



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 9, September 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569



Critical Factors Causing Construction Delay of Roads in the Niger Delta Region of Nigeria

Ogbeide, F. N; Ehiorobo, J. O2; Osuji, S. O3

Ph.D Student, Dept. of Civil Engineering, Faculty of Engineering, University of Benin, Nigeria¹

Professor, Dept. of Surveying and Geoinformatics, Faculty of Environmental Technology,
University of Benin, Nigeria²

Professor, Dept. of Civil Engineering, Faculty of Engineering, University of Benin, Nigeria³

ABSTRACT: Confirmatory Factor Analysis (CFA) was used to identify the critical delay causing factors from amongst twenty-one significant road construction delay causing factors. The outcome of the Exploratory Factor Analysis was deployed as input data in Covariance-Based Structural Equation Modelling (CB-SEM) using the Analysis of Moment Structures (AMOS) software version 20.00 incorporated with programme Statistical Package for Social Science (SPSS). The critical factor causing construction delay of road projects awarded in the Niger Delta Region of Nigeria from client's perspective are: mistakes and discrepancies (due to errors and omissions) in design documents, inadequate procurement planning of material, shortage of construction materials in market (bitumen, cement and steel), no budgetary provision/removal from properties, inadequate planning/scheduling of works, and difficulties in financing project by contractors. Also, the CB-SEM revealed the existence of strong inter-variable relationships among endogenous and exogenous latent variables. These include relationships between external factors and materials related factors; between owners contributed factors and project related factors; and between contractor contributed factors and material related factor

I. INTRODUCTION

Structural Equation Modelling (SEM) is widely used in psychology, sociology as well as marketing and management sciences (Hair et al, 2011) and it is finding increasing applications in research issues of construction engineering and management (Aibinu et al, 2011). Ogbeide et al (2021b&c) used Exploratory Factor Analysis to identify twenty-one significant construction delay factor affecting road projects awarded by NDDC in the Niger Delta Region of Nigeria out of sixty-three factors investigated. Available literatures mostly identify such influencing factors by using the analysis of regression method and/or also the important and significant indices methods. However, in the study by Ogbeide et al (2021b), the Cronbach Alpha Collection (CAC) was employed to test the questionnaires used for data collection and they were found to be statistically significant. The reliability analysis employed the use of interclass correlation of coefficients, multivariate analysis of variants (MANOVA) and the box test (Covariance Matrix).

There is the misnomer in the use of the words "significant" and "critical" interchangeably to refer to the same set of factorial delay indicators. The need to efficiently and effectively deploy resources on mitigation measures would as a matter of priority consider the critical delay causing factors from among the significant factors. In this study, Covariance-Based Structural Equation Modelling (CB-SEM) is used to determine the critical delay causing factors out of the established twenty-one significant factors. Also, the model fit in CB-SEM will be used to conduct the maximum likelihood prediction methodology which is dependent on the multivariate normality that reproduces the correct measure of associations among the latent variables (Alaloul et al, 2020). Additionally, the Structural Equation Model have the potentials to establish relationships among the latent variables causing construction delays.

II. LITERATURE REVIEW

Structural Equation Modelling (SEM) is the graphical equivalent of a mathematical representation to study relationship between dependent variables to explanatory/indicative variables (Byrne, 2010). It is a multivariate method which examines the relationship between exogenous latent variables and endogenous latent variables. SEM uses various types of theoretical models to describe the relationship among observed and latent variables, which provides the quantitative test for a researcher's hypothesis (Byrne, 2010). It is a systematic statistical technique used in investigating causal



relationships between multidimensional factors and it enables the development of a causal indicator model in which a latent theoretical construct of interest is represented by measured variables (Islam and Faniran, 2005). According to Ng et al (2010), SEM functionality is better than other multivariate techniques including multiple regression, path analysis and factor analysis in analysing the cause-effect relations between latent constructs. Apart from allowing analysis to determine what factors underlie a set of indicators, SEM also make it possible to examine the strength of the relationship between these theoretical constructs.

The basis for the measurement model is the reliability and the constructs validity tests. The construct validity consists of two parts, namely: convergent validity and discriminate validity. The convergent validity refers to the extent to which the items of the specified constructs should converge to share a high proportion of variance in common while, discriminate validity means the extent to which one construct is truly different from another construct (Kaur and Singh, 2020).

