

Assessing The Impact of Delay and Disruptions on Public Building Projects Costs in Enugu North, Enugu State, Nigeria

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Abstract- Construction projects are the major things that contribute to the socio-economic growth of any country in the world and for a country to be developed there must be a lot of construction projects in the country which include the construction of roads, schools, hospitals, bridges, etc. The construction industry in both developed and developing countries is viewed as the sector of the economy which planning, design, construction, maintenance, repair and operation transforms various resources into constructed facilities. The research aims to identify common causes of delays, determine their effect on construction costs, and evaluate the factors leading to cost overruns. This study seeks to examine the impact of delays and disruptions on public building projects costs between 2020 and 2023, revealing significant cost overruns and compromised project quality while assessing the effectiveness of good project management and monitoring to curb delay and disruptions. A mixed-method research design was employed, combining quantitative data from structured questionnaires and qualitative insights from interviews and project reports from Framework LTD, whose public projects were impacted by delays from 2020 to 2023. The findings reveal that poor project planning, financial constraints, design variations, project complexity and material shortages are the major contributors to delays and disruptions. Statistical analysis confirmed a positive correlation between project delays and increased construction costs, with cost overruns ranging from 15.6% to 21.7%. To mitigate these impacts, the study recommends improving project management, addressing financial and regulatory bottlenecks, adopting modern technologies such as Building Information Modeling (BIM), stabilizing material prices, and fostering continuous learning

from past projects. This research contributes to the body of knowledge in construction management and serves as a valuable resource for stakeholders, including contractors, project managers, clients etc. in enhancing project delivery efficiency and effectiveness.

Indexed Terms- Construction, Design, Building Information Modeling

I. INTRODUCTION

Delays and disruptions are common challenges in construction projects globally, often resulting in increased costs, extended project durations, and compromised quality. These delays are prevalent across developed and developing countries, with factors such as poor project planning, material shortages, labor unavailability, and bureaucratic bottlenecks contributing significantly to these issues (Sullivan & Harris, 2021). Successful project completion is typically measured by adherence to timelines and budgets, but disruptions across various phases of construction have continued to hinder progress, especially in developing regions.

Globally, the COVID-19 pandemic had a profound impact on the construction industry, exacerbating already existing problems. For instance, in countries like the United States, the pandemic-induced shortages of key materials such as lumber and steel led to price hikes of up to 20% and substantial delays (Associated General Contractors of America, 2021). These issues, though more severe in the wake of the pandemic, are common in regions where construction industries already face systemic challenges, such as Nigeria.

In the African construction industry, delays in construction projects lead to substantial financial losses for both owners and contractors (Al-Kass, & Mazerolle, 2021). For the owner or client, delays often translate into a loss of potential income, as the project may not be completed in time to start generating revenue. For the contractor, delays result in increased costs due to the extended duration of the project, higher labor costs, and increased expenses for materials and fabrication. On-time project completion is a critical indicator of efficiency in the construction industry.

In Nigeria, Delays and disruptions in construction projects have significant financial implications for stakeholders in Nigeria. The extended duration of projects leads to increased overhead costs, including labor, equipment, and site management expenses. Additionally, delays can result in penalties and fines for contractors, further inflating the overall cost of the project. Material costs may also rise due to inflation or scarcity, and financing costs increase as projects extend beyond their original timelines. (Odeh, & Battaineh, 2020). It is very rare to see that a construction project is completed on time.

Construction delays and disruptions are particularly pronounced, with urban centers like Enugu State being heavily affected. A lack of skilled labor is a persistent issue in the Enugu State construction industry. In Enugu State, labor shortages can lead to project delays as contractors struggle to find workers with the necessary skills to complete specialized tasks (Oladapo & Olawale, 2023). Lengthy and bureaucratic approval processes are common in Enugu State. Delays in obtaining necessary permits and approvals can stall construction projects, leading to increased costs and extended timelines (Nwankwo, 2023).

The Enugu North region faces unique challenges, including outdated infrastructure, a lack of skilled labor, financial constraints, and the cumbersome process of obtaining permits (Nwankwo, 2023). These delays not only disrupt the timelines of public and private projects but also lead to significant cost escalations, as projects are prolonged beyond their scheduled completion dates (Oladapo & Olawale, 2023).

