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Effects of Procurement Documentation Errors on the Cost Performance of Construction Projects in Nigeria

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Abstract

Considerable efforts have been made in literature to mitigate the occurrence of errors in construction projects without much results. Previous studies on construction errors overly focused on design errors, neglecting errors which may originate from other construction procurement documents. Errors in procurement documents often undermine the attainment of construction project objectives in terms of completion within agreed time, quality and cost. Yet, this phenomenon finds inadequate explanation in the literature. This study was undertaken to evaluate errors in construction procurement documents, ascertain the difference in the impacts of documentation errors in different procurement methods, and determine the influence of documentation errors on the cost performance of construction projects. The respondents, architects, engineers, builders and quantity surveyors (n=81), were selected using convenient and snowballing techniques, and the data were analyzed using severity index (SI), mean score (SC) and Kruskal Wallis test. Based on the respondents' opinions, errors in project contextual factors have the highest rank in terms of impact on the cost performance of projects followed by errors in project time schedule and design errors. The Kruskal Wallis test confirmed that these three highest ranking errors have significant effects on the eventual cost performance of projects. Clients and project managers should ensure that contextual factors are fully understood by project participants in order to obtain procurement documents that are devoid of errors. This study opines that construction procurement documentation errors should be assessed by their impacts on cost project performance, and not merely by their occurrence.

1. Introduction

Construction products serve as hosts to economic activities, while the construction process provides direct and indirect employments to citizens thereby enhancing the overall economy of a nation. Globally, the construction industry remains critical to the attainment of the socio-economic objectives of nations, and this is amplified in the case of the Global South [1]. Taken together, construction and related industries account for more than 10% of Nigeria's GDP **[2].** Further, the industry contributes 50% to the domestic fixed capital formation and about 20% of employment [3]. However, even with the immerse contributions of the construction industry, it has failed to perform acceptably in terms of cost, which has led to project abandonment and many other stakeholder dissatisfaction events.

Construction procurement is generally prone to different errors. As demonstrated by previous studies, errors in construction procurement documents are concerning [4; 5; 6], because they account for more than 82% of all construction errors [7]. Construction procurement documents comprise all documents required to: prequalify tenderers so that they may be invited to tender, collect tender offers and establish a contract upon acceptance of a tender [8]. Amongst others, procurement documents include drawings, specifications, bills of quantities, conditions of contract, articles of agreement and forms of tender. Procurement documents have been standardized both at national and subnational levels in Nigeria [9]. In spite of this, low public procurement capacity [10] continues to undermine the rightful use of the standards with attendant cost implications at the project execution stage. Added to this, the existence of quacks in the Nigerian construction industry compounds both the frequency of procurement document errors and their consequential effects on project cost performance.

Previous studies on construction documentation errors overly focused on design errors rather than investigate all relevant construction procurement documents [11; 12; 13; 15]. Errors in documents such as tender adverts, instructions to bidders, programmes of work, method statements, and conditions of contract were hardly addressed by previous studies. While Dosumu and Aigbavboa [11] observed a nexus between design errors and variation costs in buildings, Lopez and Love [13] estimated the mean direct and indirect costs of design errors as 6.85% and 7.36% of the contract sum. Neither of the studies investigated the relative degrees of the impacts of different procurement error types on the cost performance of projects. Other studies like Ogbu and Ebiminor [14] argued that errors in bills of quantities lead to construction disputes leaving out other procurement documents from the investigation.

A project's proneness to documentation error could be affected by the procurement method adopted. In Nigeria, the predominant construction procurement methods are design-bid-build, design-and-build and management-oriented (construction management and management contracting) methods [15]. Dosumu [16] found that traditional procurement (design-bid-build) projects account for up to 68% of documentation errors in the construction industry, yet this route is the dominant statutory approach to project procurement in the Nigerian construction industry [14].

Procurement arrangements place responsibilities on different project participants. In the design-bid-build method, different designers (architects and engineers) and planning/costing professionals, acting independent of one another, could develop contradictory documents leading to expensive corrections at the construction stage. In the design-and-build method, the contractor is the producer of the construction documents, he is; therefore, incentivized to deal with his own errors internally. Management-oriented contracts require construction to be undertaken by work package subcontractors who have separate contracts with the client or the management contractor. Consequently, documentation errors in one contract may not affect the entire project. Also, the design process may continue throughout the construction stage [17], thereby suiting the design to site realities with minimal errors.