First generation techniques such as factor analysis and regression modelling were the most frequent analysis methods that were used to evaluate the significance of the delay factors (Doloi et al, 2012; Truong et al, 2015) However, Since first generation techniques encounter some limitations, for example, low ability to illustrate causal or complex modelling, failure to include latent or unobservable construct in the causal modelling, measurement error is neglected and more, it behoves that Structural Equation Modelling (SEM), from second generation technique is well suited to overcome the limitations. Multivariate analysis techniques are shown in Table 1.

Table 1: Type of Multivariate Analysis (Source: Zainol, 2016)

Type	Method
First Generation Technique	Factor Analysis
	Cluster Analysis
	Multidimensional Scaling (MDS)
	Logistic Regression
	Multiple Regression
	Multivariate Analysis of Variance (MANOVA)
Second Generation Technique	Structural Equation Model, SEM
	- Covariance Based
	- Partial Least Square

Memon et al (2012) and Ramli (2018) collectively identified four approaches in use for Structural Equation Modelling. They are the Covariance-based structure analysis (CB-SEM), the Component-based analysis using partial least square estimation (PLS-SEM), the Generalised Structural Component Analysis (GSCA) and the Nonlinear Universal Structural Relational Modelling (NEUSREL),

In CB-SEM, observed variables have data that can be directly measured by a researcher, for example, numeric responses to a rating scale question on a questionnaire, while latent variables are variables that are of interest to a researcher but not directly observable (Byrne, 2010). Kline (2011) states that only factor loading of measured variables greater than 0.60 are reserved for SEM analysis and Zhao et al (2017) advanced reasons supporting the use of CB-SEM in studies of this nature. They include: inclusion of latent variables in the model with the measurable variables, examining and establishing relationships among the latent variables, and SEM is capable of combining theoretical and empirical knowledge to advance understanding.

III. RESEARCH METHODOLOGY

CB-SEM MODELLING

The Covariance method (Maximum Likelihood approach) was used since it can accommodate missing data and zero values. The aim was to compute the path coefficients through the reduction of the variances among sample covariance as well as those estimated by the proposed model. SEM Analysis Flowchart is shown in Figure 1.

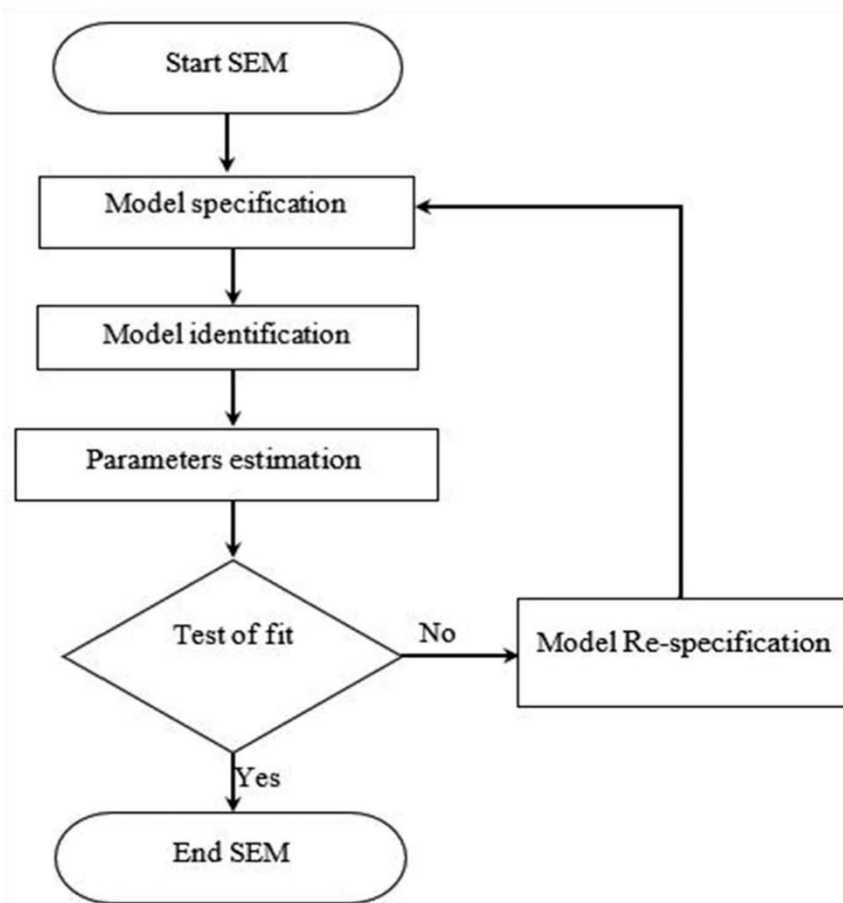


Figure 1: SEM Analysis Flowchart (Source: Alaloul et al, 2020)

To evaluate the adequacy of the model in explaining the validity of the set hypothesis, Model-fit statistics adopted from the works of previous researchers were employed. The model fit statistics used to assess the models overall goodness of fit is presented in Table 2.

