

Article Citation Format

Bello, B.T &, Leo-Olagbaye, F. (2026): Effect of Design Changes on Project Delivery in the Nigerian Construction Industry. Journal of Digital Innovations & Contemporary Research in Science, Engineering & Technology.
Vol. 14, No. 3. Pp 1-8. www.isteams.net/digitaljournal
dx.doi.org/10.22624/AIMS/DIGITAL/V14N3P1

Article Progress Time Stamps

Article Type: Research Article
Manuscript Received: 7th June, 2026
Review Type: Blind Peer
Final Acceptance: 2nd August, 2026

Effect of Design Changes on Project Delivery in the Nigerian Construction Industry

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ABSTRACT

Design changes are a major challenge that affects the successful delivery of construction projects around the world. In Nigeria, there are frequent changes to approved project designs which lead to disruptions in construction activities. These disruptions result in reduced productivity, contractual disputes, and inefficient execution of projects. This study looked into the causes of design changes in construction projects in the Nigerian construction industry, using Niscot Limited as a case study. A quantitative research design was used, and primary data were gathered through a structured questionnaire that was given to construction professionals who are involved in project delivery. This included Project Managers, Architects, Civil engineers, Quantity Surveyors, Mechanical Engineers, Electrical engineers, and Site Engineers. The data that were collected were analysed using descriptive statistical techniques which included frequency distribution, mean score, Relative Importance Index, and ranking. The findings showed that the most significant causes of design changes were client-initiated scope modifications, inadequate project planning, and incomplete design information before construction starts, financial constraints faced by clients, and design errors and omissions. The study concludes that most design changes happen during the pre-construction stage because of deficiencies in project planning, design coordination by stakeholders. The study suggests that there should be improved client briefing, thorough design reviews before the contract is awarded, better coordination among consultants from different disciplines, and the use of digital design coordination technologies like Building Information Modelling to reduce unnecessary design changes and enhance project delivery performance

Keywords: Construction Projects, Construction Industry. Design Changes, Project Planning, Ibadan, Stakeholders,

1. INTRODUCTION

The construction industry is a significant contributor to economic growth and national development through the provision of residential buildings, commercial facilities, transportation infrastructure, educational institutions, healthcare facilities, and employment opportunities. The sector plays a role in improving living standards and supporting sustainable socio-economic development in both developed countries and developing countries.

Despite its contributions, the construction industry faces several project delivery challenges that affect project performance and the achievement of client objectives. Among these challenges, design changes have been consistently identified as one of the most significant factors affecting the successful delivery of construction projects (Love et al., 2016; Famiyeh et al., 2017; Hasan et al., 2021).

Design changes refer to modifications made to the approved design, drawings, specifications, scope of work, or other contract documents after the design has been finalised or construction activities have started. Such changes are typically formalised through variation orders or change orders and may involve additions, omissions, substitutions, alterations, or changes in construction methods and specifications (FIDIC, 2017). According to Alaghbari et al. (2020), design changes may result from evolving client requirements, improved understanding of project needs, design deficiencies, or external environmental conditions. Similarly, Memon et al. (2020) classified design changes according to their sources, which include client-directed changes, consultant-initiated revisions, contractor proposals, and regulatory requirements, while Hasan et al. (2021) distinguished between minor design adjustments and major design revisions that significantly alter the functional or structural characteristics of a project.

Although some design changes are unavoidable because construction projects operate in dynamic environments, excessive or poorly managed design modifications often create serious challenges during project execution. Previous studies have shown that frequent design changes interrupt construction workflows, reduce labour productivity, increase material waste, generate rework, complicate project coordination, and increase the likelihood of contractual disputes among project stakeholders (Love et al., 2016; Gunduzand Maki, 2020; Hasan et al., 2021). The disruptive effects of design changes become more pronounced when they occur after major construction activities have started, as completed work may require demolition, redesign, reconstruction, or resequencing of project activities.