Another critical challenge in Enugu North is interference with existing utilities such as water, electricity, and telecommunications infrastructure. The relocation or modification of these utilities can be both time-consuming and costly, leading to project delays (Onuoha & Chukwu, 2022). Additionally, the scarcity of skilled labor in the region has further complicated construction timelines, with contractors facing difficulties in hiring workers qualified for specific tasks (Oladapo & Olawale, 2023).

Delays in construction projects have far-reaching financial consequences for both contractors and project owners. Contractors face increased labor costs, higher overheads, and equipment rentals for extended durations, while project owners lose potential revenue due to the delays in project completion (Ameh, 2022). These delays also have a broader economic impact, as construction plays a vital role in the development of infrastructure and overall economic growth, especially in regions like Enugu North, which are undergoing rapid urbanization.

This study aims to assess the impact of delays and disruptions on public building construction costs in Enugu North, Nigeria, with a focus on identifying the key factors contributing to these challenges.

II. METHODOLOGY

This chapter presents the analysis and interpretation of data collected during the study. The data are drawn from responses to questionnaires completed by construction professionals and secondary data obtained from a construction company, Framework LTD, located in Enugu North, Enugu State. The analysis is carried out through tables and charts, capturing the results in a structured manner.

III. DATA PRESENTATION AND ANALYSIS

The first part of the analysis evaluates the Response Rate of the Questionnaire Survey. This reveals the number of responses collected from the distributed questionnaires.

Table 3.1 Response Rate of Questionnaire Survey

Questionnaires Administered	Frequency	Percentage
Questionnaires Administered	84	100%
Questionnaires Retrieved	79	94.05%
Questionnaires Not Retrieved	5	5.95%

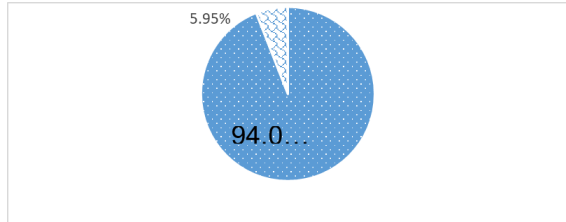


Figure 3.1 Response rate of questionnaire survey
Source: Field Survey (2024)

Table 4.1 and Figure 4.1 demonstrate that 79 (94.05%) of the total distributed questionnaires were retrieved, while 5 (5.95%) were not. The high response rate of 94.05% indicates that the data collected is reliable for further analysis.

3.1 Demographic Information of the Respondents
Next, the analysis presents the demographic breakdown of the respondents, including their professions, the types of organizations they work for, their highest educational qualifications, and their professional qualifications.

Table 3.2 Profession of Respondents

Profession	Frequency	Percentage	Cumulative Percentage
Architect	16	20.3%	20.3%
Engineer	41	51.9%	72.2%
Quantity Surveyor	9	11.4%	83.5%
Builder	13	16.5%	100.0%
Total	79	100%	100%

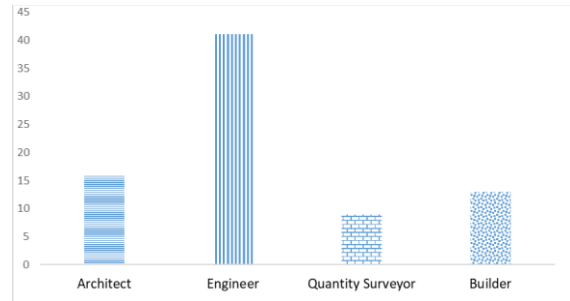


Figure 3.2: A chart showing of Profession of respondents

Source: Field Survey (2024)

Table 3.2 and Figure 3.2 show that the majority of respondents were engineers, representing 51.9% of the sample, followed by architects (20.3%), builders (16.5%), and quantity surveyors (11.4%).

Table 3.3 Type of Organization

Type of Organization	Frequency	Percentage	Cumulative Percentage
Government	27	34.2%	34.2%
Consulting	36	45.6%	79.7%
Contracting	16	20.3%	100.0%
Total	79	100%	100%

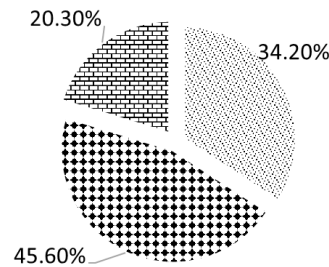


Figure 3.3: A chart showing the type of your organization respondent work for
Source: Field Survey (2024)

Table 3.3 and Figure 3.3 highlight that most respondents (45.6%) work in consulting firms, followed by 34.2% in government, and 20.3% in contracting.

