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PRINCIPAL COMPONENT ANALYSIS OF FACTORS CONTRIBUTING TO INCOMPLETE CONSTRUCTION PROJECT CONTRACTS IN LAGOS, NIGERIA

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Abstract

An incomplete construction project contract affects the early completion of construction projects, leading to abandonment. Hence, this study assessed the factors contributing to the incomplete construction project contracts in Lagos, Nigeria. A quantitative research design was used, and questionnaire was designed to retrieve data from the respondents. Two hundred and ninety-three questionnaires (87.5 %) were retrieved, distributed through Google Forms to the respondents in Lagos, Nigeria. Descriptive and exploratory factor analysis were used in analyzing the data retrieved. A one-way ANOVA test and a Least Square Design (LSD) posthoc test was also used to measure the significant difference between group responses. The principal component analysis findings established four components of factors contributing to incomplete construction project contracts: 1) inadequacy, 2) vagueness of project parties' responsibilities, 3) indecisiveness and 4) renegotiation. The study's practical implications provide construction companies with a benchmark to measure their performance against industry standards on construction project contract management, helping them set realistic goals and identify areas of incompleteness for continuous improvement.

1.0 INTRODUCTION

A contract is a usual practice in construction transactions. The construction industry adopts forms of contract, which help to facilitate contractual arrangements between contracting parties in a construction project [1]. According to [2], these parties include the clients' representatives, experts' bodies, and the built environment professionals. The goal of building projects, as perceived by diverse stakeholders, is to finish them using a variety of procedures with varying stages and phases of work [3]. Thus, construction projects need the various groups' conscientious efforts to realize projects within the specified time [4]. Sharkey *et al*, [5]

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maintained that these contract forms only give room for some individual project's varied specifics. Furthermore, [1] established that every individual project's varying specific may practically not be allowed on contract forms. However, there may be need for necessary amendment due to construction projects' characteristics' diverse nature and uniqueness. Hence, there is a need for a paradigm to minimize the adverse effects of changes in construction projects contracts.

According to [6], a contract is an instrument utilized to change a set of goals at the pre-contract stage into the rules enforceable at the post-contract stage, thus implying that the contract is a bridge that links both the pre-and post-contract phases. It could be complete or incomplete [7]. A complete contract is a contract that states each group's rights and obligations and does not need alteration, renegotiation, or additional agreement. At the same time, the latter is a contract that fails to state the party's requirements, duties, and obligations for every contingency. Titus *et* al, [7] noted that an incomplete contract has positive and negative effects. Both phenomena apply to the construction industry. In the context of the incomplete contract, [8] opined that it manifests as a result of the projects long duration, high risk or uncertainty, transaction high cost, bounded rationality, asymmetric information, and lack of trust. According to [7], an incomplete contract refers to contract that fails to address parties' rights and obligations, has gaps, lacks provision and is ambiguous in its terms and conditions.

Furthermore, [8] noted that incomplete contract happens when contracts have loopholes (gaps), vague (ambiguous), additional workload and changes, and there is negotiation. These are referred to as the characteristics of an incomplete contract. Han and Yin, [9] state that incomplete contracts expose contracting parties to disputes, moral hazards, or adverse selection. An incomplete contract can exploit construction project loopholes by exposing the contracting parties to opportunistic motive that could affect project success [7]. Given the associated uncertainties of an incomplete contract among the construction professionals, it is imperative to address incomplete contract factors that alter contract completeness. This study aims to close the gap in the literature by empirically analyzing incomplete contract traits in a single study, despite the fact that previous research has mostly focused on the individual underlying root causes of various contract incompleteness factors, such as disputes, inconsistency, defectiveness, and refusal to changes [7, 10]. Thus, this study's goal is to evaluate the variables associated with incomplete construction project contracts in Lagos State Nigerian construction sector.

