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CONSTRUCTION DISPUTE AND CONTRACT DOCUMENT DEFECTIVENESS: TESTING MODERATING EFFECT OF BIM

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Abstract:

Construction dispute is the result of contract incompleteness caused by bounded rationality and uncertainty. These disputes are prevalent and have a detrimental effect on project success in terms of increased cost, low quality of work, loss of profit, time extension, and damaged business and professional relationships. Using Structural Equation Modelling (SEM), this study examines the relationship between contract defectiveness (one of the bounded rationality classes) and dispute occurrence and the moderating effect of BIM on the causal relationship. The result shows that contract document defectiveness has a significant effect on dispute occurrence. Likewise, the multigroup moderation test revealed a significant, positive, and more substantial impact on the BIM user group. Therefore, it can be posited based on this study's findings that BIM has a significant effect on reducing contract document defectiveness, which is one of the potential benefits of its adoption on construction projects.

Keywords:

Dispute 1, Contract Incompleteness 2, BIM 3

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Introduction

Construction disputes resulting from contract defectiveness are not bizarre. These disputes are prevalent, endemic, and bring adverse effects on project performance in terms of increased cost, low quality of work, loss of profit, time extension, damaged business and professional relationships (Sai On Cheung & Pang, 2013). Modern contracts with the advent of technological development are complex, given the rising to complex activities in a fragmented environment with a high uncertainty level (Mashwama, Aigbavboa, & Thwala, 2016). The complexity in the construction project, accuracy of contract document in a futuristic environment is always challenging and, most time leads to disputes (Ejohwomu, Oshodi, & Onifade, 2016). Hughes, Murdoch, and Champion (2015) define contract documents as the mechanism by which designers' intentions are transmitted to the client, the statutory authorities, the quantity surveyor, the contractor, and subcontractors. While contract document is expected to convey the intention of designer to different parties, complex contracts are in most cases invariably incomplete.

Yates (1998), based on Transaction Cost Economic Theory (TCE) (Williamson, 1983), posited that complex contracts are invariably incomplete, particularly those executed over a long period. A contract is incomplete when, at the inception, it does not explicitly define all the parties' requirements and obligations in any possible future state of the world. When events arise during the contract's execution, the parties' complete requirements and obligations are understood, and necessary modification and adaptation are needed. Predictably, such behaviour results in conflict and dispute. Cheung (2014) likewise used TCE theory to conceptualize contractual and speculative disputes and suggested that contracts' incompleteness is a fundamental element in both disputes. The study concluded that contract incompleteness caused by bounded rationality and uncertainty are the underlying root cause of disputes.

Bounded rationality is the human limitation to foresee all future occurrences at the outset of the project (Williamson, 2014), while uncertainty is the difference between the amount of information required to do the task and the amount of information already processed by the organization (Galbraith, 1973). When there is ambiguity, the contract is open to differing interpretations of performance requirements among the contracting parties (Howell & Mitropoulus, 2001). While contract incompleteness cultivates unseen perils, opportunism may manifest through violation of contractual requirements.

Contract incompleteness sets the stage for opportunism. Cheung (2014) defines opportunism at work as a situation when an individual attempts to maximize his interest in any situation where he could gain one way or another. Opportunistic behaviour may yield to post-contractual manipulation of contract terms to affect the other party's unexpected transfer of wealth. The concept of bounded rationality is broken down into four major classes: *ambiguity, deficiency, inconsistency, and defectiveness*. While contract incompleteness cultivates the problems, opportunism manifests through *violation of commitment, forced renegotiation, evasion of obligations, and refusal to adapt*.

Several standards and methods have evolved with the presentation and documentation of construction information over the years. The traditional/ manual setting provides 2D drawings and written instructions to build what the designer has visualized in his head. This seems to be an imperfect way of information sharing, planning, and building complex project. Similarly, 2D drawing required translation of each instruction in one's head until the resulting instruction

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is visualized and built correctly. The translation of each instruction between team members may lead to error. Additionally, the traditional setting cannot visualize and verify the coordination process before the actual construction. Therefore, most projects have many requests for information (RFI) about the documentation of the project, and there is the expectation of dispute (Kymmell, 2008).

Building Information Modelling (BIM) offers a paradigm shift from the traditional settings rooted in 2D drawings. It is a process based on the software application that changes designing and building(Saka, Chan, & Siu, 2019). Moreover, it offers an efficient, faster design process, with fewer errors and safer construction. According to Charehzehi, Chai, Yusof, Chong, & Loo (2017). BIM approach can control conflict causes before the occurrence of dispute. Furthermore, BIM virtual design & construction (VDC) gives access to all information regarding the project, with this area of conflict can be identified easily. (Sacks *et al.*, 2018).