Dosumu et at. [6] found no differences in the contributions of procurement methods to documentation errors, but did not investigate whether errors have different impacts on the cost performance of projects based on their procurement methods. Dosumu [16] further found that drawings contain the most errors followed by bills of quantities and specifications. Presently, little is known about the severity of the influence of these errors on the client's major concern which is cost performance. In view of this, the objectives of this study are to: (1) evaluate documentation errors in construction procurements, (2) determine the difference in the impacts of documentation errors in different procurement methods and; (3) ascertain the influence of documentation errors on the cost performance of projects.

1.1. Related literature

1.1.1 Documentation Errors in Construction Contracts

Errors have been defined from diverse perspectives in the literature (see [12]). Reason [18] described errors as risky acts and procedural violations committed by people on the front lines. Sowers [19] defined 'error' as an individual's deviation from acceptable or desirable practice, which might result in unsatisfactory or unwanted outcomes. These definitions underscore individuals as the origin of errors, and point to nonadherence to procedure or acceptable practice as the meaning of error. They fail to refer to the intentions of the individuals or teams committing the errors. Rooney et al. [20] classified errors as either intentional or unintentional. This study views documentation errors as unintentional slips, lapses or mistakes [12] occurring in construction procurement documents. Thus, the definition of error offered by [21], "The failure of planned actions to achieve their desired goal, where this occurs without some unforeseeable or chance intervention" was adopted for this study.

Construction contracts comprise legally binding written documents showing the agreement between the owner and the contractor, and defining the roles and responsibilities of each of the parties [22]. In practice, procurement documents define the grand norms of the project, and reflect the original intentions of the parties. Errors in the documents will imply that the documents no longer constitute "the meeting of minds" of the parties, which is a precursor to claims and disputes. Additionally, the highly technical language of procurement documents and their frequent erroneous alteration by clients have been identified as among the factors making it difficult for the documents to be understood by businesses [8].

Some authors have attempted to categorise documentation errors in the construction industry. Mohammed [23] placed twenty-three (23) different types of errors in construction procurement documents under five (5) categories. They are erroneous actions, omission, non-conformance (failure to conform to design parameters), process (failure to follow laid down procedures) and co-ordination problems. Juszezyk et al. [5] made an analysis of errors committed in designs and proposed three (3) methods of categorizing them. They are: according to place of their occurrence (drawings, calculations, technical description), according to the person committing the error (investor, architect, design-specific designer) and according to the type of error (discrepancy in design and design documentation, lack/incorrect/incomplete information). Dosumu [16] classified errors according to the document in which they occur, thus: errors in drawings, errors in bill of quantities, errors in specifications and coordination errors. Errors in tender documents like instructions to bidders, conditions of contract and articles of agreement, which could have serious effects on project performance, were not identified and covered by the classifications.

Irrespective of its category, the undesirability of an error is first and foremost a function of its impact on project outcome. While it is preferrable not to have errors at all in procurement documents, errors that will by no means affect project performance (such as minor typographical errors) can be discountenanced without much consequences. Contrariwise, some types of errors lead to claims resulting in disputes, litigations and delays. Each type of error's frequency of occurrence and severity needs to be established to guide professionals on the extent to which a procurement documentation error is likely to impair project performance. Dosumu and Aigbavboa [11] found a relationship between design errors and costs of variation orders in the Nigerian construction industry based on 30 case-study projects. A more robust examination including all construction procurement documents will give a better view of the impacts of procurement documentation errors on project delivery.

1.1.2. Project Performance

Documentation errors are inimical to all the domains of project performance. The performance of a project is measured using the basic expectations of project stakeholders, particularly, the client. Narrowly, these expectations centre on executing the project within the given duration, cost, quality, scope and to the satisfaction of project owners [31]. Project performance measures; therefore, define what it means for a project to succeed or fail [32]. Each of the performance indicators can be measured in different ways. For instance, cost performance can be measured as the ratio of the tender price to the final cost of a project [33] or the ratio of preliminary estimate to final cost. Similarly, the quality performance of a project can be gauged using the cost of rework or number of rework incidences. Time performance can be measured by schedule growth. For this study, project performance will be measured based on cost performance since the other metrics of project performance are easily convertible to cost. Documentation errors leading to poor quality jobs will ultimately result in extra costs due to rework, for example. Likewise, delays will, at least, entail additional expenditure on preliminary items. Cost is; therefore, the primary measure of project performance. Conceptually, errors in procurement documents will lead to poor cost performance by affecting cost directly, or indirectly, by affecting other determinants of project cost.

