

A Strategic Approach to Improving Decision-Making Framework for Integrating the Design Changes in Construction Projects

Devi Priyanka Y, Kranti Kumar Myneni



Abstract: Design changes in construction projects often lead to cost overruns, delays, and compromised quality, particularly in the complex and rapidly urbanizing Indian context. This dissertation aims to enhance decision-making processes for integrating these changes by analysing their causes, evaluating current design management practices, and refining an existing decision-making framework. Key causes identified include client-driven scope additions, consultant errors, and regulatory updates, categorised by predictability, timing, and severity of impact. Current practices, such as Early Contractor Involvement (ECI), Building Information Modelling (BIM), and Agile Project Management, are assessed for their effectiveness, alongside challenges including inconsistent documentation, delayed decision-making, and resistance to advanced tools. The refined framework emphasizes proactive planning, structured impact assessment, collaborative decision-making, and continuous improvement through post-implementation reviews, proposing a dedicated department for managing design changes to ensure accountability and efficiency. This study presents a strategic approach for integrating design changes, suggesting future research to validate the framework across various project types and explore advanced technologies, such as artificial intelligence (AI), for further enhancement.

Keywords: Design Changes, Decision-Making, Design Change Management, Framework, Proactive Management.

Abbreviations:

BIM: Building Information Modelling

IPD: Integrated Project Delivery

MEP: Mechanical, Electrical, and Plumbing

PMC: Project Management Consultant

ECI: Early Contractor Involvement

MCDA: Multi-Criteria Decision Analysis

I. INTRODUCTION

Design changes are a common and disruptive reality in construction projects, often leading to delays, cost increases, and instability [1]. Most changes originate from the owner, affecting contract provisions and work conditions after the award, making construction dynamic and unstable [2].

Manuscript Received on 20 February 2025 | First Revised Manuscript Received on 24 February 2025 | Second Revised Manuscript Received on 18 April 2025 | Manuscript Accepted on 15 May 2025 | Manuscript published on 30 May 2025.

*Correspondence Author(s)

Devi Priyanka Y, Department of Master's of Building and Engineering Management, School of Planning and Architecture, Vijayawada (Andhra Pradesh), India. Email ID: devipriyankayerra@gmail.com

Dr. Kranti Kumar Myneni*, Department of Master's of Building and Engineering Management, School of Planning and Architecture, Vijayawada (Andhra Pradesh), India. Email ID: kranti.myneni@spav.ac.in, ORCID ID: [0000-0002-0753-5636](https://orcid.org/0000-0002-0753-5636)

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

The impact on project cost can range from 5% to 40% of the total budget [3].

A comprehensive review of proactive design change management in Indian construction projects highlights significant advancements in mindset and implementation, particularly in remote locations, through the use of emerging technologies and via strong contractual relationships. These developments underscore the importance of implementing effective management strategies to mitigate the adverse effects of design changes, thereby ensuring a smoother project execution and improved alignment with project objectives.

A. Definition

Design changes refer to any alterations or modifications made to the original project design after the design has been finalized or during the construction phase [3]. These changes can stem from various factors, such as client requests, regulatory changes, unforeseen site conditions, or design errors [2]. Design changes can significantly impact project cost, time, and quality, often leading to delays, cost overruns, and the need for rework [4].

Positive and Negative Impacts: Design changes are not inherently negative. While they may lead to cost overruns and delays, they can also yield positive outcomes such as improved functionality, better quality, or enhanced client satisfaction [5]. The key is to manage these changes proactively to minimize the negative impacts while maximizing the potential benefits.

B. Types of Design Changes

Scope Change: Design changes may involve modifying the project scope, such as adding new features or removing certain components. This can occur due to evolving client needs or unforeseen conditions on site [6].

Non-Scope Design Changes: Other design changes might not alter the scope but can include adjustments to materials, specifications, or construction methods to improve quality, reduce costs, or comply with regulatory changes [6].

C. Significance of Design Changes

The literature commonly identifies four primary dimensions to assess the significance of design changes [7]:

- Impact on Cost
- Impact on Time
- Impact on Quality
- Impact on Scope



Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication (BEIESP)
© Copyright: All rights reserved.

II. CLASSIFICATION OF DESIGN CHANGES

A. Classification of Design Changes based on Origin

- Client-Initiated: Changes driven by clients, often due to changes in scope, financial decisions, or new requirements [9].
- Consultant-Initiated: Changes caused by design errors, poor coordination, or unstructured design processes [3].
- Contractor-Initiated: Resulting from construction challenges, poor pre-construction planning, and coordination issues [4].
- External Factors: Unforeseen site conditions, regulatory changes, or economic shifts [3].