Joreskog and Sorbom (1981) introduced two Goodness-of-fit indices called AFI Goodness of Fit) and AGFI Adjusted GFI). The GFI indicates goodness-of-fit, and the AGFI attempts to adjust the GFI for the complexity of the model. There are also the Tucker-Lewis Index TLI (Tucker and Lewis, 1973), better known as the Non-Normed Fit Index (NNFI) and the Normed Fit Index NFI (Bentler and Bonett, 1980). They adjust for complexity of the model. According to Hox and Bechger (1998), simulation research shows that all these indices still depend somewhat on sample size, while TLI/NNFI shows the best overall performance. If the model fits perfectly, the fit indices should have a value of 1. Usually, a value of at least 0.90 is required to accept a model, while a value of at least 0.95 is required to judge the model fit as “good” (Zhao et al, 2019). Another approach to model fit is to accept that models are only approximations, and that perfect fit may be unrealistic to ask for. Instead, the problem is to assess how well a given model approximates the true model. This view led to the development of an index called RMSEA, for Root Mean Square Error of Approximation (Cudeck and Henly, 1991).

EXPLORATORY FACTOR ANALYSIS AND GENERATION OF INPUT DATA FOR CFA ANALYSIS

Exploratory factor analysis (EFA) was employed to explain the opinions of the client with regards to causes of construction delay of roads projects awarded by NDDC (Ogbeide, 2021; Ogbeide et al, 2021b). The selected eighteen (18) from the twenty-one (21) significant factors are shown in Table 3. Using the outcome of exploratory factor analysis, the input data for confirmatory factor analysis were generated from the raw questionnaires and presented in Tables 4.

Table 2: Goodness-of-Fit statistics of model measurement

S/n	Fit Index	Description	Recommended Range	Source
Absolute Goodness of Fit				
1	CMIN (Minimum discrepancy function)		-	Hair et al (2010)
2	DF (Degree of freedom)		-	Hair et al (2010)
3	CMIN Significance (Model probability value)		$p < 0.05$	Hair et al (2010)
4	CMIN/DF	Check whether the covariance structure of the model is adequately the same as the covariance matrix of the observed data	< 5.0	(Bentler and Bonnett, 1980)
5	GFI (Goodness of Fit Index)	Check overall fit of the model; percent of the covariance of the observed data can be explained by the covariance of the model	> 0.80	(Joreskog&Sorbom, 1981)
6	AGFI (Adjusted Goodness of Fit Index)		> 0.80	(Joreskog&Sorbom, 1981)
Incremental Fit Measure				
7	NFI (Normal Fit Index)	Explore the improvement of the overall fit of the model to independent model.	> 0.90	(Bentler and Bonnet 1980)
8	RFI (Relative Fit Index)		> 0.90	(Bollen, 1986)
9	CFI (Comparative Fit Index)	Examine whether the model fits the observed data better than the independent model	> 0.90	(Hu and Bentler 1999)
10	TLI (Tucker-Lewis Index)		> 0.90	(Tucker and Lewis, 1973)
Absolute Badness of Fit				
11	RMSEA (Root-mean-square error of approximation)	Check the mean value of the covariance residual	< 0.06	Cudeck, R. and Henly, S.1991)

Table 3: Selection of most significant causes of construction delays according to Client view

S/n	Codes	Description	Client's view of most important factors
1	A	Owner contributed factors;	Delay in payment for certified works
			Late in revising and approving design document
			Wrong choice of consultant/contractors
2	B	Contractor contributed factors;	Difficulties in financing project
			Conflicts in sub-contractor's schedule in execution of works
			Inadequate planning/scheduling of works
3	C	Consultant contributed factors;	Delay in approving major changes in the scope of work
			Mistakes and discrepancies (due to errors and omissions) in design documents
			Defective BEME
4	D	Project related factors;	Legal disputes between various parties
			Deficiency in BEME
			No budgetary provision/removal from properties
5	E	Materials contributed factor	Shortage of construction materials in the market
			Inadequate procurement planning of material
			Fluctuation in price of construction materials
6	H	External factors;	Changes in Government/Governing Board of regulations of laws
			Fraudulent practices and corruption/diversion/misappropriation
			Youth unrest, communal crisis, militancy

