

Research Article

Delay and Cost Overrun in Construction Projects: A Regression Analysis in Southeastern Nigeria

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Abstract

Construction delays are a ubiquitous phenomenon in the building industry in Nigeria. Despite the proliferation of construction delays in the country, there is a paucity of regression-based research investigating the causes of such delays in Southeastern Nigeria. A survey of 138 clients, contractors and consultants of road and building construction companies in Enugu and Anambra states, Nigeria, supplemented with the interview of an engineer with many years of experience in the construction industry, provides insights into the causes of construction delays in the region. Two multiple linear regression models were estimated, treating cost overrun and time overrun as distinct dependent variables and seven stakeholder-grouped delay factor categories as independent predictors. Contractor-related factors ranked highest descriptively (mean = 3.91), and delay in progress payment was the most severe individual factor (mean = 3.84). Regression analysis revealed that consultant-related factors were the strongest direct predictors of both cost overrun ($\beta = 0.524$, $p < 0.001$) and time overrun ($\beta = 0.628$, $p < 0.001$), despite ranking only fourth descriptively, a gap that challenges the assumption that perceived delay attribution reliably predicts measurable project outcomes. The models collectively explained 47.7% ($R^2 = 0.477$) and 52.2% ($R^2 = 0.522$) of the variance in cost and time overrun respectively. Effective performance improvement requires coordinated action by all three stakeholder groups, with contractually binding payment schedules, proactive contractor planning, and performance-based consultant accountability as priority interventions.

Keywords

Construction Delays, Cost Overrun, Time Overrun, Southeastern Nigeria, Multiple Linear Regression

1. Introduction

The construction industry plays a pivotal role in the development of the economies of various nations. The construction industry is also recognized as one of the most challenging sectors within the economy, primarily due to the difficulties associated with managing construction projects in relation to time and cost. Delays and cost overruns are two of the most common problems experienced within construction projects worldwide [1, 2, 30]. The problem is particularly challenging

in countries like Nigeria, where the construction sector faces numerous difficulties owing to high sector demands, funding challenges, and industry weaknesses [3, 4].

A project delay occurs when the contractor, consultants, or the client, or any combination of these parties, prevents the construction project from being completed within the time frame that was stated in the construction contract [5, 6]. Such delays tend to have a detrimental effect on the economy of the

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country where the construction is taking place. The effect includes the loss of foreign investors' interest, the slowing of economic development of the country, and the reduction in the economic competitiveness of the nation's economy [2, 7].

The cost escalation that commonly occurs in construction projects has a significant impact on the parties involved. Clients experience a loss of returns on their investments. The construction project's end users experience higher costs for their rentals and other products. Consultants suffer reputational damage, and the contractors lose work and money as a result of cost overruns [8, 9]. In Africa, cost escalation in construction projects continues to pose a significant threat to the projects themselves, often resulting in the failure and abandonment of these projects [10].

There are numerous research studies on the topic of construction project delays in the construction industry worldwide. However, there is a gap in the literature regarding an investigation into the causes of project delays specific to the Southeastern area of Nigeria from the perspective of all three major stakeholder groups involved in the construction of the buildings. Most existing Nigerian studies have either focused on Lagos and Abuja or have not sufficiently disaggregated findings by stakeholder category, limiting the practical utility of their recommendations. Furthermore, the relationship between specific delay factors and both cost and time overruns has seldom been subjected to regression analysis in the Nigerian context [11, 33]. This study addresses these gaps by conducting a survey-based investigation in Southeastern Nigeria, drawing on the perceptions of clients, contractors, and consultants to identify and rank the main factors contributing to construction delays and cost overruns, and to assess their respective severity through inferential statistical analysis.

The study is guided by the following objectives:

- 1) To identify the main factors causing delay and cost overrun in Nigerian construction projects.
- 2) To rank these factors by severity from the perspectives of clients, consultants, and contractors.
- 3) To assess the significance of each factor group in predicting cost and time overrun through regression analysis.
- 4) To recommend strategies for minimizing construction delays and improving project timelines in Nigeria.