Therefore, this study intends to examine the relationship between contract document defectiveness (CDD) as one of the classes of bounded rationality and dispute occurrence (DOC) and examine the moderating effect of BIM on the causal relationship using multigroup moderation in Nigeria construction industry. The following hypothesis using Structural Equation Modelling (SEM) will be tested in this study.
$H_{1:}$ **CDD** has a significant effect on **DOC**
$H_{2:}$ BIMuse moderate relationship between **CDD** & **DOC**

Methodology

Measuring Instrument

Two constructs related to construction disputes and contract incompleteness are incorporated in the proposed model. The two constructs were measured using a total of 13 questions. The first parts cover the demography features of the sample as seen in Table 1, while the second part covers the responses to the questions which are measured using a five-point Likert scale ranging from "1 = strongly disagree" to "5= strongly agree" (Brown, 2010) with 6 and 7 items measuring each construct respectively.

Table 1: Demography Characteristics of the Sample

Demography	Frequency	Percentage
BIM Use		
BIM User	140	45.3
Non-BIM User	169	54.7
Years of Experience		
1-10Years	73	23.6
11-20Years	112	36.2
21-30 Years	65	21.0
31-35Years	41	13.3
Above 35 Years	18	2.5
Certificate		
OND	73	23.6
HND	112	36.2
BSc	65	21.0
MSc	41	13.3

Journal of Information System and Technology Management
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Ph. D	18	5.8
Reg. Body		
QSRBN	56	18.1
ARCON	56	18.1
COBON	48	15.5
COREN	53	17.2
NIESV	44	14.2
PMI	52	16.8

Data Analysis

Structural equation modelling (SEM) was employed for the analysis of the study. SEM is a useful statistical tool that allows the evaluation and simultaneous estimation of multiple equations encompassing factor analysis, multiple regression analysis, and path model analysis (Joe F.Hair, Matthews, Matthews, & Sarstedt, 2017). The software allows testing the whole relationship among latent constructs that are indicated by multiple measures in a research model as well as differentiating between a direct and indirect.

Exploratory Factor Analysis (EFA)

The EFA using Promax rotation shows that all variables have good loadings, observe fairly normal distributions for the latent factors and all variables in terms of skewness and kurtosis as there no values above +/-2.2 as the normality threshold (George & Mallery, 2019). As shown in Table 2, the KMO and the chi-square result are significant indicating the suitability to conduct the EFA. Reliability and Discriminant validity of the variables appears good as the loading has a clean pattern structure obvious by the high loading factors above 0.7 and no cross-loading of the items (Reid, Stephanie, Lewis, & Armstrong, 2007).

Table 2: Pattern Matrix

Pattern Matrix[a]

Cronbach's alpha	**Component**	
	0.910	0.903
CDD1		.864
CDD2		.865
CDD3		.870
CDD4		.727
CDD5		.825
CDD6		.897
DOC1	.819	
DOC2	.829	
DOC3	.863	
DOC4	.832	
DOC5	.762	
DOC6	.749	
DOC7	.711	

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Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Structural Equation Modelling (SEM) Analysis

Model Fit

The loading for the 2 constructs has a significant loading ≥ 0.60. Modification indices were accessed to determine if there was a prospect to improve the model. Consequently, items e1, e3, e9 & e14 were deleted and e11 & 12 were covaried to obtain goodness of fit for our measurement model as shown in Figure 1

Validity and Reliability

Table 3 shows that the average variance extracted (AVE) ranges from 0.554 to 0.635 indicating that all values are more than the recommended 0.50 levels and no convergent validity issue (Niemand & Mai, 2018). Testing for discriminant validity, the square root of the AVE is compared to all inter-factor correlations. The result shows that mean shared variance (MSV) is significantly lower than the AVE and established discriminant validity for the study. Likewise, the composite reliability (CR) was computed and it shows that the CF is above the 0.7 thresholds indicating we have reliability for all constructs (Joe F.Hair et al., 2017)