Within the Nigerian construction industry, design changes remain a persistent challenge due to inadequate project planning, incomplete design documentation before construction starts, poor stakeholder coordination, insufficient communication among project participants, and frequent client-initiated modifications. In many projects, construction activities begin before the completion and proper coordination of architectural, structural, and building services designs, which increases the likelihood of design conflicts and subsequent revisions during construction. Additionally, changing client requirements, unstable economic conditions, and evolving regulatory demands further contribute to the occurrence of design changes on construction projects (Oladapo, 2017; Ibrahim et al., 2019; Okonkwo et al., 2023).

Several studies have examined the consequences of design changes on construction project performance, particularly their effects on project cost, completion time, productivity, and quality. However, comparatively fewer studies have focused specifically on identifying and ranking the underlying causes of design changes from the perspectives of construction professionals within Nigerian construction organisations. Understanding these causes is essential because effective management of design changes depends on identifying their root causes during the planning and design stages rather than addressing their consequences after construction has started.

Against this background, this study assesses the causes of design changes in construction projects within the Nigerian construction industry using Niscot Limited as a case study. The findings are expected to provide empirical evidence that will assist clients, consultants, contractors, project managers, and policymakers in improving design management practices, reducing unnecessary design modifications, and enhancing project delivery performance.

2. LITERATURE REVIEW

2.1 Causes of Design Changes in Construction Projects

Design changes have become one of the most commonly studied issues in construction management due to their frequent occurrence and impact on project delivery. While some design modifications are unavoidable because of changing project requirements and unforeseen site conditions, many design changes come from deficiencies in project planning, design coordination, stakeholder communication, and decision-making processes. Previous studies have indicated that the causes of design changes differ across projects based on project complexity, procurement methods, client requirements, contractual arrangements, and the effectiveness of project management practices (Love et al., 2016; Alaghbari et al., 2020; Hasan et al., 2021). Researchers have generally categorised the causes of design changes into client-related, consultant-related, contractor-related, regulatory, and external factors. This classification based on stakeholders has been widely used because it identifies the main source of each design modification and helps in developing suitable management strategies (Ibrahim et al., 2019; Memon et al., 2020; Hasan et al., 2021).

Client-related factors are the most frequently reported causes of design changes in construction projects. These changes often happen when clients alter the original project scope, change functional requirements, ask for aesthetic improvements, or face financial constraints that require adjustments to the approved design. Famiyeh et al. (2017) noted that changes initiated by clients made up the largest share of variation orders on building projects in Ghana. Similarly, Alaghbari et al. (2020) found that evolving client requirements and incremental scope development were the main drivers of design changes in construction projects. In the Nigerian construction industry, Ibrahim et al. (2019) pointed out that public sector projects are especially prone to client-initiated design changes due to policy shifts, political directives, and changing institutional needs after the contract has been awarded.

Consultant-related factors also play a significant role in design changes. Inadequate design development, incomplete drawings, errors and omissions, poor coordination among design disciplines, and insufficient design reviews often lead to revisions during construction. Oladapo (2017) discovered that incomplete design documentation before tendering was one of the main causes of post-contract design changes in Nigerian building projects. Likewise, Hasan et al. (2021) reported that inconsistencies between Architectural, Structural, and Building services drawings often require design revisions during project execution. These issues usually stem from insufficient design time, budget constraints, and ineffective interdisciplinary coordination among consultants. Contractor-related factors are another important source of design changes. During construction, contractors sometimes face constructability challenges that make the original design hard or impractical to execute. In these cases, contractors may suggest alternative construction methods, material substitutions, or value engineering solutions to enhance constructability and lower project costs.

Material shortages, supply chain disruptions, and unforeseen site conditions may also necessitate changes to approved designs. According to Memon et al. (2020), contractor-initiated changes are generally less frequent than those related to clients or consultants but are often technically complex and require detailed evaluation before they can be implemented. Ibrahim et al. (2019) similarly reported that contractor proposals often arise from constructability issues and the need to adapt designs to current site conditions.