B. Causes of Design Changes based on Origin

i. Client-Initiated:

- Addition/omission of scopes [10]
- Unclear initial design brief [1]
- Unrealistic expectations [9]
- financial instability [1]

ii. Consultant-Initiated:

- Poor design planning [5]
- Erroneous/discrepancies in design [10]
- Poor pre-planning [5]
- Coordination Failures [8]
- Inadequate communication [8]
- Inadequate stakeholder involvement during the design phase

iii. Contractor-Initiated:

- Lack of technical expertise [4]
- Incomplete plans [4]
- Resource management issues [10]

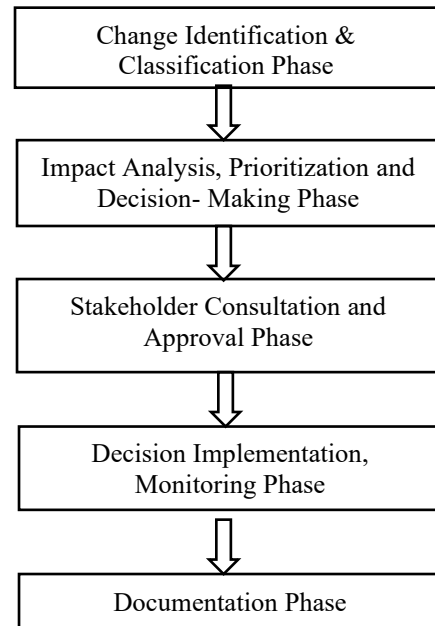
iv. External Factors:

- Economic conditions [9]
- Policy Changes [9]
- Regulatory challenges [9]
- unforeseen site conditions [9]

C. Impact of Design Changes

The detrimental (direct) effects of design changes on project performance are rework, schedule delay resulting in longer project duration and cost overruns from the additional resources and wastage involved [11]. It was also found that rework can increase project costs by 3.1% to 6.0% and extend schedules by 5.1% to 10.0%, reinforcing the assertion that rework costs are a significant part of total project expenses. It has been identified that changes related to the specifications in construction drawings account for 57.6% of the total changes that lead to variations in the projects.

III. EXISTING DECISION-MAKING FRAMEWORK



[Fig.1: Existing Decision-Making Framework]

Table-I: Outlining the Definition of Each Phase of the Current Decision-Making Framework

Phase No.	Phase	Description
1	Change Identification & Classification Phase	Design changes are often identified through site observations, client requests, or regulatory updates during project execution.
2	Impact Analysis, Prioritization Phase	The proposed changes are evaluated for their impact on time, cost, scope, and quality.
3	Stakeholder Consultation and Approval Phase	Changes are reviewed and discussed among stakeholders (client, consultants, contractors) to decide whether to approve, modify, or reject the proposed change.
4	Decision Implementation and Monitoring Phase	A decision is made based on the stakeholder consensus or the client's directive. Approved changes are integrated into the project, often disrupting workflows and requiring rework.
5	Documentation Phase	The change and its resolution are documented, but this step is frequently overlooked or inconsistently executed.

A. Limitations of Existing Decision-Making Framework

i. Identification and Classification of Design Changes Phase

- **Reactive Nature:** The framework primarily addresses changes after they occur, rather than anticipating or proactively identifying potential issues early on.
- **Inconsistent Documentation:** Change proposals are not consistently documented, leading to miscommunication and incomplete records. This makes it challenging to identify design changes early or track them effectively.

ii. Impact Assessment and Prioritization Phase

- **Inadequate Impact Analysis:**
- Impact assessments often lack depth or are rushed, sometimes based on incomplete data, which may cause short-sighted decision-making and overlook long-term project impacts.
- **Limited Prioritization Mechanisms:** There is no formal or structured system for prioritizing design changes based on their criticality, feasibility, or alignment with the overall project goals, leading to inefficient decision-making.

iii. Stakeholder Consultation and Approval Phase

- **Delayed Decision-Making:** The decision-making process can be slow due to misalignment or lack of a transparent process for stakeholders to review and approve changes, especially when multiple parties have differing interests.
- **Poor Stakeholder Coordination:** Communication gaps between stakeholders (clients, consultants, contractors) result in misaligned expectations and delayed issue resolution, leading to disruptions in project timelines.