1.2. Hypotheses of the study

Ho1: There is no significant relationship between documentation errors and the cost performance of construction projects.
Ho2: There is no significant difference in the cost impacts of documentation errors in different procurement methods

2.0 Methodology

2.1 Development of Research Instrument

The overall goal of this study is to ascertain the influence of procurement documentation errors on cost performance of construction projects. The errors suggested by previous studies were examined. For instance, the 20 and 14 documentation errors identified by [23] and [16] respectively were examined, and it was decided to adopt the documentation errors identified by [23] for this study since they encompass those of [16] as well. However, other possible documentation errors (n=11) at the procurement stage were added including: mistakes in the amendment of standard conditions, failure to appoint adjudicators/arbitrators and wrong instructions to bidders. This list of 31 documentation errors were first sent out to 15 practicing quantity surveyors to vet, and they confirmed them to be possible errors in construction procurement documentation. Quantity surveyors were chosen purposively to vet the questionnaire due to their prominent roles in construction contract documentation. The final questionnaire targeted architects, engineers, quantity surveyors and builders who usually make and use contract documents either as consultants or contractors. Due to the unavailability of a reliable database of the professionals at the time of the study, the snowballing technique was adopted in the distribution of the questionnaire. The respondents were requested to forward the questionnaire to other colleagues of theirs who could provide useful responses. They were asked to provide the responses with reference to a recently completed public sector project of not less than ₦250 million Naira contract sum. This threshold was chosen for two reasons. First, it is because ₦250 million Naira is the upper approval limit (for construction works) of parastatal tenders board set by the Bureau of Public Procurement in Nigeria [24]. Secondly, the threshold was chosen to ensure that the respondents reported on well documented projects.

The respondents were asked to rank the frequency of occurrence of each type of error and its severity on the cost performance of the project of reference on a Likert scale of 1 to 5 (1=never or none, 2=rarely or very low, 3=sometimes or low, 4=often or moderate, 5=always or high). Many studies have determined cost overruns in construction projects with widely differing outcomes [25]. For Nigeria, [26] estimated the average cost overrun of construction projects as 44.46%. Hence, in order to measure the cost performance of projects, respondents to the study were requested to state the extent of cost overrun of the projects +as ≤40% (low cost overrun), >40%≤80% (moderate cost overrun) and >80% (high cost overrun). This information is easier to obtain than actual amounts of overrun on the projects, and helped to transform the numerical dependent variable (cost performance) into categorical variables for the ordinal regression. Additionally, the respondents were asked to indicate the procurement method adopted for the projects reported on. That is, whether design-bid-build, design and build, or management-oriented contract.

2.2. Data Analysis

Ordinal Regression Analysis

The effect of each type of error on each project was first calculated on a respondent-by-respondent basis by multiplying the Likert score for the frequency of occurrence by the score for severity of impact. This error effect was then regressed against the cost performance of each project using ordinal regression. Ordinal regression predicts the cumulative probabilities for outcomes with ordered categories [27]. It is given by the formula:

$$-log\ (-\log(Q_j)) = \alpha_j - \sum_{i=1}^{n}(\beta_i x_i) \qquad 1$$

Where Q_j is the cumulative probability for the j^{th} category, α_j is the threshold for the jth category, β_i …., β_n are regression coefficients, x_i…., x_n are the independent variables and n is the number of independent variables. The negative log-log link function was used for the analysis because the lower categories of cost overrun were considered to be more probable than the higher categories [28] due to the budgetary cost limit often established in Nigerian public sector construction projects.

2.3. Impact of Error

The impact of each error type was computed for the entire data set. Impact of error (IoE)=mean score (MS) x severity index (SI). The SI of each factor was computed using the formula [29].

$$\text{SI}\ (\%) = \sum a\left(\frac{n}{N}\right) * \frac{1}{5} \qquad 2$$

where a = constant expressing weighting given to each response, which ranges from 1 for none up to 5 for high; n = frequency of the responses; and N = total number of responses.