Regulatory and statutory requirements can also require design changes during project execution. Building control authorities, environmental agencies, fire safety departments, and utility service providers sometimes introduce new requirements or identify non-compliance with existing regulations after the project has started. Such requirements often force project teams to revise approved designs to meet statutory obligations. Okonkwo et al. (2023) noted that regulatory changes have become more common in Nigerian urban construction projects due to changing planning regulations and stricter enforcement of building standards. Hasan et al. (2021) further mentioned that regulatory changes are generally unavoidable because compliance with statutory requirements is necessary for project completion.

External and unforeseen factors also lead to design changes in construction projects. These include adverse weather conditions, unexpected ground conditions, discoveries of underground utilities, natural disasters, and disruptions to material supply chains. Such events often invalidate the assumptions made during project planning and require changes to foundation designs, construction methods, or material specifications. Hasan et al. (2021) identified unforeseen geotechnical conditions as one of the most common external causes of design revisions, while Adamu and Bashir (2022) reported that force majeure events usually have significant implications for project planning because they happen unexpectedly and require immediate design responses.

Overall, the literature reviewed shows that design changes result from the combined influence of clients, consultants, contractors, regulatory authorities, and external environmental conditions. However, client-related factors, inadequate project planning, incomplete design documentation, and poor coordination among project stakeholders consistently appear as the most significant causes in both developed and developing countries. Understanding these causes is important for improving design management practices and reducing unnecessary modifications during project execution.

3. METHODOLOGY

This study used a quantitative research design to examine the causes of design changes in construction projects within the Nigerian construction industry, using Niscot Limited as a case study. A quantitative approach was deemed suitable because it allowed for the collection and analysis of measurable data from construction professionals regarding the factors responsible for design changes during project execution. The study population included construction professionals directly involved in project delivery at Niscot Limited, such as Architects, Builders, Civil Engineers, Quantity Surveyors, Project Managers, Mechanical and Electrical Engineers, and Site Engineers. These professionals were chosen because of their active involvement in project planning, design development, contract administration, and construction management, which gave them sufficient knowledge of the factors responsible for design changes.

Primary data were collected using a structured questionnaire developed from a thorough review of relevant literature on design changes in construction projects (Love et al., 2016; Famiyeh et al., 2017; Alaghbari et al., 2020; Hasan et al., 2021). The questionnaire had two sections. Section A gathered respondents' demographic information, while Section B contained statements regarding the possible causes of design changes identified from previous studies. Responses were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

A purposive sampling technique was used to select professionals with practical experience in managing construction projects that involved design modifications. The completed questionnaires were coded and analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistical tools including frequency distribution, percentage, mean score, and Relative Importance Index (RII) were used to evaluate and rank the identified causes of design changes based on their perceived significance. The results are presented in tables and discussed in relation to previous empirical studies.

3.1 Presentation of Results

3.1.1 Causes of Design Changes in Construction Projects

This objective assessed the causes of design changes in construction projects within the Nigerian construction industry using Niscot Limited as a case study. The aim was to identify and rank the major factors responsible for design changes during project execution based on the perceptions of construction professionals. The findings are presented in table below;

Table 1: Causes of Design Changes in Construction Projects

S/N	Causes of Design Changes	Never	Rarely	Sometime	Often	Always	Mean Score	Rank
1	Client/owner-initiated change in project scope after contract award	0%	3.7%	9.3%	25.9%	61.1%	4.44	1
2	Client's change in functional or aesthetic requirements during construction	5.6%	5.6%	5.6%	33.3%	50.0%	4.17	2
3	Inadequate or incomplete project brief provided by the client	1.9%	5.6%	11.1%	44.4%	37.0%	4.09	3
4	Financial constraints that compel the client to reduce scope mid-project	7.4%	7.4%	13.0%	16.7%	55.6%	4.06	4
5	Errors and omissions discovered in design drawings and specifications	0%	13.0 %	20.4%	55.6%	11.1%	3.65	5
6	Discrepancies/conflicts between architectural and engineering drawings	5.6%	14.8 %	11.1%	40.7%	27.8%	3.70	6
7	Inadequate pre-design feasibility and site investigation studies	9.3%	1.9%	13.0%	70.4%	5.6%	3.82	7