2. Literature Review

2.1. Delay Causes: Financial and Payment Factors

The financial dimension of construction delay is very well documented in the literature. Mansfield et al. [12] discovered that financing and the payment for the works that are completed are the most important factors to cause delay in construction works in Nigeria. Delayed payments to constructors are the primary cause of financial difficulties for constructors,

which make it impossible for them to continue the construction works as they cannot purchase the necessary construction materials or pay their construction workers [10, 13]. These findings are echoed by Luthan et al. [14] who also found that financial and economic factors are some of the most significant factors that affect construction project delay. The delayed payments to constructors are the most damaging factor in the financial aspects of construction projects as it causes constructors to develop financial problems that make them delay their purchase of construction materials and construction works [15, 16]. Egomo [17] also found that in almost 92% of the projects that are executed within the public institutions in Nigerian states such as Cross River, the financial factor that causes the delay is the budgetary cost to the government for the construction of these public institutions and works.

2.2. Contractor and Consultant-Related Delay Factors

The factors related to contractors have been reported in various research studies as the main cause of project delays. Authors Odeh and Battaineh [13] reported that the first cause of project delays was consultants, followed by contractors and then owners of the projects. Authors Abeysinghe and Jayathilaka [18] reported similar findings in the context of construction projects in Malaysia, where the leading cause of project delay was determined to be contractor-related issues. Breakdown of equipment that is required to complete projects is another major cause of project delay as identified in the research studies conducted in Jordan, Ethiopia, and Southeast Asia [19, 20]. Furthermore, research also indicates that addressing the factors related to contractors can lead to the most impactful reduction in project delays [3].

Most consultant-related delays are due to the various responsibilities that the consultants have in overseeing the projects. Some of these causes include the consultant's delay in approving major changes to the project, the lack of available data prior to the design of the project, and mistakes in the documentation of the project design [20, 21]. Authors Luthan et al. [14] determined that the consultants are the primary cause of any delays related to the design of the projects, yet often do not account for this in their estimation of the potential for the project to become delayed. Furthermore, Onah [22] determined in his research of power infrastructure projects in Nigeria that the inefficiencies of the consultants were one of the main contributing factors to the delays in the projects, along with political interference and delays in receiving payments for the contractors of the projects.

2.3. Effects of Construction Delays and Mitigation Strategies

The documented effects of construction project delays include cost overruns, extension of the construction period, late payments to contractors, the need to reschedule construction

activities, damage to the reputation of those involved in the construction process, the development of disputes between the parties involved in the construction process, the requirement of arbitration to resolve those construction disputes, the abandonment of the construction process, and the litigation between the parties involved in the construction of the construction project [5, 9]. Aibinu and Jagboro documented the effects of delay on construction projects in Nigeria [23]. The authors found that the most common effects of delay on construction projects in Nigeria were cost and time overruns for the construction projects; proper planning of the construction process of a project can help to avoid such effects. Additionally, Mekonen et al. also found that the delays of construction projects in Nigeria have an effect upon the beneficiaries of those construction projects, as they are unable to access the benefits that the construction project would provide to those individuals [24].

Commonly-suggested strategies to mitigate the effects of construction project delays include the proper planning of the construction project, the effective management of the construction site, the estimation of the costs of the construction project prior to its construction, the establishment of efficient and transparent communication channels among the parties involved in the construction project, the procurement of the construction materials and equipment required to construct the project, and the holding of construction project coordination meetings between the project parties to review construction progress and issues [21, 25, 26]. Additionally, construction contracts that include clauses that allow for interest to be claimed should the contract provide for payments to be made to the construction company that is experiencing delayed payments from the project owner can act as a deterrent to the project owner from delaying payments of the construction costs [10]. By reviewing the causes of construction project delays and overruns in the construction industry, especially within the construction of construction projects in Nigeria, it may be possible to adopt construction strategies and methods that are cost-efficient and ensure the overall viability of each construction project [3, 27].