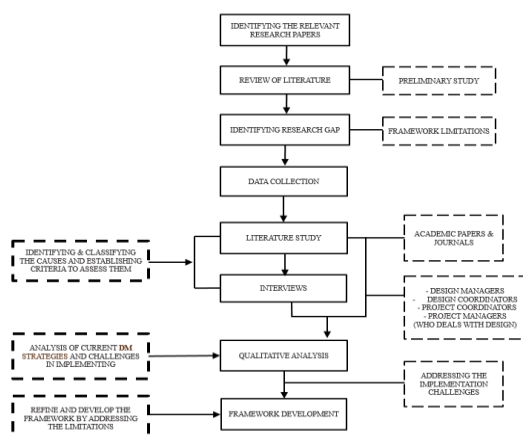
iv. Decision Implementation and Monitoring Phase

- **Resistance to Advanced Tools:** Although tools like BIM exist, their adoption is limited, primarily due to a lack of proper training and resistance to technological change. This affects effective decision-making and implementation.
- **Overreliance on Client Decisions:** Clients often take central control of decision-making, which may result in decisions that don't fully align with the feasibility, cost, or project goals, leading to inefficient implementations.

v. Documentation Phase

- **Lack of Learning Mechanisms:** Lessons learned from past design changes are rarely captured or applied to future projects. This results in a missed opportunity to improve and refine processes over time, leading to the same mistakes recurring in subsequent projects.
- **Inconsistent Documentation:** The framework lacks a formal system to consistently capture and store information about design changes, their impacts, and outcomes, making it hard to create a knowledge base for continuous improvement.

IV. RESEARCH METHODOLOGY



V. DATA COLLECTION

Five case studies from diverse contexts were selected, and five professionals—two Project Coordinators, two Design Coordinators, and one Senior Project Manager—were interviewed by telephone. The following is the list of questions posed during the interviews.

A. Interview Questions:

i. Project Overview

- Can you briefly describe the construction projects you typically manage (e.g., residential, commercial, infrastructure)?
- For the specific project we're discussing today, could you outline the scope, timeline, and your responsibilities?

ii. Design Management Process

- Could you walk me through the design management process your team typically follows from inception to completion?
- When design changes arise, how are they addressed within your process? Is there a structured protocol or an ad-hoc approach?

iii. Common Design Changes

- In your experience, what are the most frequent types of design changes that occur? Are they primarily client-driven, regulatory, or due to site conditions?

iv. Good Design Management Practices

- What are some of the best design management practices you've applied or observed that have effectively managed design changes?
- In your view, what challenges prevent the broader implementation of these best practices across projects?
- What solutions would you suggest to overcome these barriers and ensure better adoption of effective design management practices?
- How do you see technologies like Building Information Modeling (BIM) and Integrated Project Delivery (IPD) helping to manage design changes more efficiently?

v. Challenges in Implementing Design Management Practices

- What challenges have you faced while implementing the Good Design Management Practices?

B. Interview Respondents:

Responses were gathered from five professionals involved in Design Management, each representing a different case study.

Interview 01 - Senior Project Coordinator, 5 years' Experience, High-rise Hospital Project, Hyderabad.
Interview 02 - Design Coordinator, 7 years' Experience, High-rise Residential Project, Hyderabad.

Interview 03- Senior Project Manager, 12 years' Experience, Mid-rise Gated Community Project, Rajahmundry.

Interview 04- Design Manager, 5



A Strategic Approach to Improving Decision-Making Framework for Integrating the Design Changes in Construction Projects

Years of experience in commercial projects and hospital projects in Hyderabad.

Interview 05- Project Coordinator, 3 years' experience, Commercial Project, Hyderabad.

VI. ANALYSIS AND RESULTS

Qualitative Data Analysis Using Thematic Analysis

Thematic analysis involves identifying, organising, and interpreting patterns or themes within qualitative data sets. The five interview responses are analyzed based on recurring themes aligned with the questions. These themes are grouped into four key categories, which lead to the development of a comprehensive decision-making framework for managing design changes in construction projects.

Key Themes are

Theme 1: Design Management Processes

Theme 2: Common Causes of Design Changes

Theme 3: Design Management Practices

Theme 4: Challenges While Implementing Practices

A. Theme 1: Design Management Processes

Patterns Observed

All respondents described multi-phased processes, including the interconnected stages of architectural, structural, MEP (Mechanical, Electrical, and Plumbing), and landscape design processes. It begins with architectural design and incorporates inputs from structural and MEP schematics, client and marketing feedback, as well as landscape designs. To refine the designs, these inputs undergo multiple reviews by a project management consultant (PMC). The iterative process ensures that final designs in each category (architectural, structural, MEP, and landscape) converge into a coordinated design, reflecting a collaborative and integrated approach to design management.

