Strategies to Mitigate Design Changes on Building Project Cost in Edo State, Nigeria[1]

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Abstract

The aim of this study is to examine strategies to mitigate design changes on building project cost in Edo State, Nigeria by identifying the common causes of such changes, analyzing how they influence specific building elements including substructure, superstructure, finishes and various services assessing their contribution to cost overruns. 714 target population were identified with 159 responses received. To counter these issues, the study advocates for mitigation strategies focused on creating a clear and detailed scope of work early on, concluding that establishing a realistic contingency budget and ensuring strong leadership are vital for maintaining financial stability and minimizing the negative effects of design changes.

Keywords: *Design Changes, Building Project, Project Cost, Strategies, Cost Estimation*

1. Introduction

The Initiation of changes in construction projects often lead to deviation from the client's original objectives, including the cost of the project, the date of completion and failure to meet the specified performance requirements (Isaac and Nevon, 2012). It is said when tackling a problem, the initial step typically involves identifying its root cause, which then informs the appropriate corrective action to be considered for resolution. As such, the construction industry is on the upswing, and projects are becoming increasingly complicated. Besides, designs are larger and more complex, leaving construction companies with very narrow margin for error. (Nurul and Mohammad, 2018).

Ahmed and Lamiaa (2021) identified that the big challenge for construction firms is to surpass the project budget. The large number of elements in construction projects, and of dependencies that exist between these elements, makes it difficult to manually identify the impact that a change in

[1] How to cite this paper: Osazuwa, E. M. and Ikukaiwe, T. A. (2026). Strategies to Mitigate Design Changes on Building Project Cost in Edo State, Nigeria, *PM World Journal,* Vol. XV, Issue IV, April.

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the design of a component will have on the entire project, when this change is initially proposed (Isaac and Nevon, 2012), whether due to client request, regulatory requirement, or unforeseen technical issues, these changes often lead to cost overruns, delays and dispute among stakeholders.

2. Literature Review

Mitigating the cost impact of design changes in building projects requires a proactive and strategic approach from the earliest stages. Given that design changes are a recurring influence on time cost overruns, there is a need to identify the underlying causes involved. This will enable the development of strategies or frameworks for effective management of design changes in future. (Yap and Skitmore, 2018)

One of the most effective strategies is to establish a clear and detailed scope of work early in the project and ensure that all stakeholders, including owners, architects, engineers, and contractors, agree on the project's goals and limitations. Hence, disputed and claims over project changes can be minimized when the problems are recognized at the earlier stages of the project, especially when client's decision making is required (Jeffrey, Hamza and Chen, 2016).

Early design freezes, where design decisions are locked and documented after final approvals, help prevent constant revisions during construction. Another critical strategy is implementing a formal change management process: all proposed changes should be thoroughly reviewed, their cost and schedule implications analyzed, and proper approvals secured before execution. This prevents unauthorized or impulsive changes from disrupting the project. Change management is one of the project managements practices that resolve problems when changes occurred in a project or minimize changes that may occur and disrupt the progress of the project (Bon Gang and Lee, 2012).

The ideal error prevention approach is to view errors as symptoms of underlying problems so they become sources of information to understand how systems work. Design errors and the resultant rework that occurs should be viewed as tools that can be used to define margins of risk and safety so that learning how to prevent them can occur (Robert, Peter, David and Peter, 2018). Building a realistic contingency budget—typically around 5–10 percent of total construction cost—also helps absorb the financial shocks of any unavoidable changes. Incorporating flexibility into the schedule and budget during planning gives projects breathing room when unexpected modifications arise.

Besides, significant numbers of researchers promote the use of system dynamics as a solution to improve project decision making (Jeffrey, Hamza hand Chen, 2016), Therefore, regular communication and coordination meetings throughout design and construction phases are key to

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catching potential design conflicts early, before they translate into expensive on site changes. Similarly, at the project level, the implementation of constructability analysis, Building Information Modeling (BIM), benchmarking, quality management, risk management, alliancing, and integrated procurement methods can also be used contain errors, but there is a limit to the extent to which they can be eliminated using these strategies. (Robert, Peter, David and Peter, 2018). Furthermore, during design, concurrent engineering should be adopted in core and extended team internal or outsourced expert to reduce over the wall syndrome to design for construction, involving construction teams during design development (a practice encouraged by delivery models like Design Build or Integrated Project Delivery) ensures that practical, on-site perspectives inform the design, making it more buildable and reducing the likelihood of late-stage changes. (Mishra and Aithal, 2022)

Finally, strong leadership and decision-making discipline are vital. Simulation models can be used as a communication platform with graphical illustration helpful for visualizing and understanding of impacts of design changes on project performance or termed as "management simulator" (Jeffrey, Hamza hand Chen, 2016). Project managers must resist unnecessary changes driven by indecision, changing preferences, or over customization unless they bring significant value. By combining early planning, collaborative teamwork, strict change control, and smart technology use, construction teams can greatly reduce the financial risks of design changes and deliver projects more predictably and successfully.

