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Assessment of Measures Mitigating the Impact of Claims on Construction Project Cost

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Abstract

The study assessed the measures mitigating the impact of claims on construction project cost with the view of determining the adequacy and effectiveness of these measures. In this study, a quantitative research approach was adopted and data relevant to the study collected from 95 Consultancy Firms in which 86 were the responses fit for analysis as 8 had incomplete information from a list of 120 questionnaire distributed in Abuja in which random sampling technique was used. Secondary source of data such as relevant literatures were reviewed. The analysis of data collected for this study was conducted using Statistical Package for Social Scientist (SPSS) and Smart Partial Least Square (Smart PLS). The SPSS software was used to conduct descriptive analysis and Smart PLS 3.0 was used to estimate measurement and structural model parameters. The relationship between the impacts of claims and the latent constructs and adequacy of mitigating measures is significant with values at 5% significance level with β = 0.00, 0.03, 0.00, and 0.03 respectively. All the indicator variables for Effectiveness of Mitigating Measures (EMM) construct are the same as variables with the Adequacy of Mitigating Measures (AMM) construct, so they were interchangeable. This interchangeability supports the notion that once a mitigating measure is adequate then it is effective. The resulting and final model is indicated after dropping loadings that did not add to the explanatory power of the model.

Keywords: *Adequacy of mitigating measures, Effectiveness of mitigating measures, Causes of claims, Construction claims, Impact of claims*

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Background to the Study

The construction industry plays a significant role in the economy of any country. Construction helps in the development and modernization of a country. While it has a close relationship to economic growth, it does not agree that providing incentives and increasing spending on projects necessarily lead to economic growth. Ameh, Soyingbe and Odusami (2010).

According to Frimpong, Oluwoye and Crawford (2003), for a construction project to be successful, it must achieve its objectives as indicated in the project plan. Al-Tmeemy, Rahman and Harun (2011) on the other hand argued that it is a fundamental criterion that the project adhere to the quality targets within the stipulated schedule and budget for it to be a successful project. In another argument, Gunduz, Nielsen and Ozdemir (2013) said that once a project meets the time target, is in accordance with specifications, stays within the estimated cost, and stakeholder satisfaction is achieved, it is a successful construction project.

Construction claims are considered by so many project participants to be amongst the most disruptive and unpleasant events of a project (Ho and Liu, 2004). PMI's project management body of knowledge defines a "Claim" as "A request, demand, or assertion of rights by a seller against a buyer, or vice versa, for consideration, compensation, or payment under the terms of a legally binding contract, such as for a disputed change." While simplistic, this definition can be viewed as a starting point for discussion. A construction claim is more specifically a claim under the construction contract. Claim management is the process of co-ordinating and employing resources to process a claim from identification, analysis, preparation and presentation, before moving to negotiation and then finally the settlement (Kululanga, 2011).

Over the years, literatures have been written on claims. Most discussed topics in this literatures include causes of construction claims, disputes resolution/avoidance, analysis of time impact claims and assessment of construction changes. Majority of this literature are results of research works carried out in Europe or North America, though very significant research has been conducted in the Middle East. A study by Memon, Rahman, Zainun & Karim (2014) developed 13 mitigating measures to improve time performance and 15 measures to improve cost performance of construction projects in Malaysia. Though, this study did not specifically review or discuss the effectiveness of the mitigating measures as they just gave general recommendations or suggestions which are not specific for the factors upon completion of the study.

In light of globalization and the increasing number of abandoned projects due to claim, it has become necessary to bridge this gap in construction literature with the intent of providing an insight and an understanding on the measures mitigating the impact of claims on construction project cost in Nigeria.

This study assessed the measures mitigating the impact of claims on construction project cost with the view of determining the adequacy and effectiveness of these measures. To achieve the aforementioned aim, the following objectives were adopted:

1. To identify and assess the adequacy of measures mitigating the effects of claims
2. To determine the effectiveness of these measures in mitigating effects of claims on construction projects cost.

Causes of Claims

According to a study conducted by Zaneldin (2006), there are twenty-six (26) causes of claims in the United Arab Emirates (UAE) amongst which are: change or variation orders, delay caused by owner, oral change orders by owner, delay in payments by owner, low price of contract due to high competition, changes in material and labor costs, owner personality, variations in quantities, subcontracting problems, delay caused by contractor, contractor is not well organized, contractor financial problems, bad quality of contractor's work, government regulations, estimating errors, scheduling errors, design errors or omissions, execution errors, bad communication between parties, subsurface problems, specifications and drawings inconsistencies, termination of work, poorly written contracts, suspension of work, accidents and planning errors.