B. Theme 2: Causes of Design Changes

Recurring Issues

- Client-Initiated: Unrealistic expectations and scope additions (luxury features in residential projects, green building systems in commercial projects).
- Consultant-Initiated: Errors, poor pre-planning, and coordination failures (common in multi-disciplinary hospital projects).
- Regulatory Updates: Fire safety codes and healthcare compliance standards caused delays and redesigns.
- Unforeseen Site Conditions: Geotechnical surprises in projects with large basements led to foundational design changes.

C. Theme 3: Design Management Practices

Effective Practices

- Early Contractor Involvement (ECI) - to align design and execution teams early.
- Comprehensive impact analysis - to evaluate cost, time, and functional impacts before approving the change.
- BIM for Design Management—Building Information Modelling (BIM) can visualise the ripple effects of design changes, helping to forecast and manage the impacts across various project components.

- Design freeze policies - To minimize late-stage changes and their impacts.
- Use of Agile Project Management - Breaking down the project into manageable sprints allows for quicker adjustments to design changes, reducing the risk of major disruptions.
- Proactive Design Reviews - Conducting regular design reviews and involving all stakeholders in decision-making can prevent misaligned expectations and improve decision-making.
- A dedicated department for managing design changes can reduce the negative impact of design changes on project costs and time.
- Effective communication management ensures all stakeholders are aware of the change's implications.
- Strengthening stakeholder cooperation—Better collaboration between design and construction teams is emphasized to reduce errors and improve project outcomes.
- Lessons Learned Repository—This is a centralized database where knowledge from past projects is documented and stored to improve decision-making and prevent recurring mistakes in future projects.

D. Theme 4: Challenges While Implementing Practices

Barriers Identified

- Resistance to Change: Contractors hesitated to adopt BIM and digital platforms due to a lack of familiarity.
- Stakeholder Misalignment: Miscommunication between design and construction teams led to coordination failures.
- Regulatory Uncertainty: Unexpected updates led to rework and delays, particularly in hospital projects.
- Resource Constraints: Budget and manpower limitations hindered proactive planning.
- Frequently violated by client-driven or unforeseen changes: initial project plans are disrupted due to unexpected client requests or unforeseen circumstances, leading to deviations from the original scope or schedule.
- Lack of trust among stakeholders: project participants doubt each other's intentions, capabilities, or reliability, hindering collaboration and effective decision-making.
- Lack of clear accountability for design change management: Responsibilities and roles for managing design changes are not well-defined, leading to confusion and inefficiency in handling modifications.
- Time-intensive processes such as Comprehensive Impact Analysis are often underutilised due to tight project schedules, resulting in rushed decisions and incomplete implementation of design changes.

VII. PROPOSED SOLUTIONS TO OVERCOME THE IMPLEMENTATION CHALLENGES

The table below outlines the Design Management Strategies identified from the analysis, their implementation challenges, and the proposed solutions to address these challenges.



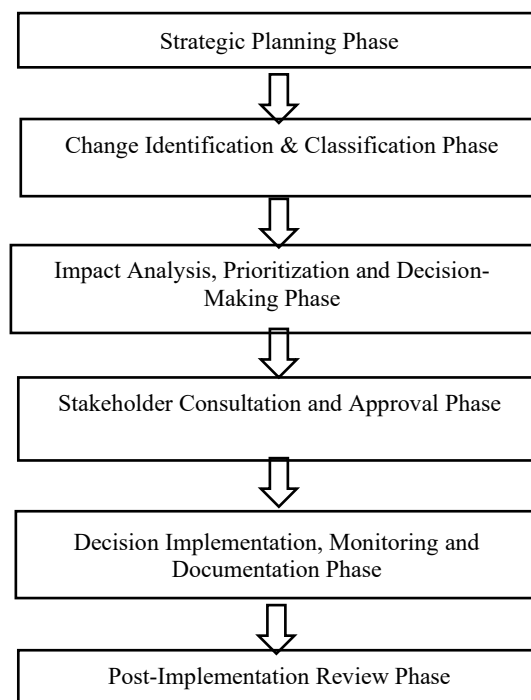
Table-II: The Table Below Presents the Design Management Strategies, Their Implementation Challenges, and the Corresponding Solutions to Address These Challenges