3. Methodology

3.1. Research Design

This study adopted a cross-sectional survey design to cap-

ture a representative snapshot of stakeholder perceptions regarding construction delays and cost overruns in Southeastern Nigeria. The cross-sectional approach is widely employed in construction management research because it permits simultaneous data collection from multiple respondent groups [21, 20]. A quantitative research strategy was employed as the primary mode of inquiry, supplemented by a qualitative element in the form of a semi-structured interview with an experienced construction engineer, together constituting a sequential mixed-methods approach. The quantitative component generated the descriptive and inferential data necessary for ranking delay factors and testing hypothesized causal relationships between delay factor categories and the two outcome variables of cost overrun and time overrun. The qualitative component provided contextual insights that enriched the interpretation of the quantitative findings.

The study was geographically focused on Southeastern Nigeria, specifically Enugu and Anambra states, due to the researcher's proximity to the study area and the availability of ongoing road and building construction projects, which provided access to sufficiently informed respondents. The research population comprised clients, consultants, and contractors who were actively involved in road and building construction projects across the selected states. These three stakeholder groups were selected because they collectively constitute the principal parties in a construction contract and are therefore best positioned to offer informed opinions on the causes, effects, and remedies of project delays [6, 26].

3.2. Research Variables

The study was structured around a clear conceptual distinction between independent and dependent variables. The independent variables comprised seven delay factor categories widely recognized in the construction delay literature: contractor-related factors, owner-related factors, consultant-related factors, equipment-related factors, material-related factors, labour-related factors, and external factors. Each category encompassed specific delay drivers operationalized as individual questionnaire items and subsequently aggregated into category mean scores for regression analysis. The dependent variables were cost overrun and time overrun, both measured on a five-point Likert scale and treated separately in two regression models to allow an independent assessment of each factor category's predictive strength on each outcome. Table 1 presents a summary classification of the variables used in this study.

Table 1. Classification of Independent and Dependent Variables.

Variable Type	Variable	Operationalization
Independent	Contractor-related factors	Project financing difficulties, ineffective planning, delay in site mobilization
Independent	Owner-related factors	Delay in progress payment, excessive change orders

Variable Type	Variable	Operationalization
Independent	Consultant-related factors	Delay in approving changes, design errors, insufficient pre-design surveys
Independent	Equipment-related factors	Equipment breakdowns, shortage of equipment.
Independent	Material-related factors	Late procurement of materials, material shortages
Independent	Labour-related factors	Shortage of skilled labour, low worker productivity
Independent	External factors	Adverse weather conditions, regulatory delays
Dependent	Cost overrun	Perceived increase in project cost beyond the original budget
Dependent	Time overrun	Perceived extension of project duration beyond the original contract period

3.3. Sampling Strategy and Data Collection

A purposive sampling strategy was adopted to select respondents who possessed direct experience with construction project delivery in Southeastern Nigeria, as this approach prioritizes the quality and relevance of data over the random selection of participants and is widely used in delay causation research to ensure that responses reflect informed professional opinion [6, 28]. Purposive sampling was preferred over stratified random sampling because the target population, professionals with direct, current experience of construction project delivery in Enugu and Anambra states, could not be reliably enumerated from a sampling frame, making random selection from a defined stratum impractical. Access was obtained through professional associations, active construction sites, and engineering seminars, ensuring that each respondent met the experience criterion.

Questionnaires were administered through multiple channels, including email correspondence, postal delivery, and hand delivery at active construction sites, to maximise coverage and minimise non-response. Where questionnaires were administered on site, the researcher engaged directly with willing participants, and for items respondents found ambiguous, the questionnaire was completed as an assisted interview to minimise misinterpretation.

A total of 150 questionnaires were distributed across the study area, of which 138 were returned, yielding a response rate of 92%, which is well above the 70% threshold generally considered acceptable for survey-based construction research [19, 21]. The respondent breakdown comprised 22 clients (15.9%), 58 contractors (42.0%), and 58 consultants (42.0%). A semi-structured interview was conducted with a senior engineer with extensive experience in project delivery in the region to elicit qualitative explanations for the patterns identified in the quantitative data.