While Bonaventura, Hadikusumo and Sonam (2015) in their study identified five (5) causes of claims in Bhutan. Namely: differing site condition, delays of project participants, changes in design and specification, force majeure and omissions/ambiguous contract provisions. On the other hand, Majid, Ali and Ghorbani. (2016) in their research work categorized the causes of claims into five (5) Major causes with the five major causes having sub-causes viz are:

1. Project Management Related
   - i. Owner's Behaviour
   - ii. Contractor's Behaviour

2. Design Related
   - i. Change order
   - ii. Incompleteness
   - iii. Estimating Errors
   - iv. Design Errors

3. Financial Problems
   - i. Owner's Problem
   - ii. Inflation and Exchange Rate
   - iii. Contractor's Problem

4. Unforeseen Conditions
   - i. Resource Shortage
   - ii. Obstacles
   - iii. Soil Conditions

5. Technical Capabilities
   - i. Contractor Related
   - ii. Owner Representative Related

Measure Mitigating the Impact of Construction Project Cost

A model of data mining techniques was developed by Ahiaga-Dagbui and Smith (2013) combined with Artificial Neural Network (ANN) aimed at checking the accuracy of cost estimation since it's one of the severe causes of cost overrun.

In view of these, other measures were proposed which includes public sector accountability and reference class forecasting by (Flyvbjerg 2007, 2008; Berechman and Chen, 2011; Cantarelli, 2012 cited by Lind, and Brunes, 2014). Chevroulet, Giorgi and Reynaud (2012) in their study to forecast a way for cost overruns, underlined lack of reliable data for reference class forecasting or framework analysis and recommend improvement in decision support prior to construction monitoring and management during construction, feedback and consolidation of knowledge after construction.

Memon, Rahman, Asmi, and Azis (2013) suggested an improved site management and supervision of contractors to control cost overruns. Although important, but not efficient in mitigating cost overrun because cost overrun is initiated from the inception of a project according to Brunes and Lind (2013), he however pointed out that most cost overruns occur in the design and planning stage. Statistical analysis by Doloi (2013) suggested well-developed technical skills to control cost in modern projects.

A study conducted by Ade, Aftab, Ismail, and Ahmad (2013), suggested measures that can be used in mitigating the impact of claims to reduce or eliminate cost overrun of projects.

1. Effective strategic planning
2. Proper project planning and scheduling
3. Frequent project meeting
4. Proper emphasis on past experience
5. Use of experienced subcontract and Suppliers
6. Use of appropriate construction methods
7. Use of up-to-date technology utilization
8. Clear information and communication channel
9. Frequent co-ordination between the parties
10. Perform a preconstruction planning of project tasks and resources need.
11. Development of human resources in the construction industry
12. Comprehensive contract administration
13. Systematic control mechanisms
14. Effective site management and supervision

Methodology

Primary and Secondary sources of data were adopted for the purpose of the study in which 120 questionnaire were distributed and 94 hardcopies were retrieved out of which 8 had incomplete information for analysis. This questionnaire was designed based on information gathered from literatures reviewed and subjected to content validity. The survey conducted had Consultant Quantity Surveyors and Project Managers as respondents which serves as the population for this study.

Secondly, extensive literature review from past or previous works on claims, causes of claims, impact of claims, claims management and measures mitigating the impact of claims was carried out. These reviewed literatures helped in the development of the measures mitigating the impact of claims on construction project cost.

The populations for this study are Consulting Quantity Surveying Firms and Contracting Building Firms in Abuja. In other to ascertain the sample size, stratified sampling technique was adopted in which 120 questionnaires were distributed. A stratified sample size of the population becomes necessary as it would be impossible to gather the views of every respondent due to time and other inherent circumstance that would be beyond control. This is a form of probability sampling that classified people into groups according to their characteristics.

The analysis of data collected for this study was conducted using Statistical Package for Social Scientist (SPSS) and Smart Partial Least Square (Smart PLS). The SPSS software was used to conduct descriptive analysis and Smart PLS 3.0 (Bido, D., da Silva, D., & Ringle, C. (2014) was used to estimate measurement and structural model parameters. The same approached was adopted by many researchers in analyzing their data collected.

