. In this situation, the contractor is liable for any financial repercussions, including the possibility of having to pay damages not just to itself but also to third parties. Possible causes include:

- Delayed Mobilization
- Delayed Procurement
- Delayed submission of important documents
- Planning & Scheduling
- Critical events that were not highlighted to client on right time, etc.

C) Concurrent Delays in Construction Projects

A concurrent delay is when many delays take place at the same time, impacting various tasks simultaneously or separately and delaying their completion. Not all of those circumstances, though, provide the contractor the right to a claim for an extension of time and costs. Importantly, there must be overlap between the delays causes and actual delays.

D) Compensable or non-compensable Delays in in Construction Projects

When delays are compensable, the contractor is responsible for Time Extension & Cost Compensation. Excusable delays encompass all compensable delays, but non-compensable delays refer to delays that are only the contractor's fault. However, depending on the circumstances it has caused and the terms of the contract, non-compensable may fall under critical, non-critical, excusable, or non-excusable categories.

3. RESEARCH METHODOLOGY

3.1 AIM

This study's primary goal is to identify the factors that contribute to delays in building construction projects in India's construction sector.

3.2 OBJECTIVES

- To identify the variables that contribute to the delay of construction projects
- To analyze the results of delayed building projects.
- To identify the risks related to delayed building projects.

The methods used to achieve the aims of this research is depicted in Fig. 1. Initially, the most relevant delay causes and mitigation techniques were determined by an intensive literature analysis and expert interviews. Following that, a questionnaire was created and distributed to professionals. The assessment of their replies allowed for the examination of the most important causes of delay, as well as the identification of the most effective, widely acknowledged strategies to improve delay reduction.

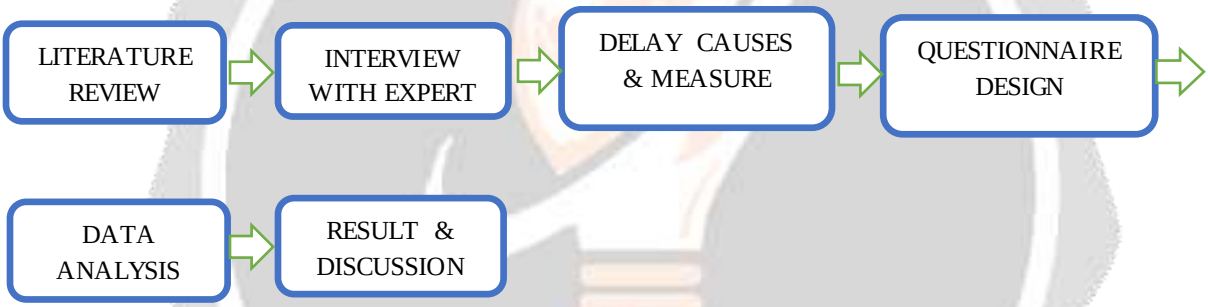

Fig -1 Methodology of research

3.3 RESEARCH SIGNIFICANCE

The government, commercial entities, contractors, consultants, and the general public in India will all use the research findings from this article as a guide. They will be aware from the project's inception phase onwards of the unknown aspects that may arise from project delays. This study will also produce a list of delay-causing variables that may be utilized as a standard for managing ongoing and upcoming projects. Stakeholders will also be informed of the issues that could cause delays as well as how to avoid them. Additionally, the study will suggest ways to reduce or completely avoid the effects of construction project delays. Finally, the study will support the findings of earlier studies about the factors that contribute to construction project delays. It will also give future academics some information they may use to look into this case or others like it in more detail.

3.4 RESEARCH SCOPE

The construction sector in India is the sole subject of the study report. It focuses mostly on building construction projects, including those for hospitals, office buildings (both residential and non-residential), and schools. Last but not least, the building projects were chosen so that they included all the key players, including consultants, subcontractors, and contractors. This is so that, in the event of a delay, it will be possible to determine if it was caused by the government, the owner, the contractors, the subcontractors, or the consultants.