3.4. Questionnaire Design and Reliability

The questionnaire instrument was developed from an ex-

tensive review of the existing literature on construction delays, encompassing causes, effects, and mitigation strategies, to ensure that all items were grounded in established scholarly frameworks and to support the content validity of the instrument [20, 26]. Prior to full deployment, the instrument was pilot-tested on a small group of colleagues with substantial expertise in construction management, who reviewed the items for clarity and relevance; minor revisions to item wording were made based on their feedback. Internal consistency of the instrument was assessed using Cronbach's alpha, which returned a value of 0.935 across the 84 items, indicating excellent reliability and confirming that the scale items consistently measured the underlying constructs of delay causation, delay effects, and mitigation strategies [34]. The survey instrument was structured into three parts corresponding to the causes, effects, and mitigation strategies of delay. Each item was measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) [19, 21].

3.5. Data Analysis

Raw data from the returned questionnaires were processed and analysed using the Statistical Package for the Social Sciences (SPSS) software. The analysis proceeded through three sequential stages. In the first stage, descriptive statistics including means, standard deviations, and frequency distributions were computed for all items and factor categories. In the second stage, cross-tabulation and chi-square tests were applied to examine the extent of agreement and divergence among clients, contractors, and consultants in their factor rankings. In the third stage, multiple linear regression analysis was conducted to assess the predictive relationship between the seven independent variable categories and each of the two dependent variables, following the multivariate regression model specified in Equation (1). The multivariate regression model took the general form:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \dots + \beta_ix_i + \varepsilon \quad (1)$$

Where y represents the dependent variable (cost overrun or time overrun), β_0 is the constant, β_1 through β_i are the regression coefficients for the respective independent variables x_1 through x_i , and ε is the error term. The independent variables x_1 through x_7 correspond to the seven delay factor categories, each expressed as a category mean score derived from the Likert-scaled items. The model was estimated separately for cost overrun and time overrun, and the significance of individual predictors was assessed at $p < 0.05$, while overall model fit was evaluated using the F-statistic and R^2 .

3.6. Research Hypotheses

Four research hypotheses were formulated on the basis of the conceptual framework, which positions the seven delay factor categories as independent predictors of cost overrun and time overrun as outcome variables.

Hypothesis 1

H_0 : There is no significant difference in the perceived severity of delay factors among clients, contractors, and consultants in Nigerian construction projects.

H_1 : There is a significant difference in the perceived severity of delay factors among clients, contractors, and consultants.

Because contractors, owners, and consultants occupy different positions within the construction contract and bear different risks and responsibilities, it is reasonable to expect that their perceptions of delay severity will differ systematically. The chi-square test and cross-tabulation analysis were employed to test this hypothesis.

Hypothesis 2

H_0 : Cost overrun is not the most significant effect of construction project delay in Southeastern Nigeria.

H_1 : Cost overrun is the most significant effect of construction project delay in Southeastern Nigeria.

This hypothesis is grounded in the observation that cost overrun and time overrun are consistently the two most severe effects of construction delay, with cost overrun frequently ranked first in developing country contexts [10, 23].

Hypothesis 3

H_0 : Contractor-related delay factors do not have a significant positive effect on cost overrun in Nigerian construction projects.

H_1 : Contractor-related delay factors have a significant positive effect on cost overrun in Nigerian construction projects.

This hypothesis is derived from the consistent finding in the literature that contractor-related factors constitute the leading category of delay causes [13, 20].

Hypothesis 4

H_0 : The seven delay factor categories, individually and as a group, do not have a significant effect on cost overrun and time overrun.

H_1 : The seven delay factor categories, individually and as a group, have a significant effect on cost overrun and time overrun.

A statistically significant model with R^2 above 0.40 was considered sufficient to confirm the collective explanatory power of the independent variables, consistent with benchmarks applied in comparable delay research [21, 26].

4. Results

Respondents were first asked to indicate the type of infrastructure most susceptible to project delays. Of the 138 respondents, 39% identified road projects while 61% identified building projects. Building projects are generally more amenable to resumption after a halt, whereas abandoned road projects deteriorate rapidly under traffic and weather exposure, thereby escalating remediation costs [20, 29, 31]. On the question of which client type was least associated with delays, 14.5% identified government clients, 44.9% cited private individuals, and 40.6% cited corporate organisations. The low rating for government clients reflects well-documented concerns about bureaucratic delays, irregular fund releases, and the absence of personal accountability in public-sector project management in Nigeria [10, 26, 32].