Chang, [6] emphasized that a contract needs control over the relationship regarding a project since a dispute in contract management can cause an incomplete contract. Therefore, renegotiation resulting from changes in the scope of work may cause the contract to become incomplete [11]. Renegotiation is how project parties achieve benefits that bring additional costs, manpower, and time and may cause inefficient decisions [12]. Contract incompleteness can also occur when extra work is done outside the scope of work, and the contract has uncleared obligations [7] and an unclear agreement [13]. Love *et al*, [14] pointed out that time and cost overruns result from variations and additional works in construction projects. Other researchers highlighted lack of provisions for preventive works by the contractors, and lack of provision for rules to evaluate work changes [4]. Incomplete contracts in construction projects also occur due to the inability to clarify the project contract that leads to parties' failure to comply with contractual responsibilities [2].

In addition, human (contracting parties) participation in a project is essential and may be limited by complex issues. This is referred to as bounded rationality. This lapse occurs because of the contract's incompleteness [15]. Asymmetric information, a lack of project parties possessing an equal amount of information, is another factor to incompleteness [16]. Thus, it exposes project parties to opportunism. Similarly, trust improves performance by fostering organizational relationship and cooperation and reducing opportunistic behaviour that minimizes transaction cost i.e contract signing and execution costs. Likewise, sophisticated designs, top-notch technological demands and high client demand promote contract incompleteness [17]. Furthermore, when there is clarity in the risk allocation, obligations, and responsibilities of the parties in a construction contract, completion is envisaged to occur [18]. [19] noted that a contract provision should deal with all possible contingencies regarding obligations, rights, responsibilities, and risk perceptions of the parties involved. Thus, implying that construction contracts must be completed to deal with unforeseen contingencies. Further, clarification in the drafting process helps to avoid disagreement among parties

during project execution. However, incomplete contracts in construction projects also occur due to a lack of rules guiding the evaluation of prime cost, provisional sums and quantities, unclear work specifications, and unspecified adopted means for measuring completed works [4]. Thus, the above offers a summary of selected factors associated with incomplete construction project contracts.

2.0 METHODOLOGY

A quantitative research design was adopted for the study using the convenience sampling technique. The method was utilized based on time limitations, cost implications, and the need to gather sufficient data from the large population of the study to generalize the findings. Also, [20] emphasized that studies that are based on quantitative methods can be replicated and compared. The respondents were the construction industry experts that comprised the sample frame. Lagos serves as the research area and is regarded as Nigeria's commercial hub and is home to numerous construction companies that engage in a significant amount of construction activity [21]. The purpose of the questionnaire was to give respondents a list of elements to rank according to their personal experiences, perceptions, and understanding of contract incompleteness. Using Google Form, 335 copies of the questionnaire were sent to the target professionals working for government agencies, contracting organizations, consulting firms, and academic institutions. Two hundred and ninety-three (293) copies of the questionnaire were returned, representing an 87.5% response rate, which was found adequate and acceptable for an online research survey, as opined by [22], who claimed that social research responses below 30%–40% are considered as biased. After the questionnaire was retrieved, it was cleaned and reviewed to ensure that the 293 replies were appropriate for research. With the Statistical Package for Social Sciences (SPSS) version 27 software, the frequency analysis of the raw data was carried out.

There are two sections to the questionnaire. The demographic data of the respondents is covered in Section A. Respondents' opinions on the frequency of twenty-four elements that have been identified as the cause of contract incompleteness in Lagos State, Nigeria, were solicited in Section B. Using a five-point Likert scale, the respondents were asked to indicate how much these factors contribute to incomplete construction project contracts in their companies: 1 was extremely low, 2 was low, 3 was average, 4 was high, and 5 was very high. Both factor analysis and descriptive analysis were used to evaluate the returned data. First, the Shapiro-Wilk (S-W) test for normality was used to assess the data's normality. This aids in selecting the kind of data analysis that should be done. The background information provided by respondents was analyzed using descriptive statistics. Subsequently, a one-way ANOVA test and a post-hoc Least Square Design (LSD) test were used to determine the significant difference between the group replies. The variable that contributes to the overall significant difference between respondents from the evaluated organization was identified with the aid of these tests. For the Likert questions, the mean item score (MIS) was used to transform the answers into readily analysed data. To do this, the total of all the weighted answers on particular factors was computed. The MIS values were arranged chronologically, which made it easy to compare how experts addressed the factors of contract incompleteness in the construction sector. Furthermore, the Kaiser-Mayor-Okline (KMO) and Barletts's tests were also evaluated. The reliability of the collected data was measured using the Cronbach alpha. Factor analysis (PCA), the second part of the analysis, was done to regroup the incomplete contract factors in this study into a more significant subscale [23]. PCA is a statistical analysis tool that may be used to reduce big data sets into clusters by examining the variables' basic theoretical structure and highlighting the relationships between each variable and the respondents [24]. The factor analysis is appropriate when the cut-off value of KMO is greater than or equal to 0.7 [26]; significant level of Bartlett's test is less than 0.0001 for factor appropriateness [25], and the Cronbach alpha minimum value is 0.7 [26]. The principal component analysis (PCA) with oblimin rotation as the rotation method was utilised to rearrange the twenty-four (24) factors into four (4) distinct groups.

