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CAUSES OF DESIGN ERRORS IN BUILDING CONSTRUCTION PROJECTS

Olowolayemo, O. E.
Department of Quantity Surveying, Faculty of Environmental Studies,
Rufus Giwa Polytechnic, Owo. Ondo State, Nigeria.
E-mail: olowoseuneben@gmail.com

Abstract
Design errors are unavoidable in the construction industry. They occur when information is misapplied or inaccessible, leading to frequent challenges. This study aims to identify and understand the significant causes of design errors in building construction. To achieve this, a literature review was conducted, and ninety-three valid questionnaires were randomly distributed among construction professionals, contractors, skilled labourers, and unskilled labourers in Ondo State, Nigeria. Eighty responses were analyzed. The study concluded that the major causes of design errors in building construction projects are incomplete or inaccurate specifications, poor communication, poor design coordination, lack of coordination processes, lack of collaboration, changes in project scope, different types of design drawings, inadequate site investigation, human error, and budget constraints. Based on this conclusion, the study recommends enhancing communication channels, improving coordination processes, fostering collaboration among stakeholders, ensuring accurate and detailed specifications, carefully managing project scope changes, using standardized design drawings, conducting comprehensive site investigations, providing continuous training for professionals, allocating sufficient budgets, and adopting multidisciplinary design teams during the design phase. These measures aim to minimize errors, omissions, and ambiguities, leading to more successful project outcomes.

Keywords: Building construction, communication, coordination, design errors, specifications

Introduction

Dedy et al. (2017) highlight that design is a critical step in construction projects. Errors in design can lead to failures during the construction stage and project development. Misunderstandings of the design concept between parties can result in design errors, which decrease the quality of construction work and cause cost overruns and project delays. The building design process involves providing all necessary information to construct a building that meets the owner's requirements and satisfies public health, welfare, and safety standards. However, construction and engineering practitioners often find it challenging to learn from their mistakes, particularly in preventing, identifying, or containing design errors. Musa and Obaju (2016) note that building design can only be legally performed by individuals deemed competent by the state where the building is to be constructed. Competency is assessed based on education, experience, and the ability to pass a written test of design skills.

LITERATURE REVIEW

Design Errors

Love et al. (2013) describe design errors as inevitable in construction projects, significantly impacting costs, schedules, safety, and overall project performance, as well as extending the delivery period. Despite strict rules, procedures,

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regulations, and standards, errors persist during the design and construction phases. These errors contribute to rework, cost overruns, schedule delays, and unsafe environments, thereby affecting project performance (Yogen, 2014). Dosumu and Aigbavboa (2018) note that various types of design drawings can harbour different levels of design errors due to factors such as unclear design overviews, lack of coordination, and human mistakes. The interests of stakeholders, including owners and contractors, in design implementation can also lead to errors, which increase difficulties in construction management. Such errors account for 80 to 90% of failures in construction projects (Robert, 2012) and as much as 10% of the total investment in new buildings and structures. These failures also entail less tangible environmental and social costs, potentially adding about 14.2% to a project's value (Musa, 2016). The actual costs of design errors are often unknown as they are rarely measured by organizations, despite research on error causation in construction and engineering projects. At the project level, design error costs are seldom recorded, though they often manifest as change orders or claims. Uncontrolled design errors can severely impact the construction process, making it crucial to manage them carefully to ensure project success and minimize performance difficulties. Inexperienced designers may produce incorrect designs, leading to poor quality work, increased costs, and extended timelines, ultimately resulting in project failure (Walker, 2009). Design errors also significantly raise the costs and timelines of social infrastructure projects and can lead to engineering failures, accidents, and loss of life (Loveet al., 2012).

Causes of Design Errors in Building Construction Projects

Despite stringent rules, procedures, regulations, and standards, errors persist within the design process (Love, 2013). Design errors are an inevitable and significant issue that negatively impacts project management efficiency and effectiveness (Love, 2012). Yogen (2014) identifies these errors as major contributors to rework, cost overruns, schedule delays, and unsafe environments, all of which affect project performance. Different types of design drawings can have varying levels of design errors due to factors such as unclear design overviews, lack of coordination, and human mistakes (Dosumu & Aigbavboa, 2018). In construction projects, stakeholders like owners and contractors have differing interests in design implementation, leading to errors that can arise at any time and increase difficulties in construction management. These difficulties account for 80% to 90% of failures in construction projects (Robert, 2012), with engineering failures constituting up to 10% of the total investment in new buildings and structures (Musa, 2016). These failures also entail less tangible environmental and social costs (Love, 2012). Rework occurs due to numerous factors, including design errors, construction failures, change orders, inadequate coordination, and ineffective communication among stakeholders (Oyewobi et al., 2011). Additional factors contributing to design errors in building construction projects include schedule delays, human mistakes, changes in project scope, different types of design drawings, negligence, inadequate site investigations, inexperienced design teams, budget constraints, lack of collaboration, and failure to consider future expansion (Oyewobi et al., 2011).

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METHODOLOGY

The success of any data collection process depends on several key factors, including selecting appropriate respondents, creating a suitable sampling design, carrying out fieldwork correctly, and handling the gathered data, which involves receiving, coding, processing, and analyzing it (Creswell, 2009; Yin, 2009).