Table 3.4 Highest Educational Qualification of Respondents

Qualification	Frequency	Percentage	Cumulative Percentage
HND	4	5.1%	5.1%
B.Tech/B.Sc	28	35.4%	40.5%
PGD	23	29.1%	69.6%
M.Tech/M.Sc	19	24.1%	93.7%
PhD	5	6.3%	100.0%
Total	79	100%	100%

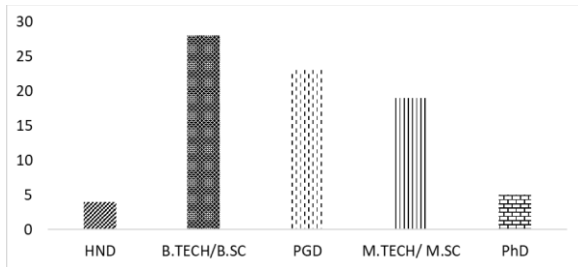


Figure 3.4: A chart showing of highest academic qualification of the respondents by their professions
Source: Field Survey (2024)

Table 3.4 and Figure 3.4 indicate that the majority of respondents hold a B.Tech/B.Sc degree (35.4%), followed by PGD (29.1%) and M.Tech/M.Sc (24.1%). This has contributed to validity of the research study.

Table 3.5 Highest Professional Qualification of Respondents

Professional Qualification	Frequency	Percentage	Cumulative Percentage
MNIA	16	20.3%	20.3%
MNSE	41	51.9%	72.2%
MNIQS	9	11.4%	83.5%
MNIQB	13	16.5%	100.0%
Total	79	100%	100%

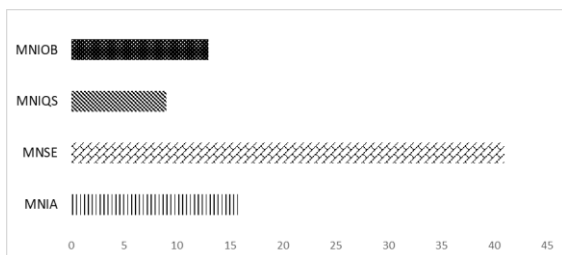


Figure 3.5: A chart showing the professional qualification of respondents

Source: Field Survey (2024)

Table 3.5 and Figure 3.5 show that most respondents (51.9%) are members of MNSE (Member of the Nigerian Society of Engineers), followed by (Member of Nigeria Institute of Architects) MNIA (20.3%), (Members of Nigeria institutes of building)MNIQB (16.5%), and (Members of Nigerian Institutes of Quantity surveying)MNIQS (11.4%).

Table 3.6 Years of Working Experience of Respondents

Years of Experience	Frequency	Percentage	Cumulative Percentage
0-5 Years	14	17.7%	17.7%
6-10 Years	49	62.0%	79.7%
11-15 Years	12	15.2%	94.9%
16-20 Years	4	5.1%	100.0%
Total	79	100%	100%

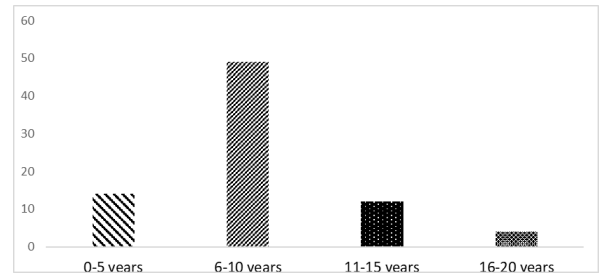


Figure 3.6: A chart showing years of working experience of the respondents by their professions
Source: Field Survey (2024)

Table 3.6 and Figure 3.6 show that 62.0% of respondents have 6-10 years of experience in the construction industry, while 17.7% have less than 5 years, and 15.2% have 11-15 years of experience.

3.3 Research Question Analysis

Research Question 1: What are the common causes of delays and disruptions in building projects in Enugu North?