MEASUREMENT MODEL

Figure 2 shows the final measurement models for causes of delay of road projects awarded by NDDC. In Figure 2, the path arrows show the hypothetical relationship among the dependent variables and the independent variables (measured indicators). The rectangular shapes indicate the observed variables that are the individual items on the questionnaire survey.

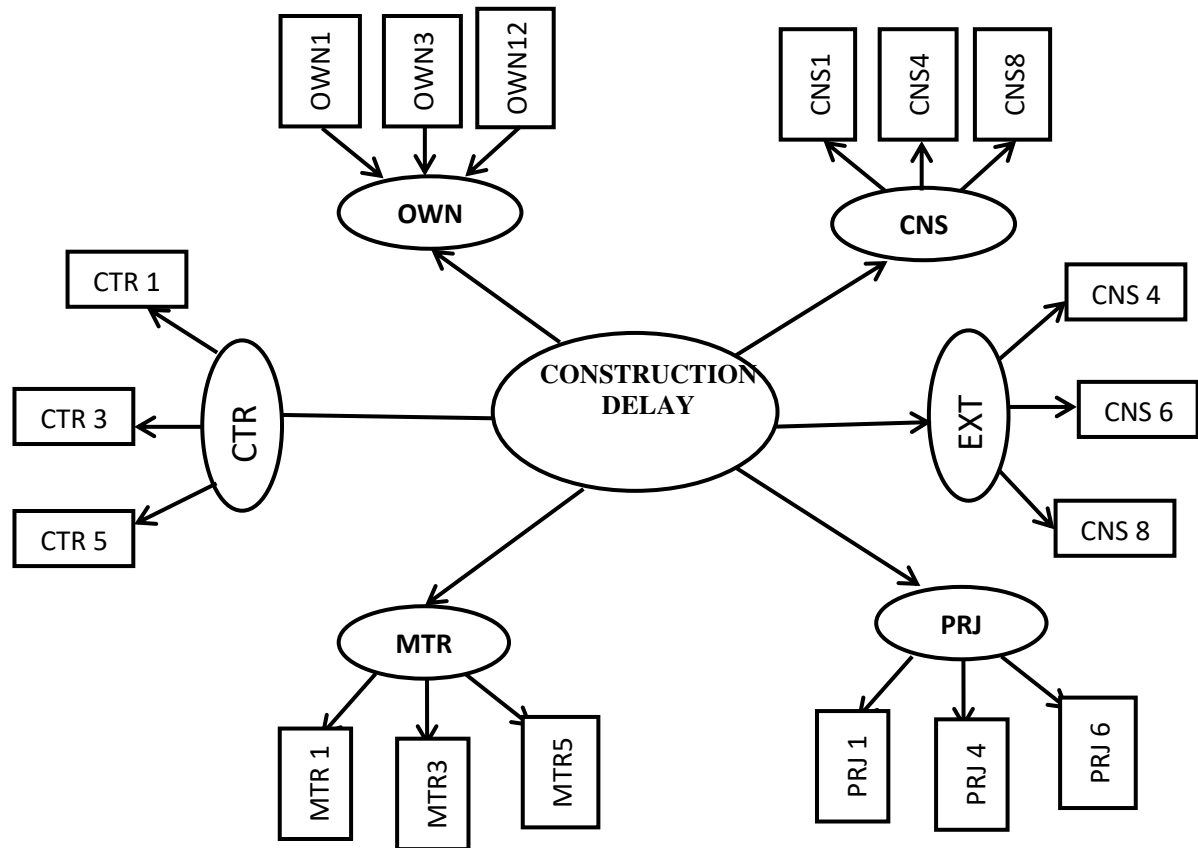


Figure 2: Final Measurement model for causes of construction delay

IV. ANALYSIS OF RESULTS

PATH DIAGRAMS FOR CB-SEM

Confirmatory factor analysis (CFA) is a multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs. The path diagram for the final confirmatory factor analysis of significant causes of construction delay based on the client view point is presented in Figure 3.