In this research, both primary and secondary data sources were employed. Primary data were gathered using a carefully designed questionnaire targeting the construction industry in Ondo State, Nigeria. Through random sampling methods, ninety-three (93) valid questionnaires were distributed to construction professionals, contractors, skilled workers, and unskilled labourers engaged in building projects in Ondo State. Ultimately, eighty (80) responses were received for analysis.

The demographic information of the respondents was analyzed using frequency and percentage methods, while the factors contributing to design errors in construction projects were evaluated through mean scores and ranking.

FINDING AND DISCUSSION

To meet the objectives of this research, a carefully designed questionnaire consisting of ninety-three (93) items was distributed, with eighty (80) responses received from the study area. This resulted in a response rate significantly higher than the typical 20-30% found in construction industry surveys. The response rate in this instance is 86%, as illustrated in Table 1.

Table 1: Questionnaire administered and retrieved

No of administered Questionnaire	No retrieved	% of retrieval
93	80	86

Background information

Table 2: Years of experience of respondents

Table 2 below presents the years of work experience among the respondents. The findings reveal that 32.5% of the respondents had 1 to 5 years of experience, totalling 26 individuals. Meanwhile, 57.5% had 6 to 10 years of experience, representing 46 respondents, and 10% had 11 to 20 years of experience, corresponding to 8 individuals.

Table 2: Years of experiences

Classification	Frequency	Per cent
1-5	26	32.5
6-10	46	57.5
11-20	8	10
Total	80	100

Academic qualification of respondents

Table 3 displays the academic qualifications of the respondents. The results show that 2.5% hold a Postgraduate Diploma (PGD), 25% have Higher National Diplomas (HND), and 61.25% possess Bachelor's degrees (B.Sc.). Additionally, 5% hold National Diplomas (ND), and 6.25% have other qualifications. From this table, it is clear that all respondents are educated, providing a strong foundation for addressing the research questions effectively.

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Table 3: Academic qualification of respondents

Classification	Frequency	Per cent
ND	4	5.00
HND	49	61.25
BSC	20	25
PGD	2	2.5
7.00	5	6.25
Total	80	100

Category of construction stakeholders

Table 4 reveals the categories of construction stakeholders or workers among the respondents. It shows that professionals had the highest response rate at 30%, followed by skilled labourers at 37.5%, unskilled labourers at 23.75%, and contractors at 8.75%. This indicates that professionals were the major category of respondents in this study.

Table 4: Category of workers

Classification	Frequency	Per cent
Contractor	7	8.75
Skilled labour	30	37.5
Unskilled labour	19	23.75
Professional	24	30.00
Total	80	100

Identify the causes of design errors in building construction projects

Table 5 outlines the factors contributing to design errors in building construction. It was found that incomplete or inaccurate specifications, poor communication, inadequate design coordination, lack of a coordination process, insufficient collaboration, changes in project scope, various types of design drawings, inadequate site investigations, human error, and budget constraints were identified as the top ten causes, with mean scores of 3.80, 3.25, 3.25, 3.24, 3.24, 3.21, 3.19, 3.19, 3.17, and 3.16, respectively.

Additionally, the table highlights design complexity, failure to consider future needs, unrealistic project schedules, negligence, and insufficient contingency planning, with mean scores of 3.13, 3.11, 3.05, 2.94, and 2.94, respectively. The least significant causes of design errors included a lack of constructability reviews, insufficient experience or expertise, schedule delays, misinterpretation of client requirements, ineffective change management, and inexperienced design teams, with mean scores of 2.90, 2.89, 2.89, 2.80, 2.78, and 2.76, respectively. Overall, the findings suggest that all the identified causes contribute to design errors in construction projects.

Table 5: Identify the causes of design errors in building construction projects

Causes of design errors	Mean	Rank
Incomplete or inaccurate specifications	3.80	1st
Poor communication	3.25	2nd
Poor design coordination	3.25	2nd
Lack of coordination process	3.24	4th
Lack of collaboration	3.24	4th
Changes in project scope	3.21	6th
Different types of design drawing	3.19	7th
Inadequate site investigation	3.19	7th
Human Mistake	3.17	9th
Budget constraints	3.16	10th
Design complexity	3.13	11th
Failure to consider future	3.11	12th
Unrealistic project schedule	3.05	13th

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Causes of design errors	Mean	Rank
Negligence	2.94	14th
Insufficient contingency	2.94	14th
Lack of constructability review	2.90	16th
Lack of experience or expertise	2.89	17th
Schedule delay	2.89	17th
Misinterpretation of client requirements	2.80	19th
Ineffective change management	2.78	20th
Inexperienced design team	2.76	21th

CONCLUSION

The study concluded that the major causes of design errors in building construction projects are incomplete or inaccurate specifications, poor communication, poor design coordination, lack of coordination processes, lack of collaboration, changes in project scope, different types of design drawings, inadequate site investigation, human error, and budget constraints.

RECOMMENDATION

Based on this conclusion, the study recommends enhancing communication channels, improving coordination processes, fostering collaboration among stakeholders, ensuring accurate and detailed specifications, carefully managing project scope changes, using standardized design drawings, conducting comprehensive site investigations, providing continuous training for professionals, allocating sufficient budgets, and adopting multidisciplinary design teams during the design phase. These measures aim to minimize errors, omissions, and ambiguities, leading to more successful project outcomes.

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