4.1. Contractor-Related Factors as the Most Severe Delay Category

Table 2 presents the mean scores and overall rankings of the seven delay factor categories as perceived by clients, contractors, and consultants.

Table 2. Mean Scores and Rankings of Delay Factor Categories by Stakeholder Group.

Stakeholder	Contractor Related	Equipment Related	Material Related	Consultant Related	Owner Related	External Factors	Labour Related
Client	4.23	4.00	3.41	3.86	3.41	2.59	3.27
Contractor	3.72	3.28	3.36	3.31	3.00	3.16	2.98
Consultant	3.98	3.26	3.33	3.12	3.19	2.88	2.64
Total	3.91	3.38	3.36	3.32	3.14	2.95	2.88

Stakeholder	Contractor Related	Equipment Related	Material Related	Consultant Related	Owner Related	External Factors	Labour Related
Rank	1	2	3	4	5	6	7

As shown in Table 2, contractor-related factors recorded the highest overall mean score of 3.91, placing them first in the combined ranking across all respondent groups. This convergence is particularly significant, as it is acknowledged by contractors themselves rather than attributed solely by external parties. Equipment-related factors ranked second (mean = 3.38), followed by material-related factors (mean = 3.36), consultant-related factors (mean = 3.32), and owner-related factors (mean = 3.14). External factors and labour-related factors occupied sixth and seventh positions (means = 2.95 and 2.88 respectively), indicating that factors beyond direct project-

party control are perceived as less severe than those that are internally manageable.

4.2. Delay in Progress Payment and Contractor Financing as the Leading Individual Delay Drivers

Table 3 presents the top-ranked individual delay factors by mean severity score.

Table 3. Top-Ranked Individual Delay Factors by Mean Severity Score.

Rank	Delay Factor	Mean	Category
1	Delay in progress payment	3.84	Owner Related
2	Difficulties in financing the project	3.81	Contractor Related
3	Equipment breakdowns	3.70	Equipment Related
4	Ineffective planning and scheduling	3.61	Contractor Related
5	Late procurement of material	3.51	Material Related
6	Delay in site mobilisation	3.49	Contractor Related
7	Delay in approving major changes	3.48	Consultant Related
7	Insufficient data collection and survey before design	3.48	Consultant Related
8	Weather effects	3.46	External Factors
9	Shortage of equipment	3.41	Equipment Related
9	Mistake and discrepancies in design documents	3.41	Consultant Related

The highest-ranked individual factor was delay in progress payment (mean = 3.84), classified as an owner-related factor. The second-ranked factor, difficulties in financing the project (mean = 3.81, contractor-related), is closely related: delayed progress payments directly impair contractors' ability to maintain the cash flow necessary for procurement and site operations. Together, these two factors describe a financing and

payment chain that, when disrupted, brings construction activity to a halt and triggers a cascade of secondary delays [10, 12]. Equipment breakdowns ranked third (mean = 3.70), followed by ineffective planning and scheduling (mean = 3.61) and late procurement of material (mean = 3.51). Three consultant-related factors appear among the top eleven, confirming that all principal parties contribute to delay causation.

4.3. Perceived Effects of Construction Delays

Table 4. Mean Scores and Rankings of Delay Effects by Stakeholder Group.