3.0 RESULTS AND DISCUSSION

3.1 Background Information

This section examines the respondents' demographic characteristics. The data shows that respondents who work for government agencies make up 44.4%. Concurrently, there are 26.3%, 16.0%, 8.9%, and 4.4% of people working for consultancy, construction, contracting, and consortia firms, respectively. Furthermore, an examination of the respondents' present occupations shows that engineers make up the bulk of the respondents (48.8%), followed by quantity surveyors (18.4%), project managers, architects, and

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builders, who round out the list at 11.9%, 10.6%, and 10.2%, respectively. Also, the study reveals that the respondents possess varying levels of academic qualifications ranging from 36.9% of respondents had bachelor's degrees, 32.8% had master's degrees, 15.7% held Higher National Diplomas (HNDs), Ordinary National Diploma (OND) at 8.2%, 5.1%, and 1.4% completed the list, followed by Postgraduate Diploma (PGD) and Ph.D. It has been found that from 293 respondents, only 42% of the respondents had less than five years of job experience, while the remaining 58% had more than five years. The demographic characteristics of the respondents suggest that many of them are involved in public (government) projects, and the majority have advanced work experience in the built environment. Participants are deemed appropriate for this study based on their occupation, educational attainment, and years of experience.

3.2 Level of Occurrence of Identified Factors

The study reveals the perceived level of occurrence of the influencing factors contributing to an incomplete contract of construction projects (Table 1). The most highly ranked factor for Engineer is "time and cost overruns" with a mean value of 3.16.

The absence of emphasis on more efficient project management techniques that reduce unforeseen delays and expenses in building projects could be the cause [27]; Project Manager is "unclear decisions on additional costs, manpower and time" with a mean score of 3.57; Quantity Surveyor is "time and cost overrun" with a mean score of 3.65. Others include architects having "time and cost overruns" as the highly ranked factor with a mean value of 3.58, and Builders with a mean score of 3.53, the most highly ranked factor being "time and cost overruns." It could be deduced that there is an agreement among the professionals on the most influencing factor responsible for the incomplete contract. In addition, the overall highest ranking for all the professionals is "time and cost overruns," with a mean value of 3.46.

Table 1: Level of Occurrence of Identified Factors Responsible for Incomplete Contract

Identified factors	Engineer		PM		QS		Architect		Builder		Overall	
	M	*R*	*M*	*R*	*M*	*R*	*M*	*R*	*M*	*R*	*M*	*R*
Time and cost overruns	3.16	1	3.40	2	3.65	1	3.58	1	3.53	1	3.46	1
Unclear decisions on additional costs, manpower, and time	3.01	4	3.57	1	3.56	2	3.23	10	3.30	3	3.33	2
Difficulty in foreseeing future contingency	3.05	2	3.31	3	3.52	3	3.03	22	3.37	2	3.26	3
Unspecified contractors' entitlement to time extension due to delay caused by the client	3.03	3	3.11	8	3.22	13	3.58	1	3.30	3	3.25	4
Unclear changes in the specification of work	2.89	11	3.06	11	3.39	6	3.42	4	3.20	8	3.19	5
Inability to deal with possible contingencies	2.90	9	3.03	12	3.30	11	3.35	5	3.30	3	3.18	6
Lack of equal amount of information to the project parties	2.84	13	3.23	4	3.35	8	3.29	7	3.03	16	3.15	7
Increase in client top-notch technological demands and sophisticated designs	2.82	17	3.20	6	3.07	21	3.45	3	3.23	7	3.15	7
Unclear risk of uncertainty	2.92	6	3.09	10	3.15	17	3.26	9	3.27	6	3.14	9
Lack of contracting parties to information about the project due to complex problems	2.91	8	3.03	12	3.39	6	3.35	5	3.03	16	3.14	9