S/N	Causes of Design Changes	Never	Rarely	Sometime	Often	Always	Mean Score	Rank
8	Unforeseen site or ground conditions (poor soil, buried utilities, groundwater)	0.0%	22.2 %	25.9%	22.2%	29.6%	3.59	8
9	Incomplete design documentation at the time of contract award / tender	11.1 %	16.7 %	5.6%	38.9%	27.8%	3.56	9
10	Poor communication between client, designers, and the contractor	5.6%	5.6%	38.9%	44.4%	5.6%	3.39	10
11	Substitution of specified materials due to unavailability or cost savings	11.1 %	16.7 %	38.9%	22.2%	11.1%	3.06	11
12	Force majeure events (flooding, pandemic disruptions, natural disasters)	11.1 %	22.2 %	33.3%	16.7%	16.7%	3.06	11
13	Absence of a formal design freeze protocol before construction commences	24.1 %	7.4%	16.7%	46.%	5.6%	3.01	13
14	Value engineering proposals initiated by the contractor	22.2 %	5.6%	44.4%	22.2%	5.6%	2.83	14
15	Constructability problems identified by the contractor during execution	16.7 %	25.9 %	24.1%	27.8%	5.6%	2.80	15
16	Inadequate coordination among design disciplines (arch., structural, MEP)	16.7 %	38.9 %	16.7%	16.7%	11.1%	2.67	16
17	Technology upgrades or introduction of new construction methods	11.1 %	44.4 %	27.8%	16.7%	0.0%	2.50	17
18	Design changes mandated by regulatory/statutory authorities	22.2 %	44.4 %	16.7%	5.6%	11.1%	2.39	18
19	Political / institutional interference, especially on public-sector projects	18.5 %	53.7 %	5.6%	16.7%	5.6%	2.38	19
20	Updated building codes, safety, or environmental standards during construction	33.3 %	27.8 %	16.7%	16.7%	5.6%	2.34	20

3.2 Discussion of Findings

The findings presented in Table 1 show that there are several factors that contribute to design changes in construction projects but the significance of these factors varies. The results indicate that changes initiated by clients or owners in project scope after the contract has been awarded, changes in clients' functional or aesthetic requirements, inadequate project briefs, and financial constraints faced by clients were the highest-ranked causes of design changes. This suggests that decisions made by clients are the main source of design modifications during the execution of projects. The high ranking of client-initiated scope changes shows that many projects undergo revisions because clients change their requirements after construction has started. Such changes often necessitate redesign, additional approvals, and modifications to completed work, which disrupts project activities. This finding aligns with the studies conducted by Famiyeh et al. (2017) and Alaghbari et al. (2020), which reported that changes related to clients are the primary source of variation orders in construction projects. It also supports the findings of Ibrahim et al. (2019), who noted that changes in client requirements continue to be a significant challenge in construction projects in Nigeria.

The findings also reveal that incomplete project briefs and financial constraints faced by clients are significant contributors to design changes. An incomplete project brief often leads to unclear project objectives during the design stage, which results in subsequent revisions as project requirements become more clearly defined. Likewise, financial limitations may force clients to reduce the scope of the project or change specified materials after construction has started. These findings are consistent with those of Hasan et al. (2021), who concluded that inadequate project planning and changing priorities of clients significantly increase the chances of design revisions.

Consultant-related factors, which include errors and omissions in design drawings, discrepancies between architectural and engineering drawings, and incomplete design documentation, also received relatively high mean scores. This shows that deficiencies in design coordination continue to be an important source of design changes. Poor coordination among design consultants often leads to inconsistencies that are only discovered during construction, which requires corrective revisions before work can continue. Similar observations were made by Love et al. (2016) and Memon et al. (2014), who highlighted that the quality of design and coordination between disciplines are crucial for minimising design changes after the contract has been signed.