Stakeholder	Cost Overrun	Time Overrun	Total Abandonment	Dispute	Arbitration	Litigation
Client	4.55	4.73	3.14	2.86	2.68	2.27
Contractor	4.03	4.03	3.10	2.84	2.84	2.98
Consultant	4.22	4.19	3.00	3.24	3.00	2.60
Total	4.20	4.16	3.07	3.01	2.88	2.71
Rank	1	2	3	4	5	6

Cost overrun attracted the highest combined mean score of 4.20 across all respondents, making it the most severely perceived effect of construction delay in Southeastern Nigeria, thereby supporting Hypothesis 2. Time overrun ranked second (mean = 4.16), followed by total project abandonment (mean = 3.07), disputes (mean = 3.01), arbitration (mean = 2.88), and litigation (mean = 2.71). The close proximity of the means for cost and time overrun reflects the strong interdependence of these two outcomes, consistent with Aibinu and Jagboro [23]. Stakeholder variation is notable: clients rated time overrun (4.73) above cost overrun (4.55), reflecting the owner's exposure to lost utility and revenue, while consultants ranked cost

overrun (4.22) above time overrun (4.19), suggesting that from a professional oversight perspective, financial escalation is the more visible indicator of project failure.

4.4. Regression Analysis: Predictors of Cost Overrun and Time Overrun

4.4.1. Regression Model for Cost Overrun

Table 5 presents the results of the multiple linear regression model, in which a cost overrun was regressed on the seven delay factor categories.

Table 5. Multiple Linear Regression Results: Dependent Variable = Cost Overrun ($F = 16.938$, $p < 0.001$, $R^2 = 0.477$, Adjusted $R^2 = 0.448$).

Predictor Variable	B	Std. Error	Beta (β)	t	Sig.
(Constant)	2.416	0.311	—	7.763	0.000
Owner-related factors	-0.269	0.091	-0.230	-2.945	0.004
Contractor-related factors	0.130	0.080	0.145	1.625	0.107
Consultant-related factors	0.486	0.079	0.524	6.113	0.000
Material-related factors	-0.086	0.089	-0.113	-0.959	0.340
Equipment-related factors	0.246	0.068	0.300	3.599	0.000
Labour-related factors	-0.183	0.073	-0.236	-2.513	0.013
External factors	0.164	0.081	0.199	2.025	0.045

The overall regression model was statistically significant ($F = 16.938$, $p < 0.001$). The coefficient of determination $R^2 = 0.477$ shows that the model accounts for approximately 47.7% of the variance in cost overrun, representing moderate to strong explanatory power for a cross-sectional survey-based model in the construction management domain [21]. Among the individual predictors, consultant-related factors exerted

the strongest and most statistically significant positive effect on cost overrun ($B = 0.486$, $\beta = 0.524$, $t = 6.113$, $p < 0.001$), reflecting the central role that consultants play in design quality, pre-construction planning, and the timely approval of design changes. Equipment-related factors also had a significant positive effect ($B = 0.246$, $\beta = 0.300$, $p < 0.001$), consistent with equipment breakdowns ranking third among individual

delay factors. External factors showed a significant positive effect ($B = 0.164$, $\beta = 0.199$, $p = 0.045$). Conversely, owner-related factors showed a significant negative association with cost overrun ($B = -0.269$, $p = 0.004$), interpreted as a threshold effect: when owner payment failures reach a critical level, they precipitate project suspension or abandonment rather

than allowing cost to overrun indefinitely [10, 29]. Labour-related factors exhibited a similar negative association ($B = -0.183$, $p = 0.013$). Contractor-related and material-related factors were not statistically significant predictors in this model. The estimated regression equation is:

$$\text{Cost Overrun} = 2.416 - 0.269(\text{Owner}) + 0.130(\text{Contractor}) + 0.486(\text{Consultant}) - 0.086(\text{Material}) + 0.246(\text{Equipment}) - 0.183(\text{Labour}) + 0.164(\text{External})$$

4.4.2. Regression Model for Time Overrun

Table 6 presents the results of the multiple linear regression model in which time overrun served as the dependent variable.

Table 6. Multiple Linear Regression Results: Dependent Variable = Time Overrun ($F = 14.327$, $p < 0.001$, $R^2 = 0.522$, Adjusted $R^2 = 0.496$).