Design Management Strategy	Implementation Challenges	Solution to Challenges
Early Contractor Involvement (ECI)	Inconsistent application, Lack of clear communication	- Define ECI protocols during project initiation. - Include contractors in all design review meetings to maintain alignment. - Use collaborative platforms.
Comprehensive Impact Analysis	Time-intensive, underutilized due to tight project schedules	- Automate impact analysis using BIM. - Develop simplified decision matrices for smaller projects. - Allocate dedicated teams for this task.
BIM for Design Management	Resistance due to a lack of training and resource limitations	- Provide BIM training programs for team members. - Phase-wise adoption of BIM for smaller or less complex projects. - Invest in skilled BIM consultants.
Design Freeze Policies	Frequently violated by client-driven or unforeseen changes	- Include penalties for late-stage client-driven changes. - Establish a formal approval process for exceptions. - Educate clients on the importance of freezing early.
Agile Project Management	Rarely adopted in traditional setups	- Provide Agile training for teams. - Start with small Agile practices, such as Kanban boards. - Incorporate Agile coaches for complex projects.
Proactive Design Reviews	Limited stakeholder participation, irregular scheduling	- Schedule mandatory reviews at defined intervals. - Use virtual meeting tools for participation. - Assign responsibility for review adherence to a project lead.
Effective Communication Management	Lack of clarity, miscommunication between stakeholders	- Implement regular communication protocols. - Use project management tools for real-time updates. - Schedule regular check-ins with key stakeholders.
Strengthening Stakeholder Cooperation	Conflicting priorities, lack of trust among stakeholders	- Organize early-stage workshops to align expectations. - Implement conflict-resolution strategies. - Establish clear roles and responsibilities.
Dedicated Department for Managing Design Changes	Limited resources, lack of clear accountability for design change management	- Assign a dedicated team with clear roles and responsibilities. - Allocate adequate resources for change management. - Set up regular reporting and tracking systems.
Lessons Learned Repository	Often overlooked in post-project evaluations	- Mandate post-implementation reviews for all changes. - Assign a team to document lessons learned. - Incentivize sharing best practices across projects.

VIII. FRAMEWORK DEVELOPMENT

The existing framework, characterised by its reactive and ad hoc nature, has been revised based on a thorough analysis. A proactive approach has been introduced by incorporating a

A new initial phase, the Strategic Planning Phase, to enhance foresight and preparedness. Additionally, a Post-Implementation Review Phase has been added at the end to facilitate continuous improvement and ensure the framework evolves through ongoing feedback and refinement.



[Fig.1: The Flowchart Above Illustrates the Revised Decision-Making Framework]

A. Proposed Design Management Strategies

A new framework has been developed to address the limitations of the existing model. The following table presents the revised framework, highlighting each phase and

the strategies implemented to overcome the identified limitations.

A Strategic Approach to Improving Decision-Making Framework for Integrating the Design Changes in Construction Projects

Table-III: The Table Below Outlines Each Phase of the Framework, Its Limitations, and the Corresponding Strategies

Phase	Limitations	Design Management Strategy
Strategic Planning Phase	Proposed New Phase	Early Contractor Involvement (ECI) to align design and construction teams.
		Strengthening stakeholder cooperation through workshops.
Change Identification and Classification Phase	Reactive approach	BIM for Design Management to enable early detection and visualization
		Use a centralized change log to document and track design changes.
Impact Assessment and Prioritization Phase	Inadequate impact analysis	Conduct a comprehensive impact analysis using decision matrices.
	No formal prioritization	Use multi-criteria decision analysis (MCDA) for prioritization.
Stakeholder Consultation and Approval Phase	Delayed decisions	Effective communication management using collaborative platforms.
	Poor stakeholder coordination	Create a steering committee for structured reviews and approvals.
Decision Implementation, Monitoring and Documentation Phase	Resistance to advanced tools	Provide BIM training programs to overcome resistance.
	Overreliance on client decisions	Use Agile project management for phased and efficient implementation.
	Inconsistent documentation	Establish a dedicated department for managing design changes for accountability.
Post-Implementation Review Phase	Proposed New Phase	Conduct post-change performance audits.
		Use a lessons-learned repository to refine future processes.

IX. CONCLUSION

This dissertation highlights the critical importance of effective decision-making in managing design changes in construction projects. By analysing the causes, impacts, and challenges associated with design changes, a refined decision-making framework is developed that integrates best practices and addresses existing limitations.

