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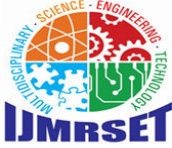
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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# A Systematic Review of Construction Delays in Infrastructure Projects

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**ABSTRACT:** Delays in infrastructure construction projects creates a significant global issue, impacting project timelines, budgets, and stakeholder dynamics. This review, based on 13 research studies and journals, illustrates the insights into the causes, impacts, and solutions for construction delays. Common contributing factors include funding, inefficiencies in contractor performance, design defects, material shortages, and external influences such as regulatory changes or natural disasters. The consequences of the same range from budget and schedule overruns to disputes, legal arbitration, and, in severe cases, project termination. Mitigation strategies highlighted in the studies focus on thorough planning, effective stakeholder communication, adoption of advanced technologies (e.g., BIM and AI-based tools), and robust risk management practices. Analytical tools such as the Relative Importance Index (RII) and advanced statistical methods play a crucial role in identifying and prioritizing delay factors. The findings emphasize the importance of proactive measures, including clear contract conditions, prompt approvals, efficient resource management, and streamlined project execution, to achieve timely and efficient project benefits. These recommendations offer valuable guidance for policymakers, project leaders, and industry professionals in addressing and optimizing the construction delays.

**KEYWORDS:** Systematic Review, Construction Delays, Impacts & Remedies

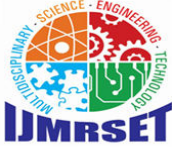
### I. INTRODUCTION

Infrastructure construction delays pose a global challenge, affecting both developed and developing countries alike. These delays frequently result in extended project duration, escalated costs, conflicts, and weakened relationships among stakeholders. The underlying causes are diverse, including financial constraints, inadequate planning, resource shortages, external influences like regulatory shifts and natural disasters, and ineffective communication among project teams. Tackling these delays is essential to enhance project efficiency, optimize costs, and ensure stakeholder satisfaction.

A significant body of research has explored the causes, effects, and mitigation strategies for construction delays. **Abdullah M. Tawfek and D. K. Bera** (2018) examined the types, causes, and impacts of delays, categorizing them into excusable, non-excusable, compensable, and concurrent delays, and emphasized proactive risk management. Similarly, **Anuradha Arya and Dr. Rajeev Kansal** (2016) focused on the Indian construction industry, identifying 78 delay causes through statistical measures like the Relative Importance Index (RII) and highlighting financial management and stakeholder coordination as key areas for improvement. **Akshaykumar P. Udasi and Milind Darade** (2018) provided global perspectives on delays, emphasizing contractor inefficiencies, material procurement challenges, and the need for better site management.

In the context of Pakistan, **Aftab Hameed Memon, Abdul Qadir Memon, Shabir Hussain Khahro, and Yasir Javed** (2023) analyzed delays in the post-COVID-19 construction industry, identifying communication inefficiencies and contract management as critical challenges. Their use of Partial Least Squares Structural Equation Modeling (PLS-





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SEM) offered a robust framework for addressing these issues. **Murali Sambasivan and Yau Wen Soon (2007)** provided insights into the Malaysian construction industry, linking delays to contractor inefficiencies and payment delays, and emphasizing strategies for improving contractor performance and client decision-making.

Recent studies have also explored the role of advanced technologies in mitigating delays. **Rinkesh Gajera (2024)** demonstrated the effectiveness of AI-driven analytics, achieving an 87% accuracy in delay prediction and substantial improvements in schedule performance. Similarly, **Pramodini Sahu, Dillip Kumar Bera, and Pravat Kumar Parhi (2024)** combined statistical and machine learning approaches to analyze delays and their impact on disputes, offering predictive models to assist in proactive management. **Dinesh Kumar R (2016)** identified contractor-related factors, such as poor risk management and subcontractor delays, as the most critical causes in Indian construction projects.

Further research by **Tushar Khattri, Sohiti Agarwal, Vaishant Gupta, and Mukesh Pandey (2016)** highlighted the importance of addressing financial constraints, design changes, and labor shortages to minimize delays. **Kartik Bagrecha (2017)** focused on Indian construction projects, emphasizing the need for better planning, financial management, and stakeholder communication. Additionally, **Yiannis Vacanas and Chris Danezis (2018)** provided a detailed analysis of delays in Cyprus, linking them to design errors, contractor productivity issues, and financing challenges, while recommending technology-driven solutions like Building Information Modeling (BIM).