Table 4: Extract of CFA data based on client's view on significant causes of road construction delay

OW N-1	OW N-3	OW N-12	CT R-1	CT R-3	CT R-5	CN S-1	CN S-4	CN S-8	PJ R-1	PJ R-4	PJ R-6	MT R-1	MT R-3	MT R-5	EX T-4	EX T-6	EX T-8
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	4	4	4	3	2	3	4	3	2	4	3	2	3	4	4	3
5	5	4	5	3	4	4	5	4	3	5	5	4	4	4	4	5	4
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
5	5	4	3	3	3	3	4	4	5	5	4	2	2	2	4	4	5
4	5	4	5	2	4	3	4	5	4	5	5	4	4	3	4	3	5
5	4	3	5	3	4	5	5	5	1	5	5	1	2	5	5	5	3
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
5	4	5	5	3	4	4	4	4	3	5	4	5	4	4	5	4	2
5	3	4	5	4	4	4	4	4	3	5	4	5	5	4	4	3	2
4	4	2	4	2	3	3	4	3	3	3	4	2	3	3	2	4	2
5	5	3	5	4	4	4	5	5	3	4	4	3	2	4	4	4	4
5	4	4	5	4	4	3	2	2	2	3	3	4	3	4	4	5	3
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
2	4	4	4	4	5	4	5	5	5	4	4	3	4	4	3	3	4
5	5	4	5	3	4	5	4	4	3	5	3	2	2	2	5	5	5
1	5	2	5	3	3	2	4	4	1	3	2	1	1	3	1	4	5
5	5	5	5	3	4	5	4	4	3	5	5	4	4	4	4	4	4
4	3	4	4	4	4	3	2	3	2	2	3	3	2	5	4	4	3
4	3	5	4	3	4	3	4	5	4	4	3	4	4	3	3	3	2
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
4	4	4	4	4	4	4	4	4	2	4	2	3	4	5	2	4	5
5	5	5	5	3	4	4	4	4	3	5	5	4	4	4	4	4	4
4	3	4	4	3	4	3	2	3	2	2	3	3	2	5	4	4	3
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5
4	3	5	4	3	4	3	4	5	4	4	3	4	4	3	3	3	2
5	4	4	5	4	4	3	2	2	2	3	3	4	3	3	4	5	3
5	5	4	5	3	4	5	4	4	3	5	4	2	2	2	5	5	5