4. QUESTIONNAIRES

A questionnaire was created to ascertain how various stakeholders in the Indian construction sector perceived the causes of delays. This was the primary instrument utilized to gather information from our target respondents. The responders were given access to the Google Form used to compile the questionnaire.

- The questions gave information about the respondents' backgrounds.
- To elicit information from construction stakeholders on the causes of construction delays.
- The question was designed to assess the impact of delay.

A total of 20 questionnaires were generated and emailed to Engineers, contractors, labor and private clients in India. Telephone interviews with several contractors and consultants were also conducted to get their opinions on mitigating construction hazards associated with delays. Out of the 149 surveys, 28 were sent to individual clients, 109 were sent to engineers, 10 were sent to contractors, and 2 were sent to labours. All questions were answered through email three weeks later. The findings were then obtained and interpreted using statistical methods. The questions were created using a 5-point Likert Scale, which spans from 1 to 5 based on the level of contribution and influence of each component, for the factors contributing to delays and the repercussions of delays.

- Strongly Agreed: 5
- Agreed: 4
- Moderately Agreed: 3
- Disagreed: 2
- Strongly Disagreed: 1

5. DATA ANALYSIS

The purpose of the questionnaire data analysis is to determine the significance of each reason of construction delay, its consequences on the construction, and viable strategies to decrease the construction delay. The data gathered is analyzed using an index known as the Relative Importance Index (RII). The following steps are involved in data analysis:

1. The relative importance index (RII) of each cause is computed using the following formula:

$$\mathbf{RII = \Sigma W / (A*N)}$$

Where,
RII = Relative Importance Index
W = Weight given to each cause by respondent (1 – 5)
A = Highest weight (i.e. 5)
N = Total number of respondents

2. Frequency index: The following formula is used to order the delays' reasons according to how frequently they occur as reported by the respondents:

$$\mathbf{Frequency\ Index\ (F.I)\ (\%) = \sum a\ (n/N)\ x\ 100/5}$$

Where, a is the constant expressing weighting given to each response (ranges from 1 for rarely up to 5 for always), n is the frequency and N is total number of responses.

6. RESULT & DISCUSSION

This chapter provides a summary of several statistical tests and analysis performed on the section-specific parameters. These cover the reasons for delays, their results, their hazards, and their preventative measures. Additionally, it displays the outcomes of the surveys that were conducted using SPSS. Tables and descriptive statistics like bar charts, pie charts are used to display the data.

In statistics and psychometrics, reliability refers to a measure's general consistency. If a measurement consistently yields findings that are comparable, it is considered to have high dependability. Highly dependable test results are those that are precise, repeatable, and consistent from one testing session to the next. The level of inaccuracy in the scores is often expressed using a variety of reliability coefficients, with values ranging between 0.00 (many error) and 1.00 (no error). The most often used indicator of internal consistency is Cronbach's alpha ("reliability"). The Cronbach's alpha of 149 respondents is 0.923. It is most frequently applied when a scale made up of several Likert

scales in a survey or questionnaire has to be evaluated for reliability. A total of 149 people answered to the poll, including 109 engineers, 10 contractors, 28 clients, and 2 labours.

According to the data, 149 surveys issued were satisfactorily completed and returned. Clients replied 28 (18.8%), Engineer answered 109 (73.2%) and Contractors answered 10 (6.7%). The representation of respondent of pie chart is shown in figure 2.