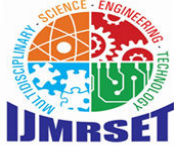
Lastly, **Prasad K.V. and Vasugi V. (2019)** and **Mrs. Rani M. Mate and Dr. G. A. Hinge (2015)** offered mitigation strategies for delays, emphasizing the role of modern tools like Primavera P6 and proposing frameworks for stakeholder coordination and contingency planning.

These studies collectively provide a comprehensive understanding of construction delays, their multifaceted impacts, and the interdependent nature of delay factors. This paper builds upon these findings, offering an in-depth analysis of delay causes, their effects, and actionable mitigation strategies to enhance project efficiency and stakeholder collaboration.

## II. LITERATURE REVIEW

Table 1. - List of 13 selected previous studies about causes of delay in construction (2007 to2024 )

Sr No.	Name Of Author	Brief Description of Study	Causes of Delays
1	Abdullah M. Tawfek and D. K. Bera, Conference Paper - November 2018	Categorized delays into excusable, non-excusable, compensable, and concurrent types, emphasizing proactive risk management.	Excusable and non-excusable delays, client-induced changes, contractor inefficiencies.
2	Anuradha Arya and Dr. Rajeev Kansal, IJSTE Volume 3 Issue 06 - December 2016	Identified 78 causes of delays in Indian projects, ranked using RII, with financial issues and client-induced changes being prominent.	Late payments, financial issues, poor site management, inadequate qualifications.
3	Akshaykumar P. Udasi and Milind Darade, IRJET Volume 05 Issue 05 - May 2018	Highlighted global delay factors such as contractor inefficiencies, material shortages, and design errors.	Material shortages, contractor inefficiencies, design errors, external factors.
4	Aftab Hameed Memon, Abdul Qadir Memon, Shabir Hussain Khahro, and Yasir Javed, Sustainability, 2023, 15, 1457	Focused on post-COVID-19 challenges in Pakistan, emphasizing weak communication and inefficient contract management.	Weak communication, contract mismanagement, inadequate site supervision.



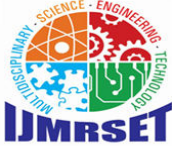
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5	Murali Sambasivan and Yau Wen Soon, International Journal of Project Management 25 (2007)	Linked delays in Malaysian projects to contractor inefficiencies and client payment delays, recommending improved strategies.	Contractor inefficiencies, delayed payments, communication failures, material shortages.
6	Rinkesh Gajera, IJSRSET Volume 11, Issue 5 - Sept-Oct 2024	Demonstrated the use of AI-driven analytics for predicting and mitigating delays, improving schedule performance.	Labor shortages, material delays, regulatory challenges, poor planning.
7	Pramodini Sahu, Dillip Kumar Bera, and Pravat Kumar Parhi, IJET Volume 19, No.-9, September 2024	Combined statistical and machine learning methods to identify and predict delay factors contributing to disputes in Indian projects.	Delayed payments, natural calamities, site-specific issues, change orders.
8	Dinesh Kumar R, IRJET Volume 03 Issue 04 - April 2016	Identified 103 delay causes in Indian construction projects, emphasizing contractor-related factors and risk management.	Contractor inefficiencies, subcontractor delays, poor planning, material shortages.
9	Tushar Khattri, Sohith Agarwal, Vaishant Gupta, and Mukesh Pandey, IRJET Volume 03 Issue 10 - October 2016	Examined financial constraints, design changes, and labor shortages as primary delay factors in Indian projects.	Financial constraints, design changes, labor shortages, resource mismanagement.
10	Kartik Bagrecha, IJIERT Volume 4, Issue 11 - November 2017	Analyzed delays in Indian projects, focusing on planning, financial management, and stakeholder communication.	Financial issues, ineffective communication, design changes, labor shortages.
11	Yiannis Vacanas and Chris Danezis, ISEC Proceedings - July 2018	Explored delays in Cyprus, identifying key factors such as design errors, contractor productivity issues, and financing challenges.	Design errors, contractor inefficiencies, financing challenges, communication failures.
12	Prasad K.V. and Vasugi V., Research - March 2019	Investigated delays by project type in India, proposing sector-specific mitigation strategies.	Financial delays, design issues, land acquisition, stakeholder approvals.
13	Mrs. Rani M. Mate and Dr. G. A. Hinge, IJERT Volume 4 Issue 06 - June 2015	Emphasized the role of modern tools like Primavera P6 in mitigating delays and improving stakeholder coordination.	Poor site management, delays in procurement, external factors like weather.