This section identifies the common causes of delays and disruptions based on respondents' ratings. This section is to examine the common causes of delays and disruptions in building projects in Enugu North, Enugu State. The respondents were asked to rate the common causes based on their level of frequency and impact using the scale; 5: strongly agree, 4: agree, 3:

disagree, 2: strongly disagree and 1: not sure for the analysis. The completed and returned questionnaires were analyzed Relative Importance Index (RII).

$$R.I.I = (5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1) / 5N$$

Where n₅ = strongly agree, n₄ = agree, n₃ = disagree, n₂ = strongly disagree, n₁ = not sure and N = number of respondents

Table 3.7 Common Causes of Delays and Disruptions in Building Projects in Enugu East

Causes	N	RII	Rank
Change in Project Scope	79	0.74	1
Project Complexity	79	0.66	2
Inadequate Planning	79	0.61	3
Improper Project Schedule	79	0.60	4
Design Variation	79	0.57	5
Inaccurate Engineering Estimate	79	0.47	6
Inefficient Material Management	79	0.45	7
Improper Post Execution Phase	79	0.42	8
Inadequate Pre-Contract Study	79	0.41	9
Award of Contract	79	0.38	10
Natural Disaster	79	0.36	11
Poor Executive Capacity	79	0.34	12

SOURCE: Field Survey

The table above shows the common causes of delays and disruptions in building projects in Enugu State, ranging from the most critical to the least as perceived by the respondents.

Research Question 2: What are the impacts of delays and disruptions on project completion costs in public building projects in Enugu North?

This section is to examine the impact of delays and disruptions on project completion costs in public building projects in Enugu North construction costs.

Table 3.8 Delays and Disruptions impact on completion costs of public building project in Enugu North

Effects	N	RII	Rank
Cost Overruns	79	0.75	1
Extended Project Duration	79	0.68	2
Reduced Profit Margins	79	0.65	3
Poor Stakeholder Relationships	79	0.61	4
Loss of Reputation and Client Trust	79	0.58	5
Disruption to Cash Flow	79	0.49	6
Decreased Productivity	79	0.41	7
Contractual Penalties	79	0.37	8
Project Scope Reduction	79	0.35	9
Environmental and Social Impact	79	0.34	10

SOURCE: survey

The table above shows the impact of delays and disruptions on completion cost in public building projects in Enugu North, ranging from the most critical to the least as perceived by the respondents which reveals that all these impacts trend.

Research Question 3: What are the relationship between the duration of delays and disruptions and cost overruns in building projects?

This section is to examine the significant relationship between delay and disruption and cost overruns in Enugu North. The respondents were asked to rate the relationships based on their level of frequency and impact using the scale; 5: strongly agree, 4: agree, 3: disagree, 2: strongly disagree and 1: not sure for the analysis.

Table 3.9: The significant relationship between delay and disruption and cost overruns.

(Using R.I.I)

Significant relationship between delay and disruption and cost overruns.	N	RII	RA N K
Extended Project Timelines	79	0.83	1

Idle Equipment and Resources	79	0.72	2
Increased Labor Costs	79	0.68	3
Rework and Waste	79	0.67	4
Material Price Escalation	79	0.64	5
Inflated Interest on Financing	79	0.59	6
Contractor and Supplier Penalties	79	0.52	7
Loss of Economies of Scale	79	0.50	8
Reduced Productivity	79	0.47	9
Claims and Legal Disputes	79	0.38	10

SOURCE: field survey (2024)

The table above shows the significant relationship between delay and disruption and cost overruns in public projects in Enugu North, ranging from the most critical to the least as perceived by the respondents.

3.4 Hypothesis Testing and Data Analysis

This section presents the hypothesis testing and data analysis carried out to determine the relationship between delays and disruptions in construction projects and their impact on contract sums.

The following hypotheses were tested:

- Hypothesis 1: There is no significant relationship between delays and disruptions and construction costs.
- Hypothesis 2: There is no significant relationship between delays and disruptions and cost overruns in construction projects.

Table 3.10: Award Date, Contract duration on program of work, actual contract duration Practical completion, Initial Contract sum, status and revised contract sum (as a result of increase in contract sum due to extension of time) by Framework Ltd and Percentage increase of the contract sum.