Table 1: Mitigation Strategies to Design Changes on Building Project Cost and References

S/N	Mitigation Strategies	References
1	To establish a clear and detailed scope of work early in the project	Jeffrey Boon Hui Yap, Hamzah Abdul Rahman and Chen Wang ,2016
2	Early design freezes lock and document decisions after final approvals	
3	Design errors and the resultant rework help define risk and safety margins	Robert Lopez, Peter E. D. Love, Ph.D. And David J. Edwards, Ph.D.; and Peter R. Davis, Ph.D. ,2018
4	Change management	Bon Gang Hwang and Lee Kian Low, 2011
5	Building a realistic contingency budget	
6	Regular communication and coordination meetings throughout design and construction phases	Jeffrey Boon Hui Yap, Hamzah Abdul Rahman and Chen Wang ,2016
7	Constructability analysis, Building Information Modelling (BIM),	Robert Lopez, Peter E. D. Love, Ph.D. And David J. Edwards, Ph.D.; and Peter R. Davis, Ph.D. ,2018
8	Involving construction teams during design development	A. K. Mishra and P. S. Aithal, 2022
9	Strong leadership and decision-making discipline	Jeffrey Boon Hui Yap, Hamzah Abdul Rahman and Chen Wang ,2016

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3. Results And Discussion of Findings

Demographic Characteristics of Respondents

To ensure a thorough analysis, demographic information such as profession, years of professional experience, highest educational qualification, and membership in professional organizations or associations was collected. These categories were selected because they represent key stakeholders in the construction industry who are directly impacted by design changes. Gaining insights from their perspectives provides a more accurate evaluation of building project costs in Edo State, Nigeria.

Table 2: Demographic Characteristics of Respondents

Category		**Frequency**	**Percentage (100%)**
Profession	Architects	42	26.4
	Civil/Structural Engineer	30	18.9
	Quantity Surveyor	58	36.5
	Builder	17	10.7
	Site Supervisor	12	7.5
	Total	**159**	**100**
Level of Education	B.Sc./B.Tech.	88	55.3
	HND	35	22
	PGD	22	13.8
	PhD	7	4.4
	M.Sc./M. Phil	4	2.5
	ND/OND	2	1.3
	Total	**159**	**100**
Professional Experience	0 5 years	81	50.9
	6 10 years	49	30.8
	11 15 years	25	15.7
	16 20 years	4	2.5
	Total	**159**	**100**
A member in professional organizations or associations	MNIA	51	32.1
	MNIQS	42	26.4
	MNSE	34	21.4
	MNIOB	32	20.1
	Total	**159**	**100**

The survey participants represent a diverse group of key stakeholders in the construction industry, with Quantity Surveyors forming the largest group at 36.5%. Architects and Civil/Structural Engineers make up a significant portion at 26.4% and 18.9%, respectively, highlighting their crucial roles in design and structural compliance. The remaining respondents include Builders

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(10.7%) and Site Supervisors (7.5%). Collectively, the expertise of these professionals from cost management (Quantity Surveyors) to design integrity (Architects/Engineers) and site execution (Builders/Supervisors) is essential for accurately assessing the impact of design changes on overall building costs.

The high level of formal education among the respondents reinforces the credibility of the survey data. The majority of participants, 55.3%, hold a BSc/B.Tech degree. Following this are HND holders at 22% and those with a PGD at 13.8%. A smaller but notable percentage hold advanced degrees, including PhD holders (4.4%) and MSc/MPhil holders (2.5%), with the remaining 1.3% holding an ND/OND. This strong academic foundation ensures the participants possess the necessary technical knowledge and expertise related to construction-related fields to provide informed and reliable responses.

The professional experience of the respondents is quite varied, with a slight concentration toward less experienced individuals. Specifically, 50.9% of the participants have less than 5 years of experience. However, a substantial portion has a moderate to high level of experience: 30.8% have over 5 years, and 15.7% possess over 10 years of experience. Only a small group, 2.5%, has more than 15 years of experience. This distribution suggests a blend of fresh perspectives and seasoned expertise, ensuring the survey captures insights from professionals across various career stages.
A significant number of respondents are certified professionals, evidenced by their membership in prominent professional organizations, which strengthens the validity and authenticity of the data. The highest affiliation is with the Nigerian Institute of Architects (NIA) at 32.1%, followed by the Nigerian Institute of Quantity Surveyors (NIQS) at 26.1%, and the Nigerian Society of Engineers (NSE) at 21.4%. Others are affiliated with the Nigerian Institute of Building (NIOB). These professional affiliations demonstrate a commitment to industry standards and ethical practice, confirming that the participants are recognized experts in their respective fields within the Nigerian construction sector.