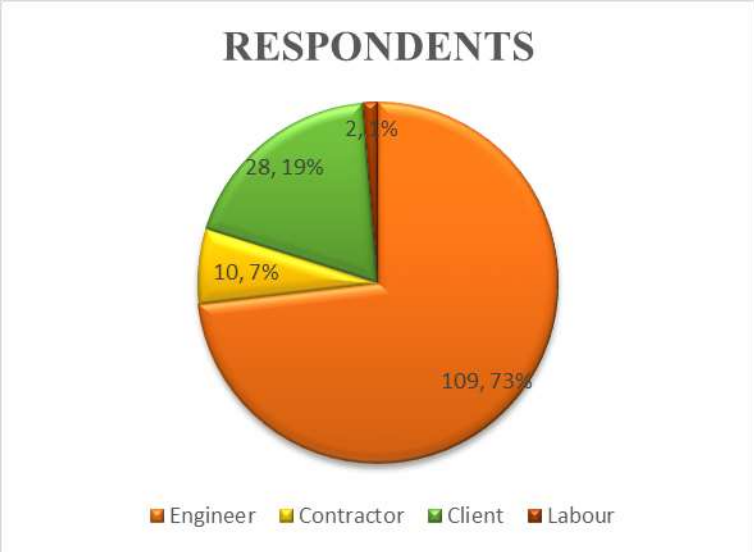

Fig -2 Number of Respondents

Fig -3 Experience of Respondents

Based on the ranking, the major causes of construction delays by Relative Importance Index (RII) were:

Table -1 Ranking of Delay cause

SL.NO	DELAY CAUSE	RII	RANK
1	Poor equipment productivity	0.742466	1
2	Design errors	0.739726	2
3	Client Financial difficulty	0.738356	3
4	Shortage in construction materials	0.734247	4
5	Contractor's financial difficulties	0.731507	5
6	Weather condition	0.730137	6
7	Experience of Designer	0.723288	7
8	Design variations	0.721918	8
9	Intermittent Design Change	0.720548	9
10	Slow permits from municipality	0.719178	10
11	Poor communication	0.716438	11
12	Shortage in manpower	0.712329	12

This paper delves at the Frequency Index and Relative Importance Index of the elements that impact the timeline of building projects. The significance index of each element is calculated as the sum of its frequency and relative important index indices. A survey was used to identify 12 criteria. The acquired data was examined using the frequency and relative important indexes. The results are based on the Relative importance index, and this technique revealed that the key variables are Poor equipment productivity (RII =0.742) & (FI =74.2%), Design errors (RII =0.739) & (FI =74%), Client Financial difficulty (RII =0.738) & (FI =73.8%), and Shortage in construction materials (RII =0.734) & (FI =73.4%). Minor factors influencing the timeline include low Shortage in manpower (RII =0.712) & (FI =71.2%), Poor communication (RII =0.716) & (FI =71.6%), Slow permits from municipality (RII =0.719) & (FI =72%), and Intermittent Design Change (RII =0.7205) & (FI =72.05%).

Table -2 Major and Minor Factors of Delay cause

MAJOR/MINOR	RANK	DELAY CAUSE	RII
MAJOR	1	Poor equipment productivity	0.7425
	2	Design errors	0.7397
	3	Client Financial difficulty	0.7384
	4	Shortage in construction materials	0.7342
MINOR	5	Intermittent Design Change	0.7205
	6	Slow permits from municipality	0.7192
	7	Poor communication	0.7164

	8	Shortage in manpower	0.7123

7. CONCLUSION

The study's major goal was to identify the important delay reasons that impact the performance of big public building projects in India. The existing literature analysis, interviews, and pilot study indicated 12 delay factors. These were included in a questionnaire set that was delivered to the major stakeholders involved in these sorts of initiatives. The poll participants have extensive expertise conducting large-scale public works projects. According to the data, over 96% of the projects are delayed, with more than half of them experiencing delays ranging from 9% to 30%. The most essential criteria were sorted according to their "Relative Important Index" and the average of each set of factors. Among the 149 investigated, the research identified “Poor equipment productivity and Design errors” as the leading (with R.I.I. = 0.7425) cause of big public construction projects. Data from 149 India construction projects are gathered to create regression models that characterize the link between delay and worker productivity. Delay is regarded as the dependent variable, whereas poor equipment productivity is regarded as the independent variable. The prediction model demonstrates a substantial link between delay and worker productivity. Similarly, the nature of the link is inversely proportional, which means that the higher the worker productivity, the shorter the delay, and vice versa. The following points are suggested to improve construction efficiency and reduce delays on the job site: (1) Continuous training programmes should be conducted to develop labour skills and managerial skills of construction participants; (2) Owners should pay progress payments on time so that contractors can pay for labour and other resources on time; and (3) Before awarding the contract, the owner should check the contractor's qualifications. Bidding on the basis of the lowest price should be improved.

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