2.4. Kruskal Wallis Test

In order to determine whether the impacts of documentation errors vary for different procurement methods, Kruskal Wallis test was carried out on the data. Kruskal Wallis test is a nonparametric alternative to the ANOVA, which is used to compare the means of two or more independently sampled groups on a non-normally distributed data [30]. As a result of the different approaches used in documenting construction contracts for different procurement arrangements, it is possible that some documentation errors will be avoided or their effects will be greatly reduced in some procurement methods. Each of the identified documentation error

type was tested based on Ho2. Where significant differences existed, the results were subjected to multiple comparison analysis to determine the procurement methods for which the procurement documentation errors differed.

3.0. Results

Table 1 shows that 40.1% of the respondents have had construction industry work experience of 6-10years. Taken together, those with more than 10 years of construction industry work experience were 40.74% which signifies that the respondents have the requisite experience to understand contract documentation-related issues in construction projects. In terms of the number of projects so far handled by the respondents, 43.21% of them have handled above 10 projects. Most of the respondents were builders (29.63%), and 38.27% of them were designated as project managers. The respondents' characteristics suggest that they were capable of giving informed responses to the questionnaire. Additionally, Table 2 showed that 32 (39.5%) of the 81 projects reported on by the respondents had low cost overruns, 27 (33.3%) had moderate cost overrun while 22 (27.2%) had high cost overrun.

3.1 Impact of Documentation Errors

Table 3 shows the respondents' rankings of the different procurement documentation errors based on their impacts on a project. Errors in projects' conceptual factors were opined to have the greatest impact on project cost performance with an IoE of 2.542 out of a maximum of 5.0. Project contextual matters refer to the unique features of a project from which it was conceptualized such as its location features. An example is where a design does not take cognizance of the size of the site; or the road alignment used in a design was incorrect and inapplicable on ground. Such errors lead to serious redesign work with implications for both the cost and time performances of the project. *Errors in project time schedule* and *non-conformity of documents to design calculations* ranked 2nd and 3rd respectively signifying that in the opinions of the respondents, errors in time schedule have comparatively serious effects on the cost performance of construction projects.

3.2. Differences in the Impacts of Procurement Documentation Errors in Different Procurement Methods

The results of the test of differences in the impacts of documentation errors on cost performance in different procurement methods are also shown in Table 3. The impacts of most procurement documentation errors do not differ for different procurement methods, except *callouts of the details are incorrect or missing (E20)* and *failure to appoint adjudicators/arbitrators (E29)*.

Multiple comparison tests revealed, that the impacts of E20 on project cost performance is significantly different between design-and-build and management contracting (p=0.049). Based on their mean ranks, the impacts are significantly higher in design-and-build (mean rank=50.85) than in management contracting projects (mean rank=30.15). Similarly, multiple comparison tests showed that a significant difference exists between the impacts of E29 on project cost performance in design-bid-build projects and management contracting projects (p=0.016). The impacts are significantly higher for design-bid-build (mean rank=47.13) than in management contracting (mean rank=21.65).

Table 1: General Information of Respondents

Category	Description	Frequency	Percentage (%)
Construction Industry Work Experience	1-5 years	15	18.52
	6-10 years	33	40.74
	11-15 years	12	14.81
	16-20 years	10	12.35
	Above 20 years	11	13.58
	Total	**81**	100
Number of projects handled up to date	1-5	21	25.93
	6-10	25	30.86
	11-20	19	23.46
	Above 20	16	19.75
	Total	**81**	100.00
Academic qualification	OND	24	29.63
	HND/B.Sc/B.Tech	39	48.15
	M.Sc./PGD/M.Phil	12	14.81
	PhD	6	7.41
	Total	**81**	100
Professional qualification	MNIA/Reg. Arc	19	23.46
	MNSE/Reg. Engr.	18	22.22
	MNIQS/Reg. Q.S	20	24.69
	MNIOB/Reg. Bld	24	29.63
	Total	**81**	100.00
Position in firm/company/establishment	Principal partner	11	13.58
	Senior partner	15	18.52
	Director	19	23.46
	Project manager	31	38.27
	Others	5	6.17
	Total	**81**	100.00

Table 1: Extent of cost overrun and procurement types of the projects of reference

Range	Description	Frequency	Percentage (%)
≤40%	Low cost overrun	32	39.50
>40%≤80%	Moderate cost overrun	27	33.30
>80%	High cost overrun	22	27.20
	Total	81	100.00
	Procurement Type		
1	Design-bid-build	41	50.61
2	Design-and-build	23	28.40
3	Management Contracting	10	12.35
4	Construction Management	7	8.64
	Total	81	100.00

3.3. Relationship between Procurement Documentation Errors and Cost Performance

Given that the respondents indicated their opinions regarding the types of errors based on their experiences in completed projects, the effect of each type of error was regressed against the cost performance of each project. This analysis helped to confirm that the respondents' opinions regarding the types of errors (the ranking based on IoE) reflect the errors' eventual impacts on the cost performance of the projects.