S/No	Project Title	Award Date	Expected Completion date/ Contract duration (Months)	Actual contact duration at practical completion (Months)	Initial Contract sum (₦)-(x)	Revised contract sum (as a result of increase in contract sum due to extension of time)-(₦)(y)	Difference between the initial Contract sum and revised contract sum (₦)	Status (%)	% Difference
1	Shopping Plaza, New Haven	15 th January, 2020	15 th January 2022 (24 Months)	14 th January, 2023 (36 Months)	324,890,000.00	390,006,700.00	65,116,700.00	100%	20% increase
2	3 storey Ware house, Old Artisan	30 th October, 2020	29 th October, 2021 (12 Months)	July 30 th 2022 (21 Months)	345,000,880.00	405,000,000.00	59,999,120.00	100%	17.39% increase
3	Hotel, Old Park	30 th June, 2021	29 th of June 2022(12 Months)	25 th February, 2023 (20 Months)	346,000,465.00	399,889,000.00	53,888,535.00	100%	15.6%
4	Gas station, Asata	4 th March, 2021	3 rd May, 2022 (15 Months)	ongoing	430,000,779.00	509,675,902.00 (Revised on April, 2024)	79,675,123.00	50%	18.5%

5	Event center, Asata.	12 th September, 2022	11 th April 2023 (17 Months)	ongoing	600,000,000.00	730,000,000.00 (Revised on May, 2024)	130,000,000.00	60%	21.7%
6	Lock-up shops, Obiagu.	14 th May, 2022	13 th May 2023 (12 Months)	Ongoing	76,000,000.56	95,000,000.00 (Revised on April, 2024)	18,999,999,44	65%	25%
7	Warehouse, Kenyetta.	15 th June, 2022	14 th March, 2023 (9 Months)	Ongoing	120,890,098.65	136,098,098.00 (Revised on April, 2024)	15,207,999,35	62%	12.6%
8	Ongoing secondary school, Ogui Road.	3 rd September, 2022	2 nd November, 2023 (14 Months)	Ongoing	150,840,000.00	169,900,000.87 (Revised on December, 2023)	19,060,000.87	70%	12.6%
9	Ongoing Event center, Ogui Newlayout	17 th July, 2023.	16 th April, 2024 (9 Months)	Ongoing	154,000,908.90	167,090,000.90 (Revised on May, 2024)	13,089,092.00	50%	8.5%
10	Ongoing block of office spaces, Enugu.	20 th October 2023.	19 th May, 2024 (7 Months)	Ongoing	89,098,000.44	110,098,768.00 (Revised on July, 2024)	21,000,767.56	68%	23.6%

Source: field survey, (2024)

As seen in Table 3.10, significant increases in contract sums were observed across all projects due to delays and disruptions. For example, the initial contract sum of the 24-unit block of flats at New Haven increased by ₦65,116,700.00, representing a 20% rise over the original estimate. Similarly, other projects

experienced cost increases ranging from 15.6% to 21.7%, largely due to the prolonged completion times and related disruptions.

Diagram showing the comparison between the initial contract sum and revised contract sum due to delay and disruptions for some projects from 2020-2023.

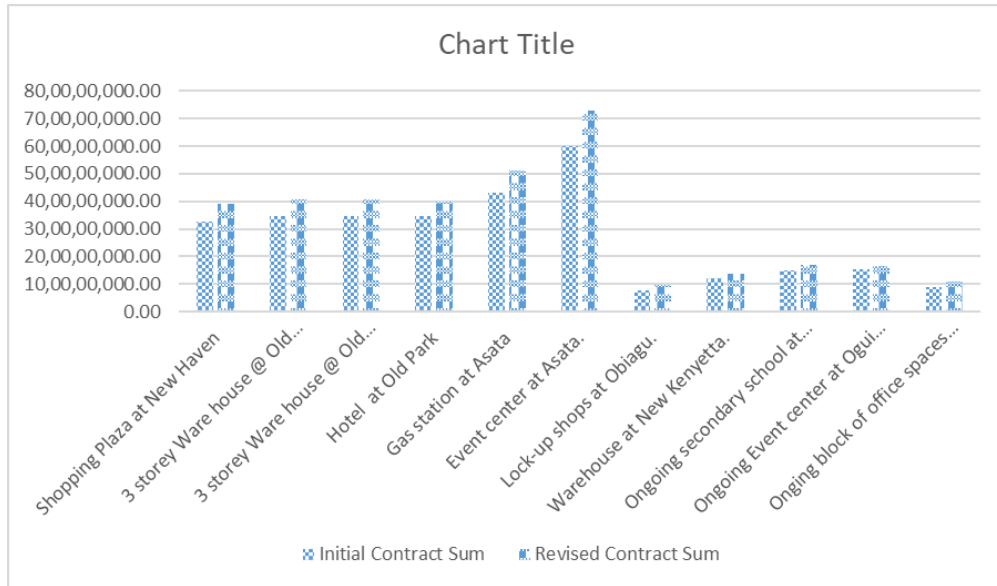


Figure 3.7: Comparison between the initial contract sum and revised contract sum due to delay and disruptions for some projects from 2020-2023

Data Analysis

The findings from Table 3.11 highlight the financial implications of delays and disruptions on construction projects. These projects, such as the 3-storey warehouse at old Artisan and the event center at Asata and the rest demonstrate how deviations from the planned timelines result in substantial cost overruns. The ongoing delays in both the gas station and event center projects emphasize the potential for even greater cost increases as completion is further delayed.