The proposed framework emphasizes proactive planning, structured prioritization, collaborative decision-making, and continuous improvement, ensuring minimal project timelines, costs, and quality disruption. It leverages advanced tools like BIM, stakeholder cooperation, and a dedicated change management department to streamline processes and enhance outcomes.

While the framework offers significant benefits, its success depends on overcoming challenges such as stakeholder resistance, resource constraints, and inconsistent documentation. Future research could focus on validating the framework across more specific project types or exploring the integration of emerging technologies, such as AI and IoT, for managing design changes.

Ultimately, this dissertation contributes to advancing design change management by providing a practical, adaptable, and stakeholder-focused framework that aligns with the dynamic nature of construction projects.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted with objectivity and without any external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

REFERENCES

1. M. F. M. N. Muhamad, "Impact of Design Changes in Construction Project," Malaysian Journal of Sustainable Environment, 2018. <https://www.researchgate.net/publication/332372594>
2. S. T. M. M. A. G. J. S. Lina Gharaibeh, "Factors leading to design changes in Jordanian construction projects," International Journal of Productivity and Performance Management, 2020. DOI: <https://doi.org/10.1108/ijppm-08-2019-0412>
3. E. B.-T. F. S. Mughees Aslam, "Design Changes in Construction Projects – Causes and Impact on the Cost," Civil Engineering Journal, 2019. DOI: <https://doi.org/10.28991/CEJ-2019-03091360>
4. C. K. Chhavi Gupta, "Study of Factors Causing Cost and Time Overrun in Construction Projects," International Journal of Engineering Research & Technology (IJERT), vol. 9, no. 10, 2020. <https://www.ijert.org/study-of-factors-causing-cost-and-time-overrun-in-construction-projects>
5. P. S. A. Ajay K. Mishra, "Causes and Effects of Design Change of Construction Projects," International journal of applied engineering and management letters, 2022. DOI: <https://doi.org/10.47992/ijaeml.2581.7000.0122>
6. D. S. L. S. J. R. Rong Wang, "A Study of Design Change Management for Infrastructure Development Projects in New Zealand," MDPI, 2022. DOI: <https://doi.org/10.3390/buildings12091486>
7. J. H. S. T. Viktoria Mordaschew, "Methods of Change Impact Analysis for Product Development: A Systematic Review of the Literature," in Proceedings of the Design Society, 2023. DOI: <https://doi.org/10.1017/pds.2023.266>
8. E. B. B. Gizachew Markos Makebo, "Causes and Effect of Design Change on Building Construction Project: Review," International Journal of Advance Research and Innovative Ideas in Education, 2020. IJARIE-ISSN(O)-2395-4396, Vol-6 Issue-3 2020. https://ijarie.com/AdminUploadPdf/Causes_and_Effect_of_Design_Change_on_Building_Construction_Project_Review_ijarie12190_converted.pdf
9. N. C. Shahab Shoar, "Exploring the Causes of Design Changes in Building Construction Projects: An Interpretive Structural Modelling Approach," Rethinking Sustainable Construction: Renewing Old Perspectives and Emergent New Frames of Thinking, 2021. DOI: <https://doi.org/10.3390/su13179578>
10. S. C. K. Khaza Nawaz Mohammed, "An analytical approach in usage of agile methodologies in construction industries – A case study," in Materials Today: Proceedings, 2020. DOI: <https://doi.org/10.1016/j.matpr.2020.05.045>
11. M. S. J. B. Yap, "Investigating design changes in Malaysian building projects," Architectural Engineering and Design Management, 2017. DOI: <https://doi.org/10.1080/17452007.2017.1384714>

AUTHOR'S PROFILE



As an architect, Devi Priyanka Y is dedicated to bridging the gap between design vision and practical implementation. My work ensures that projects align with client expectations and adhere to industry standards. With a solid foundation in construction management, I am committed to maintaining a proactive and



collaborative approach to my work. I aim to contribute meaningfully to innovative construction teams by fostering synergy between design intent and practical execution, optimising project outcomes, and enhancing efficiency within the construction process.



Dr. Kranti Kumar Myneni, received B.Arch degree from JNTU, Hyderabad, Telangana, India in 2001, pursued Master's (M.Sc. - Construction Management) from South Bank University, London in 2003 and received a doctorate from the School of Planning and Architecture, Vijayawada.

Currently working as an Assistant Professor in the School of Planning and Architecture, Vijayawada. Member of the Council of Architecture and a Fellow of the Indian Institute of Architects. Published nearly 26 articles and presented papers in 5 international conferences. 3 chapters.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)/ journal and/or the editor(s). The Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP) and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.