To ascertain that ordinal regression could be used, the test of parallel lines was conducted on the data. The null hypothesis stated that there is no significant difference in the slope coefficients across response categories. The result of the analysis is shown in Table 4 indicating a chi-square value of 33.268, and *p*-value of 0.357 which exceeds the alpha-level of 0.05. Therefore, the null hypothesis was accepted with the conclusion that the proportional odds assumption was satisfied by the data. Similarly, deviance and Pearson's chi-square statistics were used to determine the fitness of the model. The two test statistics yielded *p*-values of 0.89 and 0.198 respectively leading to the acceptance of the null hypothesis that the model was adequately fitted.

Table 2: Impacts of Documentation Errors on Project Cost Performance

CODE	DOCUMENTATION ERRORS	N	SI	MS	IoE	R	p-value
E6	Error in project contextual factors, (not compatible with survey or roads)	81	0.71	3.58	2.542	1	0.243
E23	Errors in project time schedule	81	0.70	3.47	2.429	2	0.055
E18	Design error	81	0.58	4.10	2.378	3	0.680
E17	Discipline coordination problems (within the same discipline)	81	0.57	4.16	2.371	4	0.763
E19	Document does not conform to client's design criteria	81	0.59	4.00	2.360	5	0.406
E5	Wrong instructions to bidders	81	0.68	3.43	2.332	6	0.675

E15	Coordination problem (between disciplines)	81	0.59	3.86	2.277	7	0.713
E12	Document does not conform to vendor data	81	0.56	3.98	2.229	8	0.281
E4	Dimensional error	81	0.67	3.27	2.191	9	0.513
E13	Additional views / details needed	81	0.61	3.51	2.141	10	0.144
E9	Document does not conform with the law (such as documents do not comply with Public Procurement Law)	81	0.57	3.72	2.120	11	0.135
E16	Document does not conform to code	81	0.66	3.20	2.112	12	0.675
E11	Document does not confirm with building regulations	81	0.57	3.67	2.092	13	0.582
E3	Errors and omission in the bills of quantities	81	0.81	2.54	2.057	14	0.288
E30	Errors in method statement	81	0.57	3.57	2.035	15	0.821
E2	Non-conformity of documents to design calculations	81	0.77	2.56	1.971	16	0.564
E20	Callouts of the details are incorrect or missing	81	0.51	3.85	1.964	17	0.034
E1	Errors in capital cost estimating	81	0.80	2.44	1.952	18	0.066
E28	Errors in bid bonds	81	0.55	3.42	1.881	19	0.835
E7	Errors in specifications	81	0.73	2.56	1.869	20	0.353
E27	Errors in performance/advance payment guarantee	81	0.64	2.86	1.830	21	0.050
E26	Wrong order of precedence of contract documents	81	0.55	3.11	1.711	22	0.257
E10	Errors in symbols and abbreviations	81	0.57	2.91	1.659	23	0.997
E31	Missing or incorrect notes on the drawings	81	0.72	2.30	1.656	24	0.818
E21	Mistakes in the amendment of standard conditions	81	0.68	2.42	1.646	25	0.857
E8	CADD (Computer) related problem	81	0.58	2.80	1.624	26	0.531
E25	Error in/omission of dates/names/addresses	81	0.57	2.80	1.596	27	0.671
E24	Wrong references	81	0.64	2.47	1.581	28	0.796
E22	Lack of specificity regarding timelines	81	0.52	2.93	1.524	29	0.075
E29	Failure to appoint adjudicators/arbitrators	81	0.52	2.86	1.487	30	0.020
E14	Document does not conform to drafting standards	81	0.51	2.26	1.153	31	0.888

Table 3: Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	109.668			
General	76.400b	33.268c	31	0.357