Even though poor communication among project stakeholders and unforeseen site conditions received lower rankings, they still remain important contributors to design changes. Failures in communication can delay decision-making and create misunderstandings among clients, consultants, and contractors, while unforeseen ground conditions may necessitate technical modifications to approved designs. These findings suggest that effective communication, thorough site investigations, and comprehensive design reviews before construction are necessary for reducing unnecessary design changes and enhancing project delivery performance.

4. CONCLUSION

This study assessed the causes of design changes in construction projects within the Nigerian construction industry using Niscot Limited as a case study. The findings revealed that design changes are primarily influenced by client-related factors. These factors include changes in project scope after contract award, modifications to functional and aesthetic requirements, inadequate project briefs, and clients' financial constraints. Consultant-related issues were also identified as significant contributors to design changes.

These issues include design errors, omissions, incomplete design documentation, and poor coordination among design disciplines. Although contractor-related and external factors such as unforeseen site conditions and communication challenges contributed to design modifications, their influence was comparatively lower. The study concludes that many design changes can be minimised if adequate attention is given to project planning, comprehensive design development, stakeholder coordination, and effective communication before construction commences. Addressing these root causes during the pre-construction stage will reduce unnecessary design revisions and contribute to improved project delivery within the Nigerian construction industry.

REFERENCES

- Adamu, A., and Bashir, M. (2022). *Managing design changes in public building projects in Nigeria. Journal of Construction in Developing Countries*, 27(2), 45–63.
- Alaghbari, W., Al-Sakkaf, A. A., Sultan, B., and Al-Mekhlafi, A. B. (2020). Causes and impacts of variation orders in construction projects. *Ain Shams Engineering Journal*, 11(4), 1215–1223. <https://doi.org/10.1016/j.asej.2020.02.004>
- Famiyeh, S., Amoatey, C. T., Adaku, E., and Agbenohevi, C. S. (2017). Major causes of construction time and cost overruns: A case of selected educational sector projects in Ghana. *Journal of Engineering, Design and Technology*, 15(2), 181–198. <https://doi.org/10.1108/JEDT-11-2015-0075>
- International Federation of Consulting Engineers. (2017). *Conditions of contract for construction for building and engineering works designed by the employer* (2nd ed.). FIDIC.
- Gunduz, M., and Maki, A. (2020). Assessing causes of construction contract variation orders using analytical techniques. *Engineering, Construction and Architectural Management*, 27(9), 2353–2375.
- Hasan, A., Thaheem, M. J., Maqsoom, A., and Badar, Y. (2021). Developing a framework for managing design changes in construction projects. *Journal of Building Engineering*, 44, 102608. <https://doi.org/10.1016/j.jobe.2021.102608>
- Ibrahim, Y. M., Bala, K., Bustani, S. A., and Anigbogu, N. A. (2019). Assessment of causes of variation orders in Nigerian building projects. *Nigerian Journal of Construction Technology and Management*, 20(1), 15–29.
- Love, P. E. D., Edwards, D. J., and Irani, Z. (2016). Moving beyond optimism bias and strategic misrepresentation: An explanation for social infrastructure project cost overruns. *IEEE Transactions on Engineering Management*, 63(4), 560–571. <https://doi.org/10.1109/TEM.2016.2585060>
- Memon, A. H., Rahman, I. A., and Haron, A. T. (2014). Significant causes and effects of variation orders in construction projects. *Applied Mechanics and Materials*, 567, 232–237. <https://doi.org/10.4028/www.scientific.net/AMM.567.232>
- Oladapo, A. A. (2017). An investigation into the causes and effects of variation orders in Nigerian construction projects. *Journal of Engineering, Design and Technology*, 5(1), 35–48.
- Okonkwo, C., Eze, E., and Onyia, M. (2023). Design change management and project delivery in the Nigerian construction industry. *International Journal of Construction Management*, 23(8), 1401–1415.