Predictor Variable	B	Std. Error	Beta (β)	t	Sig.
(Constant)	1.671	0.439	—	3.809	0.000
Owner-related factors	-0.435	0.129	-0.252	-3.374	0.001
Contractor-related factors	0.121	0.113	0.091	1.068	0.287
Consultant-related factors	0.859	0.112	0.628	7.669	0.000
Material-related factors	-0.383	0.126	-0.343	-3.038	0.003
Equipment-related factors	0.314	0.096	0.260	3.259	0.001
Labour-related factors	-0.061	0.103	-0.053	-0.591	0.555
External factors	0.315	0.114	0.258	2.750	0.007

The overall model for time overrun was statistically significant ($F = 14.327$, $p < 0.001$), and $R^2 = 0.522$ indicates that the seven predictor categories collectively explain 52.2% of the variance in time overrun, slightly higher explanatory power than for the cost overrun model. Consultant-related factors again emerged as the strongest positive predictor ($B = 0.859$, $\beta = 0.628$, $t = 7.669$, $p < 0.001$). The unstandardised coefficient $B = 0.859$ is notably larger than the corresponding coefficient in the cost overrun model ($B = 0.486$), indicating that consultant-related problems exert a proportionally stronger influence on schedule than on cost outcomes, reflecting the di-

rect connection between consultant performance and the construction programme [20, 21]. Equipment-related factors ($B = 0.314$, $\beta = 0.260$, $p = 0.001$) and external factors ($B = 0.315$, $\beta = 0.258$, $p = 0.007$) both exerted significant positive effects of broadly similar magnitude, suggesting that equipment management and contingency planning for external risks warrant equal attention from a schedule perspective [20, 25]. Owner-related factors exhibited a significant negative association ($B = -0.435$, $p = 0.001$) for the same reasons as in the cost overrun model. Contractor-related and labour-related factors were not statistically significant predictors of time overrun. The estimated regression equation is:

$$\text{Time Overrun} = 1.671 - 0.435(\text{Owner}) + 0.121(\text{Contractor}) + 0.859(\text{Consultant}) - 0.383(\text{Material}) + 0.314(\text{Equipment}) - 0.061(\text{Labour}) + 0.315(\text{External})$$

5. Discussion

The primacy of contractor-related factors is in agreement with the findings of Odeh and Battaineh [13] in their study of traditional construction contracts; Muzondo and McCutcheon [26] also find contractor-related factors as the most common

cause of underperformance in building projects. However, the fact that the contractors themselves have recognized this primacy of contractor-related factors suggests that these findings are likely to be reliable. These findings suggest that while contractors are aware of the problems associated with their construction companies, they have not yet taken steps to address these recognized problems. As such, contractors should develop programmes in advance of construction commences that

dedicate resources to addressing these identified problems.

The consistent finding of the damaging effects of payment and financing problems three decades after Mansfield et al. [12] first noted the problems indicates a lack of success in addressing these problems within the construction industry of Nigeria. The findings are in agreement with Demisew and Lecturer [10] who also found that payment problems by project owners is the main cause of cash flow problems for contractors within the African continent. Thus, project owners should recognize that the costs and burdens of construction projects far exceed the advantages of late payment to constructors. Project owners should, therefore, establish payment schedules for construction projects that include interest and penalty clauses, minimize change orders after the award of the construction contract, and perform assessments of the contractors' financial and technical capabilities before awarding the construction contracts to those firms.

The difference between the ranking of consultant-related factors as the fourth among seven categories of factors that impact construction projects, and their role as the strongest predictor of both cost and time overrun in the regression models, is the most theoretically significant result of this study. The impact of consultants on cost and time overrun is theoretically recognized by Rezaei and Jalal [21], who have stated that the deficiencies in the designs of construction projects and the inadequate planning that occurs prior to the construction of those projects has a disproportionate impact upon cost overrun relative to the impact of those same issues upon the stakeholders' perception of the issue, and Tafesse [20] who have stated that discrepancies in the designs of construction projects are the primary cause of the extension of the construction schedules of those projects. Furthermore, the coefficient of consultant-related factors is stronger for the regression model that measured time overrun relative to cost overrun, which suggests that the impact of consultant-related issues upon the sequence of operations at a construction site is harder to mitigate than the impact that those same consultants can have upon cost overrun.