### III. METHODOLOGY

The research methodologies across the 13 papers encompass a variety of qualitative and quantitative approaches, reflecting the complexity of construction delays. Most studies employed literature reviews to establish foundational knowledge and identify key delay factors. Surveys and questionnaires were widely used to gather data from industry professionals, including contractors, consultants, and clients, with tools like the Relative Importance Index (RII) and Spearman's Rank Correlation employed for ranking delay causes. Advanced techniques like Partial Least Squares Structural Equation Modeling (PLS-SEM) and machine learning models (e.g., RFGA) were applied in some studies to analyze relationships between delay factors and their impacts. Several papers conducted case studies of specific projects, analyzing real-world scenarios to validate theoretical findings. Tools like Primavera P6 and Building Information Modeling (BIM) were used in some studies to simulate and compare planned and actual project timelines, identifying deviations. Interviews with stakeholders, statistical analyses, and sector-specific breakdowns (e.g., transport, power, buildings) further enriched the research, offering comprehensive insights into delay mitigation.



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strategies. This blend of traditional and modern methodologies ensures robust findings applicable to diverse construction contexts.

A total of 13 peer-reviewed literature on causes of delay in construction projects were used applications for the study and research

Applications Used in Research on Construction Delays

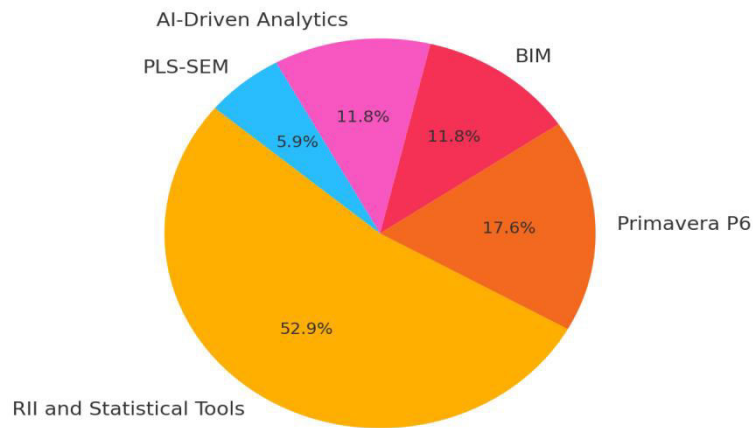
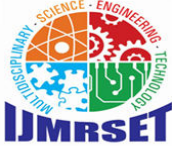


Fig 1. Application Used in Research on Construction Delays

### IV. FINDINGS

Table . 2 From all 13 papers /journals , studies followings finds are illustrated areas under

Sr No	Author(s)	Findings
1	Abdullah M. Tawfek and D. K. Bera	Categorized delays and emphasized the importance of proactive risk management.
2	Anuradha Arya and Dr. Rajeev Kansal	Ranked 78 delay causes using RII, identifying financial issues and client-induced changes as key factors.
3	Akshaykumar P. Udasi and Milind Darade	Highlighted global causes of delays like contractor inefficiencies, material shortages, and design errors.
4	Aftab Hameed Memon, Abdul Qadir Memon, Shabir Hussain Khahro, and Yasir Javed	Post-COVID-19 analysis identified weak communication and contract mismanagement as major challenges.
5	Murali Sambasivan and Yau Wen Soon	Linked delays to contractor inefficiencies, client payment delays, and communication