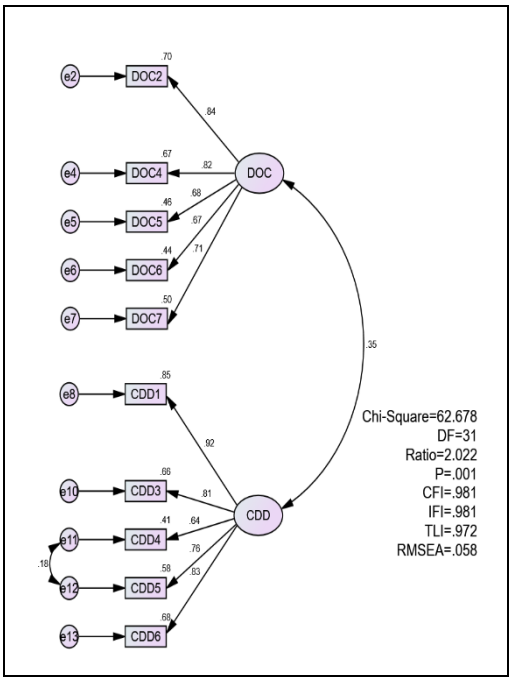

Figure 1: Measurement Model

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Table 3: Reliability and Validity

	CR	AVE	MSV	MaxR(H)	DOC	CDD
DOC	0.860	0.554	0.122	0.875	0.744	
CDD	0.896	0.635	0.122	0.921	0.350***	0.79

Invariance Test

Since the study will be considering moderating the structural model with categorical variables, we conducted a configural invariance test. The model fit with group loaded separately was good ($\chi 2/DF = 1.422$; CFI =0.979) signifying that the model is configurally invariant. likewise, after constraining the model to be equal, we discovered the chi-square difference test to be significant (p=0.013) as shown in Table 4, consequently, our measurement model satisfies the metric variance across the group.

Main Result

Figure 2 shows the results of the structural model with standardized parameters. The model displays a good fit (Joe F.Hair et al., 2017). The probability of getting a critical ratio as large as 5.615 in absolute value is less than 0.001. In other words, the regression weight for **CDD** in the prediction of **DOC** is significantly different from zero at the 0.001 level (two-tailed). Hypothesis **H_1** is supported and confirms the assertion of contract incompleteness as the cause of construction dispute as posited by Yates (1998) and Cheung & Yiu (2014).

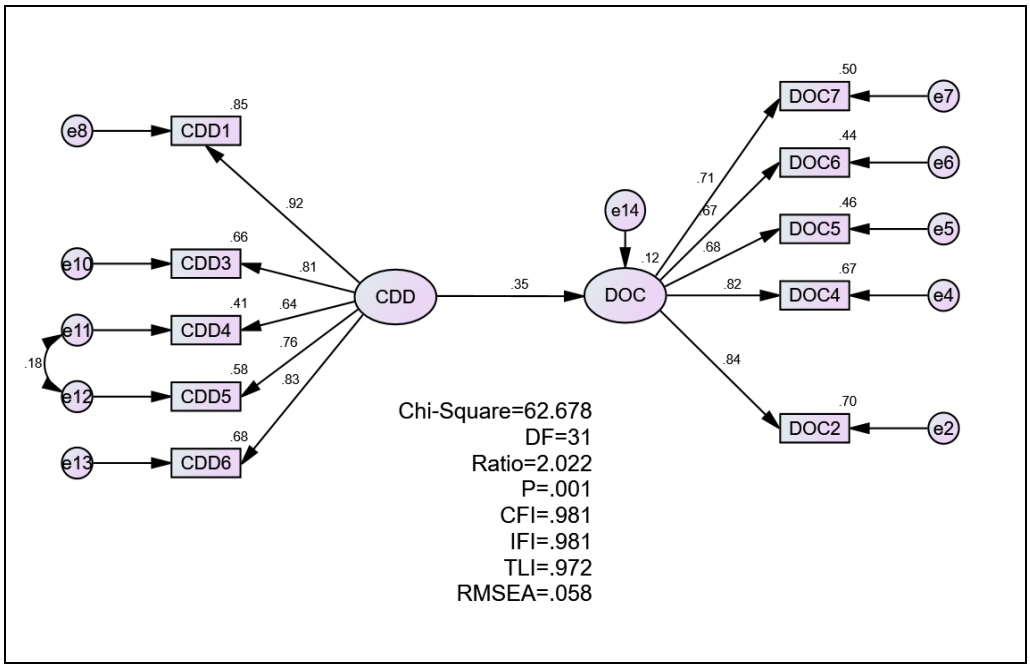

Figure 2: Structural Model

Multigroup moderation test was carried out for the model. The model was divided into two groups based on the moderator variable, as shown in figure 3. To test the moderation effect, the critical ratio for the constrained and unconstrained model was generated. From these critical ratios, the chi-square value between the constrained and unconstrained models is more than 3.84, as shown in Table 4. The result shows that moderator variable BIMuse significantly and

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positively moderates CDD's causal effect on DOC. Likewise, its effect is more substantial in the BIMuser group; therefore, hypothesis **H_2** is supported.