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Unclear contracting parties' obligation in the contract	2.84	13	3.23	4	3.28	12	3.10	19	3.17	10	3.12	11
Unforeseen ground and adverse weather conditions	2.97	5	2.97	17	3.22	13	3.23	10	3.20	8	3.12	11
Not addressing the differences in the understanding and interpretation of terms	2.77	22	300	15	3.33	9	3.13	17	3.13	12	3.07	13
There is a lack of rules to evaluate the professional sums and quantities and the prime cost	2.83	16	3.20	8	3.09	20	3.23	10	2.97	18	3.06	14
Unclear agreement	2.84	13	2.86	21	3.41	5	3.23	10	2.90	23	3.05	15
Unclear scope of work	2.82	17	2.94	18	3.44	4	3.03	21	2.97	18	3.04	16
Lack of trust from the parties involved	2.80	19	3.00	15	3.33	9	3.13	17	2.93	21	3.04	16
Clear evidence of ambiguity in the responsibilities of the project parties	2.90	9	2.91	19	3.22	13	3.00	22	3.13	12	3.03	18
A clear appearance of opportunistic behaviour	2.80	19	3.11	8	3.00	24	3.16	16	3.07	14	3.03	19
Lack of provision for preventive works by the contractors	2.92	6	3.03	12	3.04	22	3.23	10	2.80	24	3.00	20
Lack of clarification in the drafting process	2.69	24	2.86	21	3.11	18	3.23	10	3.07	14	2.99	21
Lack of provision for rules for evaluation of work changes	2.80	19	2.89	20	3.04	22	3.29	7	2.97	18	2.99	22
Unspecified means for measuring completed projects	2.74	23	2.80	24	3.11	18	3.10	19	3.17	10	2.98	23
Dispute and conflict in contract management	2.89	11	2.86	21	3.19	16	2.74	24	2.93	21	2.92	24
GRAND MEAN	**2.88**		**3.07**		**3.26**		**3.22**		**3.12**		**3.11**	

Key: QS (Quantity Surveyor); PM (Project Manager); M (Mean); R (Rank)

3.3 One-Way Anova Test

In order to ascertain the differing opinions among the professionals (that is comparing the means of different factors), a one-way ANOVA test was employed [28]. First, a test of normality was conducted and the analysis showed that the data was normally distributed. The result indicates an F-value of 4.143 with an asymptotic significance P-value of 0.003, less than 0.05 [28]. Thus, showing a significant difference in the professionals' responses on the level of occurrence of factors causing incomplete contracts.

3.4 Least Square Design (LSD) posthoc Test

As a follow-up to the ANOVA, the Least Square Design (LSD) posthoc method was employed to check the difference between group means calculated after ANOVA that shows an overall difference (multiple comparisons) [28]. The analysis indicates that two groups of respondents show statistically significant differences in the perceived level of occurrence of the factors responsible for contract incompleteness. The first group consists of Engineer and Quantity Surveyor with a *p-value* of 0.000, while the second group comprises Engineer and Architect with a *p-value* of 0.012.

3.5 Factor Analysis

Factor analysis was employed to identify and reduce a large set of variables into a small coherent subscale by establishing the variables of the exact underlying dimensions [29]. To achieve factors for incomplete construction project contracts in the construction industry, the twenty-four (24) identified incomplete

construction project contract factors were subjected to exploratory factor analysis (EFA). Outcomes of the EFA on incomplete construction project contract elements in the Nigerian construction industry (NCI) presented the Kaiser-Meyer-Olkin (KMO) and the Bartlett's test of sphericity to determine the adequacy of the data. According to [24] and [28], 0.6 is the minimum value for KMO and for Bartlett's test of sphericity, it must be significant at *p-value* < 0.05. Based on this, the KMO test gave a result of 0.944, while the Bartlett test gave a significant level of 0.000. Thus, providing appropriateness and factorability of the used data. In addition, the reliability of the research instrument was determined using Cronbach's alpha; it gave a value of 0.935.