The counterintuitive finding of the negative relationship between owner-related factors and the increases of both cost and time overrun for construction projects can be explained by the threshold effect of those failures. Should an owner's financial and payment issues reach a critical level for a construction project, the cost and time overrun will halt with the withdrawal of the contractor from the construction project, the suspension of construction, or the initiation of proceedings to resolve the disputes between the parties to the construction contract. This relationship was recognized by Demisew and Lecturer [10], who have stated in their research that many construction projects in Africa have ended in abandonment due to the owner's financial issues. The non-significance of the variable for the impact of contractor-related factors is not inconsistent with the findings that contractor-related factors have an impact upon cost and time overrun; those contractors primarily impact cost and time overrun indirectly, as the majority of contractors are

not independent contractors who work within a construction project yet have no relationship with the other factors that impact the project (as recognized by Muzondo and McCutcheon [26]). Thus, any interventions into the contractors' costs, schedules, and performance will be effective only if other interventions into consultant, equipment, and owner-related factors are also made.

6. Conclusion

This study investigated the causes, effects, and mitigation strategies of construction delays and cost overruns in South-eastern Nigeria, drawing on survey data from 138 clients, contractors, and consultants involved in active road and building projects in Enugu and Anambra states. Contractor-related factors emerged as the most severe delay category overall (mean = 3.91), while delay in progress payment ranked first among individual factors (mean = 3.84), confirming that the payment-financing chain remains the single most damaging source of disruption in Nigerian construction projects, consistent with the foundational findings of Mansfield et al. [12] and more recent African evidence [10, 20]. Cost overrun was identified as the most severe effect of delay (mean = 4.20), and the regression models revealed that consultant-related factors are the strongest direct predictors of both outcomes ($\beta = 0.524$ and $\beta = 0.628$ respectively), despite ranking only fourth descriptively. This gap between descriptive perception and regression prediction is itself a contribution of the study.

Reducing delays and cost overruns in Southeastern Nigerian construction projects requires coordinated action by all three principal stakeholder groups, as no single intervention directed at one party in isolation is likely to produce lasting improvement. Effective project delivery depends on improvements in owner payment practices, contractor planning and financial management capacity, consultant design quality and responsiveness, and the collective management of equipment, materials, and external risk, all pursued concurrently within a framework of clear contractual obligations and transparent communication. Future research should examine these relationships using longitudinal data and larger sample sizes, and should investigate the moderating role of contract type, project size, and procurement method on the relative severity of the delay factor categories identified in this study.

7. Recommendations

Based on the findings of this study, the following recommendations are made:

Owners and clients should establish contractually binding payment schedules with interest penalty clauses for delayed disbursements, conduct thorough pre-award assessments of contractor financial and technical capacity, and minimise post-award change orders through comprehensive pre-construction planning.

Contractors should develop detailed, resource-loaded programmes before mobilisation commences, maintain disciplined cash-flow management systems, implement preventive maintenance regimes for critical plant and equipment, and invest in structured workforce training.

Consultants should ensure design documentation is complete before construction commences, adhere to defined review timescales, and exercise professional flexibility in contract administration so that approval processes do not become an independent source of delay. Performance-linked fee structures and contractually defined approval timelines are recommended as structural incentives for improved consultant accountability.

All parties should establish transparent communication from project inception, hold regular coordination meetings, and implement proactive risk management protocols that identify and address potential financial, logistical, and regulatory challenges before they disrupt the programme.

Abbreviations

SPSS	Statistical Package for the Social Sciences
RII	Relative Importance Index
R ²	Coefficient of Determination
β	Standardised Regression Coefficient (Beta)
B	Unstandardised Regression Coefficient
H ₀	Null Hypothesis
H ₁	Alternative Hypothesis
ORCID	Open Researcher and Contributor Identifier
AE-	Alex Ekwueme Federal University Ndufu-
FUNAI	Alike
NIPP	National Integrated Power Projects

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Author Contributions

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Data Availability Statement

The data supporting the findings of this study are primary data generated through a structured questionnaire survey administered to clients, contractors, and consultants actively involved in construction projects in Southeastern Nigeria. The datasets are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no competing interests, financial or otherwise, that could have influenced the design, conduct, or reporting of this study.

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