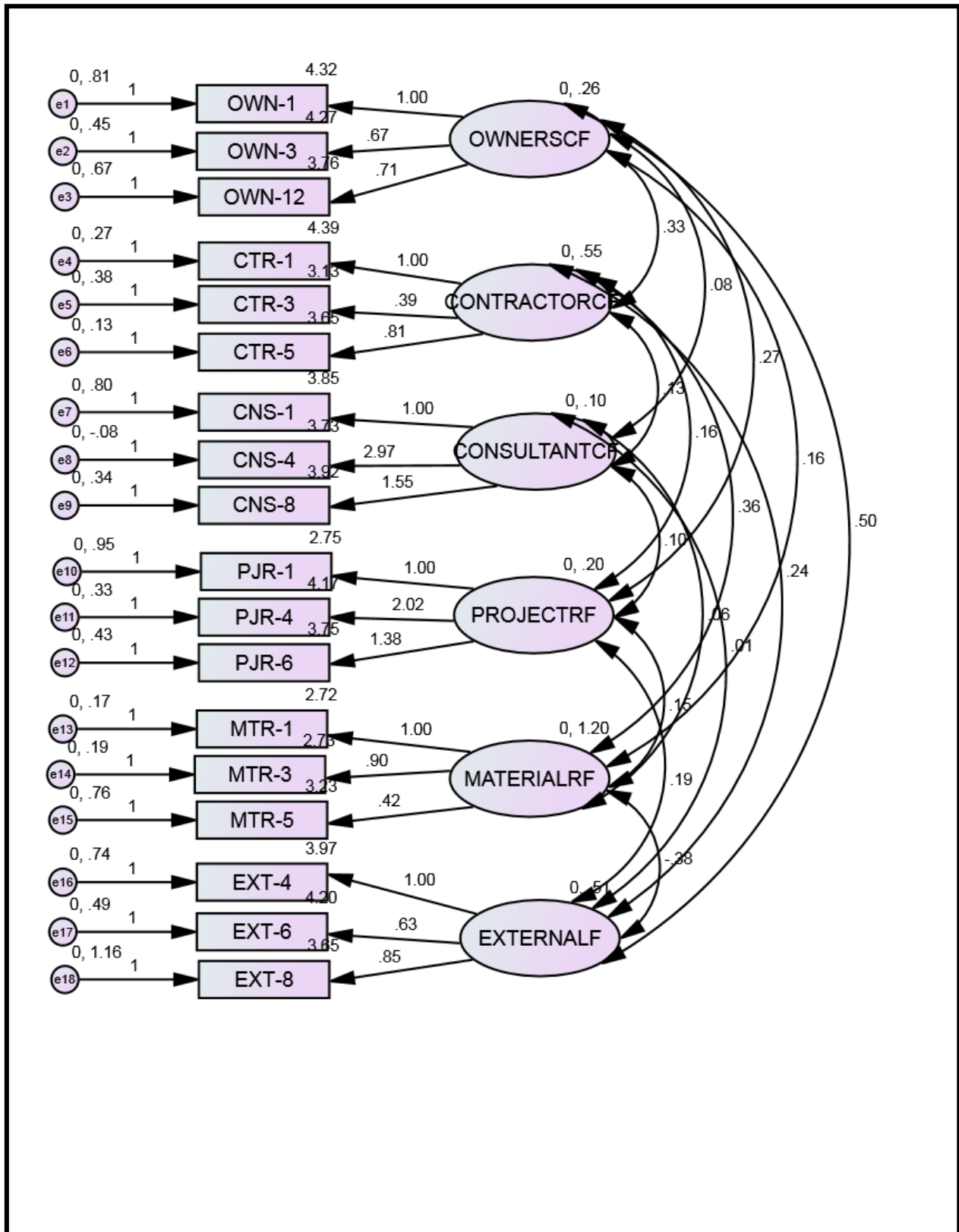


Figure 3: Path diagram for significant causes of construction delay based on client view

ANALYSIS OF MODEL RESULTS

To determine the unobserved variables with strong relationship, covariance matrix was calculated and presented in Table 5

Table 5: Structural equation results for final model of significant causes of construction delay from client's view

			Estimate	S.E.	C.R.	P	Label
OWNERSCF	<-->	CONTRACTORCF	.330	.093	3.536	***	
CONTRACTORCF	<-->	CONSULTANTCF	.134	.055	2.447	.014	
CONSULTANTCF	<-->	PROJECTRF	.100	.045	2.202	.028	
PROJECTRF	<-->	MATERIALRF	.150	.078	1.926	.054	
EXTERNALF	<-->	MATERIALRF	-.380	.136	-2.801	.005	
OWNERSCF	<-->	CONSULTANTCF	.077	.039	1.990	.047	
OWNERSCF	<-->	PROJECTRF	.274	.091	2.998	.003	
OWNERSCF	<-->	MATERIALRF	.164	.106	1.549	.121	
CONTRACTORCF	<-->	PROJECTRF	.164	.065	2.498	.012	
CONTRACTORCF	<-->	MATERIALRF	.361	.119	3.040	.002	
EXTERNALF	<-->	CONTRACTORCF	.237	.096	2.470	.014	
CONSULTANTCF	<-->	MATERIALRF	.063	.045	1.378	.168	
EXTERNALF	<-->	CONSULTANTCF	.006	.033	.171	.864	
EXTERNALF	<-->	PROJECTRF	.195	.077	2.528	.011	
EXTERNALF	<-->	OWNERSCF	.495	.123	4.021	***	

From the result of Table 5, p-values less than 0.01 are considered as exhibiting strong relationships and the following conclusions could be inferred.

- The relationship between contractor contributed factors and material related factor is very strong with a p-value of 0.002.
- The relationship between owners contributed factors and project related factors is very strong with a p-value of 0.003, and
- The relationship between external factors and materials related factors is very strong with a p-value of 0.005

To determine the observed variables with the highest contributory influence (critical factors) on construction delay, the square multiple correlation coefficients was computed for all the selected observed variables (significant factors) and presented in Table 6.