With an extraction value of at least 0.500, the study also captured the communalities of the variables that described how the variables were determined. According to [22], this extraction value was employed in comparable research and proved to be successful. As a result of no variable having a low extraction value, cross-loading, or improper loading, the factor loading was reliable. Similarly, there is no variation in the variables, and each variable fits well with their respective components.

The factors contributing to incomplete of construction project contracts in the NCI were indicated by the total variance explained with respect to their eigenvalues. In this investigation, the Kaiser's criterion of remaining components with eigenvalues higher than 1.0 was also applied. The variance of the four components that were retrieved are component 1 (40.406), component 2 (6.500), component 3 (4.482), and component 4 (4.463). About 55.851% of the variation is explained by the statistics of the eliminated components and PCA. The direct oblimin rotation of the four components was applied, and the rotation was selected based on the correlation between the twenty-four (24) variables. The variables grouped under each cluster of the four components jointly discovered in the total variance explained are displayed in the pattern matrix (Table 2) as an outcome of the direct oblimin rotation.

Table 2 reveals the factor loadings of every variable under the cluster of four components identified in the total variance explained. The maximum items loading on the four components are displayed, thus signifying that identified items are the highest ranked factors contributing to incomplete construction project contracts. The principal component analysis revealed the presence of four components with eigenvalues greater than one (Table 2). Each component's underlying factors were carefully noted and given new names as follows: Component 1: Contractual ambiguities and Inadequacy factors; Component 2: Vagueness of project parties' responsibilities; Component 3: Indecisiveness factors and Component 4: Renegotiation factors.

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Table 2: Rotated Component Matrix

Variables	Component			
	1	2	3	4
Lack of provision for preventive works by the contractors	0.746			
Lack of clarification in the drafting process	0.676			
Unclear changes in specification of work	0.652			
Not addressing the differences in the understanding and interpretation of terms	0.649			
Increase in client top-notch technological demands and sophisticated designs	0.623			
Lack of provision for rules to evaluate work changes	0.607			
Lack of rules to evaluate the professional sums and quantities as well as the prime cost	0.573			
Inability to deal with possible contingencies	0.570			
Lack of trust from parties involved		0.665		
Clear evidence of ambiguity in the responsibilities of the project parties		0.631		
Unclear contracting parties' obligation in the contract		0.594		
A clear appearance of opportunistic behavior		0.578		
Lack of contracting parties to information about the project due to complex problems		0.570		
Unclear risk of uncertainty		0.547		
Unclear agreement		0.528		
Unspecified means for measuring completed projects		0.512		
Lack of equal amount of information to the project parties		0.509		
Dispute and conflict in contract management			0.736	
Unclear scope of work			0.700	
Unclear decisions on additional costs, manpower, and time			0.628	
Unforeseen ground and adverse weather conditions				0.609
Time and cost overruns				0.585
Difficulty in foreseeing future contingency				0.564
Unspecified contractors' entitlement to time extension due to delay caused by the client				0.547

Extraction Method: Principal Component Analysis; Rotation method: Oblimin with Kaiser Normalisation;

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4.0 IMPLICATIONS OF EXTRACTED COMPONENTS

4.1 Component 1- Inadequacy factors

A total of eight factors loaded onto this cluster (Table 2). These variables address construction contract insufficiency termed **Contractual Ambiguities and Inadequacy Factors.** This cluster has a total variance of 40.406%, making it highest ranked factor contributing to contracts incompleteness. These factors relate to the state of incompleteness to be addressed in project contract in Nigeria with a view to ensure complete contract provisions. This categorization agrees with the findings of [4] and [2] who asserted that construction contracts adequacy can be achieved if there is clarification in the drafting process, work specification as well as contracts provision that makes contingencies possible. Titus *et al*, [8] and Amoah and Nkosazana, [11] also concluded that refusal to adapt to changes and lack of provision for rules on additional work contribute to contract incompleteness. Hence, to halt projects incompleteness, rules and guidelines that limit the breeding grounds should be lay down.