Results and Discussions

Table 1: Characteristics of Respondents

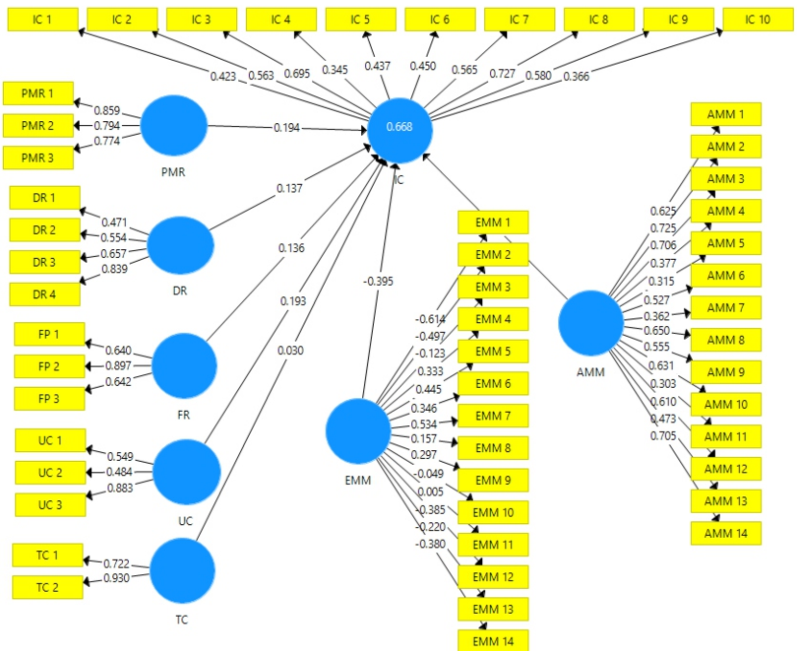
Characteristic	Frequency	Percentage	Cumm. percentage
Company Type			
Consultant	58	67.4	68.6
Contractor	25	29.1	97.7
Government Establishment	1	1.2	98.8
Monitoring/Supervision	1	1.2	100
Company Turnover			
2 -5m	11	12.8	15.1
5 - 10m	23	26.7	41.9
6 - 10m	1	1.2	43.0
Above 10m	47	54.7	97.7
Less than 1m	2	2.3	100
Practice Duration			
1 - 5 years	9	10.5	10.5
6 - 10 years	28	32.6	90.7
11 - 15 years	17	19.8	30.2
16 - 20 years	24	27.9	58.1
Above 20 years	8	9.3	100
Staff Responsible for Claims			
Civil Engineering	1	1.2	1.2
Quantity Surveyor	85	98.8	100
Profession			
Project manager	2	0.0	0.0
Quantity Surveying	80	93.0	100

Projects within the last 15 years			
1 - 5 projects	4	4.7	9.3
11 - 15 projects	29	33.7	43.0
16 - 20 projects	21	24.4	67.4
6 - 10 projects	11	12.8	80.2
Above 20 projects	17	19.8	100
Insurance Adopted			
Employer's Liability	32	37.2	68.6
Insurance against non-negligent withdrawal of support	5	5.8	74.4
Insurance of the works and insurance of existing structures	6	7.0	81.4
Professional indemnity insurance	11	12.8	94.2
Public Liability	5	5.8	100

Source: Field Survey 2018

From Table 1 above, the characteristics of the respondents show that 67% of them work in a construction consulting firm while 29% work for contractors and 1% in government construction establishment. A large proportion of the respondents, 49%, had been practicing for more than 10 years and majority, 96%, have handled more than 10 projects in the past fifteen years which makes them competent enough and capable to participate in the survey.

Figure 1: Initial Path Model



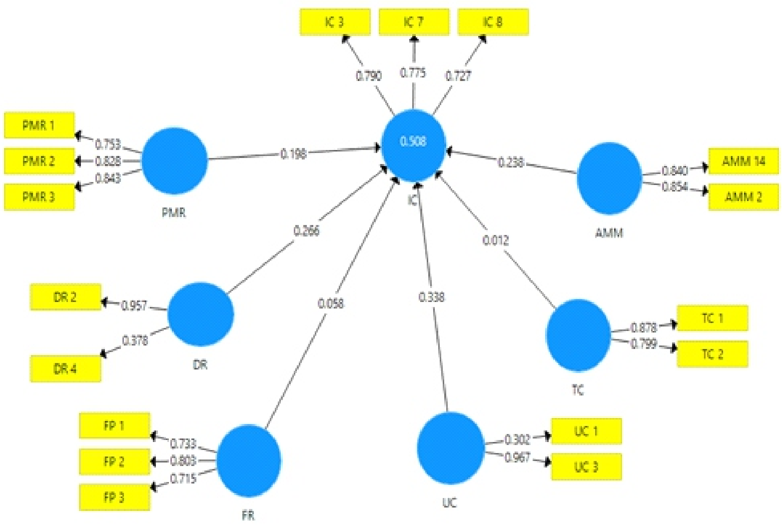
IC	Impact of Claims
AMM	Adequacy of Mitigating Measures
EMM	Effectiveness of Mitigating Measures
PMR	Project Management Related
DR	Design Related
FP	Financial Problem
UC	Unforeseen Condition
TC	Technical Condition