Variables with squared multiple correlations greater than 0.5 are selected as critical. From the result of Table 6, the critical causes of construction delay on road projects awarded by NDDC were identified to include:

- Mistakes and discrepancies (due to errors and omissions) in design documents (CNS-4, 1.100)
- Shortage of construction materials in market (bitumen, cement and steel) (MTR-1, 0.874)
- Inadequate procurement planning of material (MTR-3, 0.837)
- Inadequate planning/scheduling of works (CTR-5, 0.733)
- No budgetary provision/removal from properties (PJR-4, 0.712)
- Difficulties in financing project y contractors (CTR-1, 0.671)

5.5 Assessment of Model Fitness of significant causes of construction delay from client's view

Results of the model fit statistics is presented in Tables 7 a-c

Table 6: Square multiple correlation estimate of the final model of construction delay from client's view

Squared Multiple Correlations: (Group number 1 - Default model)	
	Estimate
MTR3	.837
EXT8	.243
EXT6	.290
EXT4	.410
MTR5	.216
MTR1	.874
PJR6	.469
PJR4	.712
PJR1	.172
CNS8	.419
CNS4	1.100
CNS1	.112
CTR5	.733
CTR3	.182
CTR1	.671
OWN12	.163
OWN3	.201
OWN1	.239

Table 7a: Result of model fit statistics of construction delay from client's view

Amos Output

3 7 0

CFA ANALYSIS OF CAUSES.amw

- Analysis Summary
 - Notes for Group
- Variable Summary
 - Parameter Summary
- Notes for Model
- Estimates
 - Notes for Group/Model
- Modification Indices
 - Minimization History
- Model Fit
- Execution Time

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	69	606.368	120	.000	5.053
Saturated model	189	.000	0		
Independence model	36	1212.655	153	.000	7.926

Baseline Comparisons

From the results of Table 7a, it was observed that the model is significant with calculated p-value of 0.000. In addition, the chi square (CMIN) value of 606.368 for the default model is small compared to the value of the independent model of 1212.655 and this support the proposed theoretical model being tested. More fit-statistics of the model is presented in Tables 7b and 7c respectively.

Table 7b: Result of model fit statistics of construction delay from client's view

Model Fit		Baseline Comparisons				
Execution Time		Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2
Group number 1		Default model	.969	.941	.994	.989
Default model		Saturated model	1.000		1.000	1.000
		Independence model	.000	.000	.000	.000
		Parsimony-Adjusted Measures				CFI
		Model	PRATIO	PNFI	PCFI	
		Default model	.533	.517	.530	
		Saturated model	.000	.000	.000	
		Independence model	1.000	.000	.000	

Table 7c: Result of model fit statistics of construction delay from client's view

Pairwise Parameter Comparisons		Model Fit			
Execution Time		Model	FMIN	F0	LO 90
Group number 1		Default model	.038	.007	.000
Default model		Saturated model	.000	.000	.000
		Independence model	1.225	1.165	.953
		RMSEA			
		Model	RMSEA	LO 90	HI 90
		Default model	.029	.000	.083
		Independence model	.279	.252	.306
		AIC			
		Model	AIC	BCC	BIC
		Default model	47.648	48.738	
		Saturated model	54.000	55.549	
		Independence model	331.510	332.198	

Using the recommended fit statistics of model measurement presented in Table 2, the overall result of the model was generated and presented in Table 8, From the results of Table 8, it was observed that the statistical parameters of the model are exceptionally good. It was concluded that the confirmatory factor analysis showed an acceptable overall model fit and hence, the theorized model fit well with the observed data.

Table 8: Fit statistics of model measurement for significant causes of road construction delay in NDR.

S/n	Fit Index	Recommended Range	Source	Obtained Model Index
1	CMIN (Minimum discrepancy function)	-	Hair et al (2010)	606.368
2	DF (Degree of freedom)	-	Hair et al (2010)	120
3	CMIN Significance (Model probability value)	$p \leq 0.05$	Hair et al (2010)	0.000
4	CMIN/DF	< 5.0	(Bentler and Bonnett, 1980)	5.053
5	GFI (Goodness of Fit Index)	> 0.80	(Joreskog&Sorbom, 1981)	0.994
6	AGFI (Adjusted Goodness of	> 0.80	(Joreskog&Sorbom,	