As shown in Table 5, 7 types of error were found to have significant influences on the cost performance of projects. These were: errors in capital cost estimating (E1, p=0.006), wrong instructions to bidders (E5, p=0.035), errors in project contextual factors (E6, p=0.038), design errors (E18, p=0.002), coordination problem between disciplines (E15, p=0.007), errors in project time schedule (E23, p=0.023) and errors in method statement (E30, p=0.001). Ho1 of the study was; therefore, rejected for these error types, and it was concluded that a significant relationship exists between them and the cost performance of construction projects.
This means, for instance, that for every unit rise in *errors in capital cost estimating*, the odds of the cost performance becoming worse (i.e., the cost overrun becoming worse) increases by 0.095. Likewise, a unit rise in *wrong instructions to bidders* is associated with an increase of 0.072 increase in the chances of the cost performance becoming worse, every other variable in the model remaining constant. The magnitudes of the effects (Exp_B) of these two variables on cost performance as computed from their coefficients were 1.10 and 1.07 respectively.

3.4. Discussion

Based on the results, *errors in project contextual factors* are the most impactful errors on the cost performance of construction projects. An example of an error in contextual factors is where structural drawings were produced based on the wrong/inapplicable architectural drawing, or where a road project was designed using the wrong survey data. Where such an error is discovered at the construction stage its implications in terms of cost could be very serious. *Errors in project time schedule* have implications for the cost performance of projects particularly due to the extension of time-related preliminary items. This result supports the existence of a significant relationship between construction projects' cost and time as proposed by previous studies [34; 35]. *Design errors* often result from the haste with which construction drawings are prepared. Sometimes, conceptual designs are used for construction at the site-level in a bid to realize the project within the client-desired time. Design errors also arise from the works of junior/trainee engineers/architects whose works are not fully supervised by their more experienced principals, leading to redesigns/reworks with cost implications [36].
There are no significant differences in the respondents' opinions on the impacts of most procurement documentation errors on projects procured using the four procurement methods. Thus, the result supports [6] which found no differences in the causes of documentation errors for different procurement methods, but seems to differ from [16] which claimed that most documentation errors occur in design-bid-build projects. Apparently, even though more procurement documentation errors occur in design-bid-build projects, the eventual effects of the errors on the cost performance of the projects mostly do not vary for the procurement methods.
A significant difference was, however, found in the impacts of *callouts of the details are incorrect or missing* on the cost of projects procured using design-and-build method and management contracting method. The impacts were higher in design-and-build projects than in management contracting projects. Design-and-build contractors often do not go through the rigors of producing construction details, given the often absence of a consultant to check their works. However, the cost implications of errors arising from this are usually transferred to the client. In management contracting, the management contractor oversees the works of specialist sub-contractors ensuring that they produce required design details prior to site operations. Further, management oriented procurement ensures that the effects of documentation errors are restricted to work packages rather than being project-wide.

Table 4: Relationship between Documentation Error and Cost Performance of Projects