Moment Linear Correlation Coefficient.

A product moment correlation coefficient will be used to test the hypothesis. Below is the table prepared for use in calculating the product moment correlation coefficient showing the value for x,y, X,Y,X²,XY, and Y².

Table 3.11 Product Moment Linear Correlation Coefficient Table

X	y	X=x-X	Y=y-Y	X ²	XY	Y ²
324,890,000.00	390,006,700.00	61,217,886.75	78,730,853.02	3.75E+15	4.82E+15	6.20E+15
345,000,880.00	405,000,000.00	81,328,766.75	93,724,153.02	6.61E+15	7.62E+15	8.78E+15
346,000,465.00	399,889,000.00	82,328,351.75	88,613,153.02	6.78E+15	7.30E+15	7.85E+15
430,000,779.00	509,675,902.00	166,328,665.75	198,400,055.02	2.77E+16	3.30E+16	3.94E+16
600,000,000.00	730,000,000.00	336,327,886.75	418,724,153.02	1.13E+17	1.41E+17	1.75E+17
76,000,000.56	95,000,000.00	-187,672,112.70	-216,275,846.98	3.52E+16	4.06E+16	4.68E+16
120,890,098.65	136,098,098.00	-142,782,014.61	-175,177,748.98	2.04E+16	2.50E+16	3.07E+16
150,840,000.00	169,900,000.87	-112,832,113.26	-141,375,846.11	1.27E+16	1.60E+16	2.00E+16
154,000,908.90	167,090,000.90	-109,671,204.36	-144,185,846.08	1.20E+16	1.58E+16	2.08E+16
89,098,000.44	110,098,768.00	-174,574,112.82	-201,177,078.98	3.05E+16	3.51E+16	4.05E+16

2.64E+09	3.11E+09	0.00	0.00	2.69E+17	3.26E+17	3.96E+17
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$$\text{Mean of X} = \frac{2.64E+09}{10} = 263,672,113.26$$

$$\text{Mean of Y} = \frac{2.11E+09}{10} = 311,275,846.98$$

Decision Rule: If the product of moment linear correlation coefficient is positive, accept H1, if otherwise, reject H1 and accept H0.

$$R = \frac{3.26E+18}{4.94E+18}$$

$$R = +0.66$$

Based on the calculated product moment linear correlation coefficient, which indicates a positive correlation (+0.66), we reject the null hypothesis (Ho) and accept the alternative hypothesis (Hi) for both hypotheses 1 and 2. This suggests that delays and disruptions in public building projects are associated with increased construction costs and inflation in building materials costs, particularly occurring during periods of delay and disruption.

CONCLUSION

This study has provided a comprehensive analysis of the causes and impacts of delays and disruptions in public building projects in Enugu North, Nigeria. The findings indicate that poor project planning, changes in project scope, and project complexity are the primary causes of delays, while cost overruns, extended project durations, and reduced profit margins are the most significant impacts. The research questions further explore the correlation between delays and cost overruns, while also identifying factors contributing to these delays in Enugu State. These factors range from poor project management and funding issues to labor shortages and inefficient supply chains.

The hypotheses tested in this study further strengthen the findings. For Hypothesis 1, there is strong evidence supporting the alternative hypothesis (Hi) that a significant relationship exists between delays

and disruptions and increased construction costs. Finally, Hypothesis 2 confirms the significant correlation between delays, construction costs, and the inflation of building material costs during disruptions. Furthermore, the strong positive correlation between delay duration and cost overruns highlights the need for improved project management practices and stakeholder collaboration.

To address these challenges, this study recommends strengthening project planning and management, improving scope management, enhancing stakeholder communication, building contractor capacity, and addressing labor and material shortages. By implementing these recommendations, stakeholders in the construction industry can reduce delays, control costs, and improve the overall efficiency of public building projects in Enugu North. These actions will ultimately contribute to better project outcomes and enhanced public service delivery in the region.

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