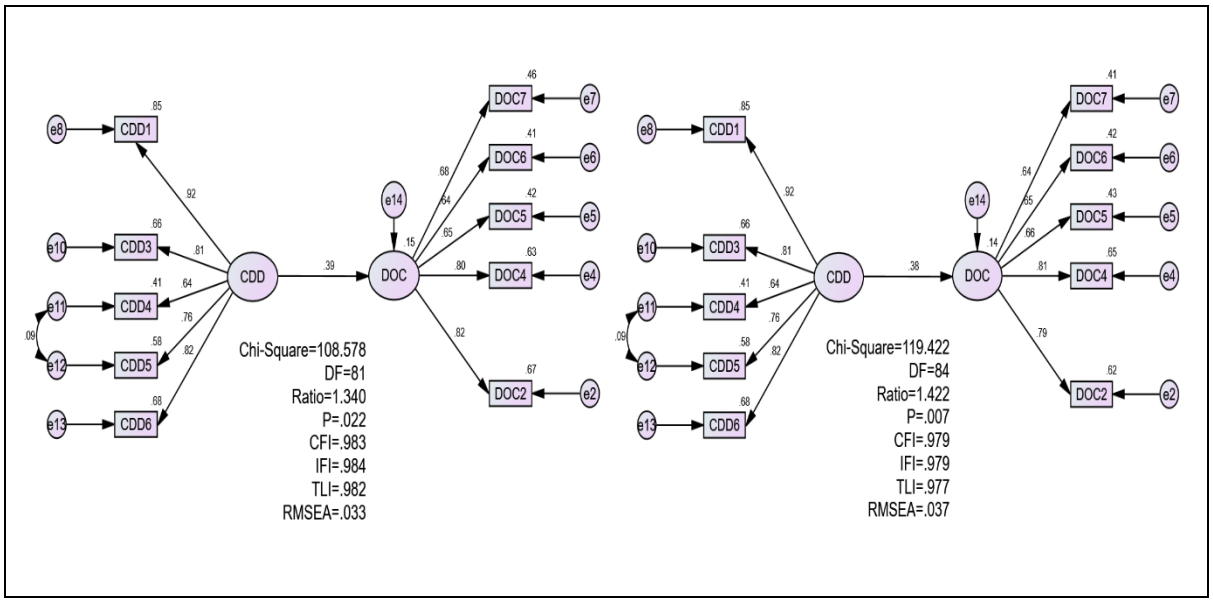

Figure 3: Constrained & Unconstrained Model

Table 4: Moderation Test Table

	Chi-square	**df**	**p-val**
Model			
Unconstrained	108.578	81	
Fully constrained	119.422	84	
Number of groups		2	
Difference	**10.844**	**3**	**0.013**

Conclusion

The study contributes to the few existing literature exploring the effect of contract incompleteness on dispute occurrence. In this study, construction dispute is discussed to occur due to contract incompleteness caused by bounded rationality and uncertainty. Likewise, the study attempts to test the causal relationship between contract documents defectiveness (CDD), one of the classes of bonded rationality and dispute occurrence (DOC). The result shows that CDD had a significant effect and adverse effect on DOC. This indicates that when a contract document is defective, the likelihood of dispute occurrence is high, which is similar to the assertion of Yates (1998, 2002) and Cheung & Yiu (2014).

The moderating effect of BIM effects on the causal relationship was significant, positive, and decisive for the BIMuser. Therefore, it can be posited based on the findings of this study that BIM has a significant effect on reducing defectiveness of contract documents which is one of the potential benefits of its adoption in construction projects, as explained by Olawumi & Chan (2019) and Saka et al., (2019). BIM captures, explore, coordinates, and maintains consistent data through the planning, design, construction, and operational phase (Kymmell, 2008; Wei & Mydin, 2017). It is evident from this finding that the implementation of BIM played a vital role and exerted a profound impact on construction projects. It is recommended that BIM

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adoption on projects should be promoted and mandated for complex projects to reduce dispute occurrence drastically on such projects.

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