Parameter Estimates							95% Confidence Interval		
		Estimate	Std. Error	Wald	Df	Sig.	Lower Bound	Upper Bound	Exp_B
Threshold	[CP = 1.00]	9.095	2.253	16.292	1	0.000	4.679	13.511	8910.63
	[CP = 2.00]	11.152	2.401	21.567	1	0.000	6.446	15.859	69703.09
Location	E1	0.095	0.034	7.705	1	0.006	0.028	0.161	1.10
	E2	-0.034	0.032	1.123	1	0.289	0.097	0.029	0.97
	E3	0.004	0.029	0.017	1	0.895	0.053	0.06	1.00
	E4	-0.013	0.03	0.201	1	0.654	0.072	0.045	0.99
	E5	0.072	0.034	4.465	1	0.035	0.005	0.139	1.07
	E6	0.062	0.03	4.302	1	0.038	0.12	0.003	0.94
	E7	0.059	0.035	2.845	1	0.092	0.01	0.128	1.06
	E8	0.042	0.035	1.42	1	0.233	0.027	0.111	1.04
	E9	-0.012	0.029	0.169	1	0.681	0.068	0.045	0.99
	E10	-0.039	0.03	1.728	1	0.189	0.097	0.019	0.96
	E11	0.065	0.034	3.68	1	0.055	0.001	0.131	1.07
	E12	-0.03	0.028	1.133	1	0.287	0.086	0.025	0.97
	E13	0.063	0.036	3.16	1	0.075	0.006	0.133	1.07
	E14	0.035	0.031	1.271	1	0.260	0.026	0.095	1.04
	E15	0.092	0.034	7.249	1	0.007	0.025	0.159	1.10
	E16	-0.012	0.037	0.101	1	0.751	0.084	0.06	0.99
	E17	0.053	0.03	3.162	1	0.075	0.005	0.112	1.05
	E18	0.111	0.035	9.83	1	0.002	0.042	0.181	1.12
	E19	-0.002	0.033	0.003	1	0.958	0.067	0.063	1.00
	E20	0.011	0.031	0.135	1	0.714	0.05	0.073	1.01
	E21	-0.018	0.032	0.314	1	0.575	0.081	0.045	0.98
	E22	0.036	0.036	0.98	1	0.322	0.035	0.106	1.04
	E23	0.066	0.029	5.149	1	0.023	0.009	0.122	1.07
	E24	0.001	0.032	0.00	1	0.987	0.062	0.063	1.00
	E25	0.063	0.035	3.322	1	0.068	0.005	0.132	1.07
	E26	-0.015	0.013	1.281	1	0.258	0.04	0.011	0.99
	E27	0.001	0.031	0.002	1	0.968	0.06	0.063	1.00
	E28	0.029	0.027	1.164	1	0.281	0.024	0.082	1.03
	E29	-0.067	0.036	3.461	1	0.063	0.137	0.004	0.94
	E30	0.112	0.035	10.175	1	0.001	0.043	0.181	1.12
	E31	0.025	0.032	0.606	1	0.436	0.037	0.086	1.03

Link function: Negative Log-log.

Similarly, from the respondents' rankings, *failure to appoint adjudicator/arbitrators* affects the cost performance of design-bid-build projects more than management contracting projects. This outcome supports the suggested frequent adversarial relationships between parties to design-bid-build projects [37]. Although [38] opined that documentation errors may be more in management contracting projects due the emphasis on commencing site operations early, the findings of this study show that such errors have less effects on the cost outcome of a project than those for design-bid-build. Given management contractors' oversight powers over work package subcontractors, and the fact that payments for management contractors' services are fee-based [17], the eventual effects of documentation errors on management contracting projects are substantially reduced.

When related to the cost performances of the projects, it was observed that the procurement documentation errors significantly affecting project cost performance were: *errors in capital cost estimating, wrong instructions to bidders, errors in project contextual factors, design errors, coordination problem between disciplines, errors in project time schedule* and *errors in method statement*. This suggests that not all procurement documentation errors influence the cost performance of construction projects. Ogbu and Ebiminor [14] found that errors in bills of quantalities lead to construction disputes. Complimenting, the results of this study show that errors in estimating are significantly responsible for cost overruns, and this leads to disputes. The result also aligns with Love et al.'s (2012) demonstrations of instances where coordination problems between engineers and architects led to expensive cost overruns in building projects.

4.0 Conclusion

Documents will remain relevant in the consummation and execution of construction contracts in the foreseeable future. While documentation errors are undesirable, they do occur given human's proneness to error. This study determined the impacts of procurement documentation errors, and related the claimed impacts to the cost performance of the projects reported on. The outcomes of the study showed that the respondents consider *Error in project contextual factors, Errors in project time schedule* and *Design error* as the procurement documentation errors with the highest impacts on the cost performance of projects. It was further observed that out of the 31 errors studied, only the impacts of *callouts of the details are incorrect or missing* and *failure to appoint adjudicator/arbitrators* differed for different procurement methods. Their impacts were significantly lower in management-oriented contracts.

Seven (7) of the documentation errors were found to have significant impacts on the cost performance of the projects. These were *errors in capital cost estimating, wrong instructions to bidders, errors in project contextual factors, design errors, coordination problem between disciplines, errors in project time schedule* and *errors in method statement*.

The outcome of this study underscores the importance of ensuring that project participants are fully informed about all contextual factors surrounding a project, and granted access to relevant documents for making well-informed documentations on the project. Construction consultants and planners should take steps to ensure that design errors are minimized, and project time scheduling should be taken more seriously. From this study, clients can observe that errors in design and time scheduling do have financial consequences. As a result, more attention should be given to both design and scheduling of construction projects with a view to curbing the occurrence of errors. Contractors should carefully examine construction drawings and other procurement documents for errors before bidding in order to mitigate possible financial consequences that can arise from documentation errors.

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