The conceptual model was analyzed using the Partial Least Squares (PLS) approach. The path model generated from the software was used for examining the effect of the causal factors on claims and measures mitigating the impact of claims on the cost of construction projects using a reflective construct. Reflective constructs assume correlation of indicators in order to maximize the overlap in the indicators to make them interchangeable. The PLS model criteria was calculated using a two-step approach adopted from Henseler, 2009 study. The steps are:

i. Outer model (measurement model) evaluation to determine the reliability and validity of the construct (Hulland, 1999). This is done by examining each item loading, and each item internal composite reliability and discriminant validity (Chin, 1998).
ii. Inner model (structural model) evaluation to assess the relationship between the latent independent and dependent variables in respect of variance accounted for (Hulland, 1999). In the structural model, the research questions are answered by assessing the path coefficients "which are standardized betas" (Compeau, 1999). Non-parametric bootstrapping (Akter, 2011) with 5000 replications was applied to test the significance of the variables.

The sequence listed above ensures the establishment of the reliability and validity of the measures before drawing conclusions regarding the relationships between the latent variables (Aibinu and Al-lawati (2011). The measure of the goodness of fit was also used to access the explaining power of the model.

Figure 2: Final Path Model



IC	Impact of Claims
AMM	Adequacy of Mitigating Measures
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TC	Technical Condition

Source: Field Survey, 2018

Outer Model Evaluation

The measurement loadings are standardized path weights connecting the factors to their indicators. The outer model is checked for both convergent validity and discriminant validity (Hair, 2012) and to ensure that the indicators measure the attributes they are supposed to measure, the internal consistency is checked by convergent validity. The composite reliability scores which are similar to the Cronbach alpha to test the reliability of the path model. The commonly suggested threshold value for a good model is to have a Cronbach alpha value more than 0.6 and composite reliability scores more than 0.7 (Rahman, 2013). The Average variance extracted stated that AVE should be higher than 0.5 which means that the latent variable should explain at least 50% of each indicator's variance.

According to Aibinu and Al-lawati (2010) and Hulland (1999), factors with low loadings are advised to be reviewed or dropped as they add little to no explaining power to the model. Researchers as such advice that loadings below 0.4 be dropped while others argued that item with loading below or less than 0.5 should be dropped (Chin, 1998). The closer the loadings are to 1.0, the more reliable the latent variable. Hence, a well-fitting model should have path loadings higher than 0.7 should be considered highly satisfactory (Marko, Jörg, Christian,(2011),; Gotz 2010). Regarding items with loading between 0.4 to 0.7, the potential significance needs to be checked before elimination. If an indicator's reliability is low and eliminating this indicator goes along with a substantial increase of composite reliability, it makes sense to discard this indicator (Marko, Jörg, Christian, 2011).

Table 2: Item Reliability and Construct Validity

Constructs	Factor Loadings	Composite Reliability	AVE
AMM - Adequacy of mitigating measures		0.84	0.72
AMM 14 - Effective site management and supervision	0.84		
AMM 2 - Proper project planning and scheduling	0.85		
DR - Design related factors		0.65	0.53
DR 2 – Incompleteness	0.96		
FP - Financial related problems		0.79	0.56
FP 1 - Owner's problem	0.73		
FP 2 - Inflation and exchange rate	0.80		
FP 3 - Contractor's problem	0.71		
IC - Impact of claims		0.81	0.59
ICT 3 - Logistic delay	0.79		
ICT 7 - Unnecessary procurement	0.78		
ICT 8 - Loss of productivity	0.73		
PMR - Project management related factors		0.85	0.65
PMR1 - Absence of project mgmt. firms	0.75		
PMR 2 - Owner's behaviour	0.83		
PMR 3 - Contractor's behaviour	0.84		
TC - Technical capabilities		0.83	0.70
TC 1 - Contractor Related	0.88		
TC 2 - Owner representative related	0.80		
UC - Unforeseen Conditions		0.62	0.51
UC 3 - Soil conditions	0.97		

Source: Field Survey, 2018

The result in table 2 indicate that the variance extracted for the five scales used for the causal factors of claims, impact of claim, and mitigating measures possessed convergent validity because they ranged from 0.51 to 0.72 (Table: 2). The discriminate validity of a model is adequate when constructs have an AVE loading greater than 0.5 meaning that at least 50% of measurement variance was captured by the construct. This criterion is satisfied by the data in Table 2, hence the model possesses discriminate validity. Therefore, only the indicators in Table 2 above have significant effect on the latent variables.