4.2 Component 2- Vagueness of Project Parties' Responsibilities

As shown in Table 2, this component has a total of nine factors that are all related to the second cluster. These factors account for 6.5% of the total variance. The common factor to the variables in this component is the project parties' responsibilities. Based on the latent similarity amongst these variables in addressing incomplete contract factors, this cluster is therefore labelled **Vagueness of Project Parties' Responsibilities**. This study found that unclear contracting parties' obligation in the contract is one of the most significant factors for incomplete construction project contracts. This is in agreement with the previous work [11] who emphasized that the participants to a construction project should endeavour to comprehend and manage the assigned risks and obligations as soon as the contracts are signed. Therefore, this aids in the accomplishment of project goals by all parties involved and reduces the likelihood of adverse consequences on the construction project's performance in terms of cost, schedule and quality outcomes. Likewise, it is recognized that human behaviour must be trusted in order for human interaction to occur and for project results to be achieved [30]. Unfortunately, trust does not play its role because of the presence of formal laws and regulations that should promote innovation by encouraging collaboration and fostering tolerance for failure [31]. Therefore, the need to complement formal laws and regulations with informal to minimize contract incompleteness in the Nigerian construction industry becomes a pertinent issue to uphold trust. Furthermore, lack of equal amount of information to the project parties is a factor for incomplete construction project contracts; once there is dearth of detailed information and specification of the works, indicate a critical contract-related disputes [11].

4.3 Component 3- Indecisiveness Factors

This cluster has three factors loaded (Table 2). The variables relate basically to unclear issues by the contractors and are therefore labelled **Indecisiveness Factors.** This cluster gathered 4.482% of the total variance and ranked third. As pointed out by [12], incompleteness of construction project contracts is as a result of unclear scope of work. This was also corroborated by the opinion of [32], namely that unclear scope of work affects the incompleteness of construction projects. Furthermore, the study discovered that dispute and conflict in contract management is a factor for construction project contracts incompleteness. [33] described both as disagreements over interests or ideas, which if not appropriately managed, could destroy long-term corporate relationships as well as cause project delays, low team morale, and increase project costs. As a result, conflict resolution during project operations is common and needs to happen right away on the project site.

4.4 Component 4- Renegotiation Attributes

The last component consists of four variables (Table 2). These are factors that are related to clients/owners of the project, they are termed **Renegotiation Factors.** This cluster had a total variance of 4.463% which makes it the lowest-ranked classification of factors contributing to incomplete construction project contracts. Accordingly, [7] asserted that incomplete contract exposes the parties involved to renegotiation which requires additional cost, time, and manpower. This view is supported by [34] opining that errors due to time and cost overruns are as a result of errors in design and incomplete contract drawings which results in construction project delays that influence contract incompleteness. As pointed out by [35], unforeseen ground and adverse weather conditions affect contract project completeness. [36] corroborated that unexpected or extreme weather typically has a negative effect on project contract incompleteness since it jeopardises the interests of the project owner and contractor productivity.

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5.0 CONCLUSION

The study's main objective was to assess the factors contributing to incomplete construction projects contract in Lagos, Nigeria. The study used a questionnaire survey to evaluate 24 factors contributing to incomplete construction project contracts, further grouped into four distinct components. The study concludes that to prevent contractual risks in construction projects arising from many factors, significant attentions must be devoted to the scope of work, disputes and conflict resolutions, trust among professional that encourages human interactions and communication and there should be no room for uncertainty that breeds opportunistic behaviour. Future research can use the four main clusters identified as a base to expand upon, given there are few studies on incomplete contract factors in the context of the NCI. Although the study adds to the body of knowledge on factors contributing to incomplete construction project contracts, its findings are constrained by the sample size and distribution. This is because of time and financial restrictions; the study was only conducted in one state. The extent of this study was constrained by the accessibility of specialists and the lack of expertise at the pre-contract stage in other states. As a result, the conclusions of this study cannot be generally applied to the Nigerian construction sector.

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