Table 3: Strategies to Mitigate Design Changes on Building Project Cost using Mean Item Score

Strategies	MIS	S/D	Rank
To establish a clear and detailed scope of work early in the project	3.54	0.817	1
Building a realistic contingency budget	3.36	1.058	2
Strong leadership	3.29	1.176	3
Early design freezes lock and document decisions after final approvals	3.28	1.136	4
Abstract reasoning	3.25	1.162	5
Constructability analysis	3.20	1.195	6
Decision making discipline	3.18	1.250	7

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Building Information Modelling (BIM),	3.15	1.298	8
Design errors and the resultant rework help define risk and safety margins	3.14	1.340	9
Self-motivation	3.08	1.167	10
Regular communication and coordination meetings throughout design and construction phases	3.08	1.215	11
Adaptability	3.06	1.168	12
Involving construction teams during design development	3.00	1.196	13
Change management	2.94	1.194	14

The analysis of strategy importance clearly indicates a strong professional consensus favoring proactive planning and financial certainty as the primary drivers for successful cost mitigation in projects. The top-ranked strategy, "To establish a clear and detailed scope of work early in the project", stands out as the most critical intervention a view shared by Jeffrey, Hamzah and Chen (2016). This reflects a deep-seated understanding that ambiguities in the initial design are the root cause of subsequent expensive changes. By "freezing the design intent early," project teams effectively immunize the budget from the cost escalation that accompanies mid-project variations, validating established literature that advocates for detailed, upfront planning as the most effective form of cost management.

The strategies outlined are also highlighted by by Jeffrey, Hamzah and Chen (2016), Complementing this focus on scope clarity is the second highly valued strategy, "Building a realistic contingency budget". While not a preventative measure, its high ranking signals the practical recognition that projects are inherently susceptible to unforeseen issues or minor scope adjustments. Professionals view this contingency as an essential financial buffer, a necessary component of responsible project management that allows for the controlled absorption of inevitable minor risks without jeopardizing the overall budget. This financial foresight, when coupled with the third key strategy, "Strong leadership", forms a robust control mechanism. Strong leadership is seen as vital for the decisive project governance required to enforce the initial scope, manage demanding stakeholder expectations, and ultimately own the project's financial plan, preventing the costly drift known as scope creep Jeffrey, Hamzah and Chen (2016) concurs.

In contrast to these preventatives and controlling strategies, the strategies perceived as less impactful primarily involve reactive management or facilitative processes. Bon and Lee (2011) highlighted that the low ranking of formal "Change management" is particularly insightful. While necessary for documentation and process, its low Mean Importance Score suggests that industry professionals consider it a process for managing the consequences of change rather than a strategy for preventing cost increases in the first place. The data thus argues that efficiency lies not in perfecting the change management ritual, but in the initial rigor and project control that minimizes the necessity for major change events, reinforcing the value placed on the top-tier strategies.

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The middling scores for strategies such as "Involving construction teams during design development" and "Adaptability" further support this emphasis on initial rigor over later-stage collaboration or flexibility, Mishra and Aithal (2022) lends credence to this finding. While early construction input is widely accepted as critical for buildability and value engineering, the data suggests that these activities are seen more as supporting the execution of the design rather than fundamentally preventing the initial design-change-driven costs. Ultimately, the collective findings present a clear hierarchy of importance where project success is overwhelmingly perceived to be rooted in front-end control, financial prudence, and authoritative governance, making these the critical focus areas for any cost mitigation effort as detailed by Robert, Peter. And David and Peter (2018).

4. Conclusion

An effective mitigation strategy against design change cost escalation is establishing a clear and detailed scope of work early, which validates the literature by showing that freezing the design intent prevents expensive mid-project variations rooted in initial ambiguity. Complementing this is the highly valued strategy of building a realistic contingency budget, acknowledging the inevitability of minor unforeseen issues and providing an essential financial buffer for controlled risk absorption. This dual approach of detailed upfront planning and financial foresight is reinforced by the third key strategy, strong leadership, which is deemed vital for decisive governance to enforce the initial scope, manage stakeholder expectations, and prevent costly scope creep.

In conclusion, to mitigate this cost escalation, projects must prioritize three key strategies: first, freezing the design early by establishing a detailed scope of work; second, building a realistic contingency budget for risk absorption; and third, implementing strong leadership for decisive governance to enforce the initial scope and prevent costly scope creep. This combined approach of detailed upfront planning and strict oversight is essential for managing the cascading financial effects of design revisions.

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This research by Edosa Mark Osazuwa1 and Thomas Azuka Ikukaiwe examine strategies to mitigate design changes on building project cost in Edo State, Nigeria by identifying the common causes of such changes, analyzing how they influence specific building elements including substructure, superstructure, finishes and various services assessing their contribution to cost overruns. 714 target population were identified with 159 responses received. To counter these issues, the study advocates for mitigation strategies focused on creating a clear and detailed scope of work early on, concluding that establishing a realistic contingency budget and ensuring strong leadership are vital for maintaining financial stability and minimizing the negative effects of design changes.

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