Inner Model Evaluation

In the structural model, the research questions are answered by assessing the path coefficients "which are standardized betas" (Compeau 1999). Non-parametric bootstrapping with 5000 replications was applied to test the significance of the variables.

Table 3: Path Coefficients and t-values

Path	Coefficient	t value	p Value	Inference
AMM -> IC	0.24	2.23	0.03	Significant
DR -> IC	0.27	2.86	0.00	Significant
FP -> IC	0.06	0.64	0.52	Not significant
PMR -> IC	0.20	2.13	0.03	Significant
TC -> IC	0.01	0.14	0.89	Not significant
UC -> IC	0.34	3.27	0.00	Significant

Source: Field Survey, 2018

The relationship between the impacts of claims and the latent constructs; design related factors, project management factors, unforeseen conditions, and adequacy of mitigating measures is significant with $\beta = 0.00, 0.03, 0.00$, and 0.03 respectively (Table 3 values at the 5% level of significance). All the constructs have a positive significant or insignificant influence on claims and its impact.

Model Evaluation

According to Ken, Michael, and Michael, (2005), the goodness of fit is an index for the overall fit of the model that is used in validating the partial least squares path model globally which is the geometric mean of the average communality and the average R^2. In this study, the global fit index of the model is 0.508, which indicates that the empirical data fits the model very well and the predictive power is 50.8%.

Discussion

From Table 1 above, the characteristics of the respondents show that 67% of them work in a construction consulting firm while 29% work for contractors and 1% in government construction establishment. A large proportion of the respondents, 49%, had been practicing for more than 10 years and majority, 96%, have handled more than 10 projects in the past fifteen years which makes them competent enough and capable to participate in the survey.

Taking all criteria of Partial Least Square into consideration, in fig. 1, 5 iterations were carried out to remove the indicators with low correlation. After the first iteration, only three constructs Financial Problems (FP), Project Management Related (PMR) and Technical Condition (TC) had AVE values more than 0.5 while the remaining five constructs had values less than 0.5. In order to increase the measure of the AVE, factor loadings less than 0.4 were deleted. This reduced the number of constructs that were less than 0.5 to three. In the 5th and last iteration factor loadings less than 0.7 were eliminated which resulted in all the constructs having an AVE measure greater than 0.5 therefore confirming the adequate reliability and convergent validity of the measurement model. All the indicator variables for Effectiveness of Mitigating Measures (EMM) construct ended up being deleted as they add little or no significance to the power of the model and also has the same variables with the Adequacy of Mitigating Measures (AMM) construct, so they were interchangeable which supports the notion that once a mitigating measure is adequate, then it is effective. The resulting and final model is indicated in fig.2 after dropping loadings that did not add to the explanatory power of the model

The result in table 2 indicate that the variance extracted for the five scales used for the causal factors of claims, impact of claim, and mitigating measures possessed convergent validity because they ranged from 0.51 to 0.72 (Table: 2). The discriminate validity of a model is adequate when constructs have an AVE loading greater than 0.5 meaning that at least 50% of measurement variance was captured by the construct. This criterion is satisfied by the data in Table 2, hence the model possesses discriminate validity. Therefore, only the indicators in Table 2 above have significant effect on the latent variables.

Conclusion

This study has been able to examine the relationship between the impacts of claims and the latent constructs; design related factors, project management factors, unforeseen conditions, and adequacy of mitigating measures is significant with β = 0.00, 0.03, 0.00, and 0.03 respectively (Table 3 values at the 5% level of significance), the adequacy and effectiveness of measures mitigating the impact of claims on construction project cost.

Thus, the following conclusion was drawn. All the indicator variables for Effectiveness of Mitigating Measures (EMM) construct ended up being deleted as the same variables with the Adequacy of Mitigating Measures (AMM) construct, so they were interchangeable. This interchangeability supports the notion that once a mitigating measure is adequate then it is effective. The resulting and final model is indicated in fig.2 after dropping loadings that did not add to the explanatory power of the model. Out of the fourteen measures mitigating the impact of claims on construction project cost, only Effective site management and supervision and Proper project planning and scheduling were adequate and effective in mitigating the impact of claims on construction project cost.

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