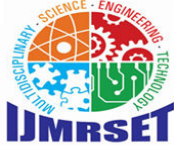


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		failures.
6	Rinkesh Gajera	Demonstrated the effectiveness of AI analytics in delay prediction and schedule performance improvement.
7	Pramodini Sahu, Dillip Kumar Bera, and Pravat Kumar Parhi	Combined statistical and machine learning methods to predict and mitigate delay-related disputes.
8	Dinesh Kumar R	Identified 103 delay causes, emphasizing the role of contractor inefficiencies and poor planning.
9	Tushar Khattri, Sohith Agarwal, Vaishant Gupta, and Mukesh Pandey	Examined financial constraints, design changes, and labor shortages as primary delay factors.
10	Kartik Bagrecha	Focused on planning, financial management, and stakeholder communication to address delays.
11	Yiannis Vacanas and Chris Danezis	Identified design errors, contractor inefficiencies, and financing issues as critical in Cypriot projects.
12	Prasad K.V. and Vasugi V.	Proposed sector-specific mitigation strategies for financial and design-related delays.
13	Mrs. Rani M. Mate and Dr. G. A. Hinge	Emphasized modern tools like Primavera P6 and improved coordination to mitigate delays.

TABLE 2 - Finding from the Literature Study



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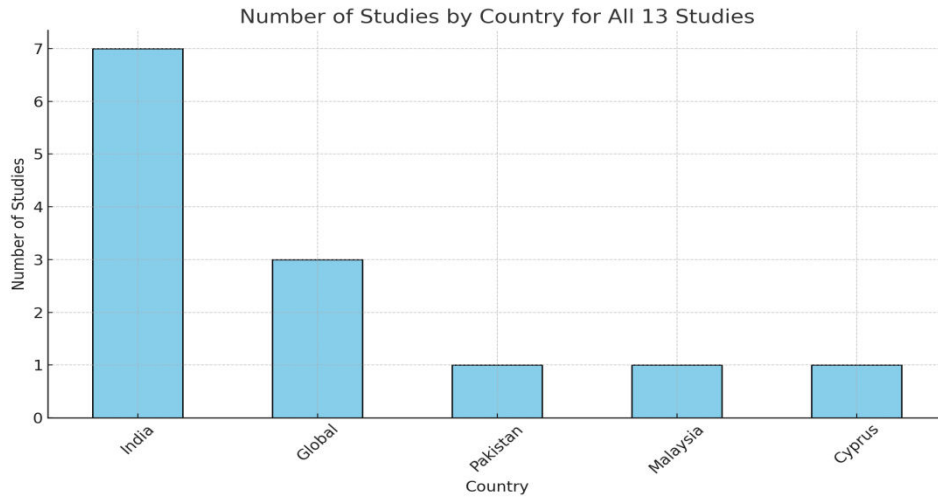


Fig 2. Showing Number of Studies by Country

Distribution of all 13 Journal Publishers of Literatures

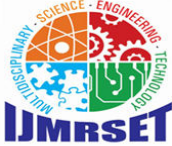
The table 3 below, shows the journal publishers with the most articles on causes of delay in construction projects

SR.	Journal Publishers	Number of Papers	Ranking
1	IJERT (International Journal of Engineering Research & Technology)	1	3rd
2	IRJET (International Research Journal of Engineering and Technology)	4	1st
3	IJSTE (International Journal of Science Technology & Engineering)	1	3rd
4	Sustainability (MDPI)	1	3rd
5	International Journal of Project Management (Elsevier)	1	3rd
6	IJSRSET (International Journal of Scientific Research in Science, Engineering and Technology)	1	3rd
7	ISEC Proceedings	1	3rd
8	IJIERT (International Journal of Innovations in Engineering Research and Technology)	1	3rd
9	ResearchGate Publications	1	3rd
10	Global Conference Proceedings	1	3rd

### V. CONCLUSION

The collective findings from the 13 studies on construction delays reveal that these challenges are pervasive across various regions and project types, impacting timelines, costs, and stakeholder relationships. Key causes include financial constraints, contractor inefficiencies, design errors, material shortages, regulatory delays, and labor issues.





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The effects range from time and cost overruns to disputes, strained relationships, and, in extreme cases, project abandonment. These studies emphasize the importance of robust planning, stakeholder communication, advanced technologies (e.g., AI, BIM, Primavera P6), and proactive risk management to mitigate delays. Recommendations include streamlining financial processes, improving resource allocation, fostering collaboration among stakeholders, and implementing tailored mitigation strategies for specific project types. Collectively, these insights provide a comprehensive framework for addressing construction delays, highlighting the need for an integrated approach combining traditional methods with innovative technologies to enhance project delivery and sustainability

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