	Fit Index)		1981	
7	NFI (Normal Fit Index)	> 0.90	(Bentler and Bonnet 1980)	0.969
8	RFI (Relative Fit Index)	> 0.90	(Bollen, 1986)	0.941
9	CFI (Comparative Fit Index)	> 0.90	(Hu and Bentler 1999)	0.994
10	TLI (Tucker-Lewis Index)	> 0.90	(Tucker and Lewis, 1973)	0.989
11	RMSEA (Root-mean-square error of approximation)	< 0.06	Cudeck, R., and Henly, S. J., 1991)	0.029

V. CONCLUSION

The findings on critical causes of construction delay from client's perspectives from this study includes:

- The CB-SEM showed an acceptable overall model fit and hence, the theorized model fit well with the observed data, thus confirming that road construction delay in the Niger Delta Region of Nigeria is caused by client-, contractor-, consultant-, project-, material-, equipment-, labour- and external - related factors was accepted.
- A strong inter-variable relationship was observed to exist among endogenous and exogenous variables regarding significant latent factors causing construction delay of roads in the Niger Delta Region of Nigeria. These are relationships between: external factors and materials related factors; owners contributed factors and project related factors; as well as, contractor contributed factors and material related factors.
- The critical factors causing construction delay of road projects awarded by NDDC in the Niger Delta Region from client's perspective include: mistakes and discrepancies (due to errors and omissions) in design documents, inadequate procurement planning of material, shortage of construction materials in market (bitumen, cement and steel), no budgetary provision/removal from properties, inadequate planning/scheduling of works, and difficulties in financing project by contractors.

REFERENCES

- Aibinu, A. A., Ling, F. Y. Y. and Ofori, G. (2011), Structural Equation Modeling of organizational justice and cooperative behaviour in the construction project claims process, Contractors' perspectives, Construction Management and Economics, 29(5), Pp. 463-481.
- Bentler, P. M., and Bonett, D. G. (1980) Significance tests and goodness-of-fit in the analysis of covariance structures. Psychological Bulletin, 88, 588-600.
- Bollen, K. A. (1986) Sample size and Bentler and Bonett's non-normed fit index. Psychometrika, 51, 375-377.
- Byrne, B. B. (2010), Structural equation modelling with AMOS: Basic concepts, applications and programming, 2ed.; Routledge, New York, USA, ISBN: 978-0-8058-6373-4.
- Cudeck, R., and Henly, S. J. (1991), Model selection in covariance structure analysis and the "problem" of sample size: a clarification. Psychological Bulletin, 109, 512-519.
- Hair, J. F; Black, W. C; Babin, B. J. and Anderson, R. E. (2010), *Multivariate Data Analysis (7th Edition)*, 7th ed. Pearson Prentice Hall, 2010.
- Hox, J. J., Bechger, T. M. (1998), "An introduction to structural equation modelling", Fam. Sci. Rev., Vol 11, Pg. 354-373
- Hu, L. T., and Bentler, P. M. (1999), Cut-off criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modelling, 6, 1-55.
- Islam, MD. M. and Faniran, O. O., (2005), "Structural equation model for project planning effectiveness" Construction management economics, Vol. 23, Pg. 215-223 (CrossRef)
- Jöreskog, K. G. and Sörbom, D. (1993), *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Lincolnwood, USA,
- Kaur, M. and Singh, R. (2020), Evaluating the impact of construction risk factors on project performance in India: Structural Equation Modelling, Academy of Marketing studies Journal, 24 (4).
- Kline, R. B. (2011), Principles and practice of structural equation modelling, 3ed.; Guilford Publications, Inc; New York, NY, USA, ISBN: 978-1-60623-876-9.



13. Ng, T. S., Wong, Y. M. W. and Wong, J. M. W. (2010), "A structural equation model of feasibility evaluation and project success for public private partnerships in Hong Kong, IEEE Transactions on Engineering Management, 57(2), Pp. 310-322.
14. Ogbeide F. N. (2021), "Construction delay of road projects in the Niger Delta Region of Nigeria: Causes. Effects and Remedial Measures", Paper delivered at the 7th Engr. Enoch George Annual Lecture Series held at the Nigerian Society of Engineers Secretariat, Port Harcourt, Nigeria, August 17, 2021.
15. Ogbeide, F. N., Ehiorobo J. O. and Osuji, S. O.(2021c), "Significant Factors Causing Construction Delay of Roads in the Niger Delta Region of Nigeria", Paper submitted for publication in the International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), September 2021.
16. Tucker, L. R., and Lewis, C. (1973) The reliability coefficient for maximum likelihood factor analysis. Psychometrika, 38, 1-10.
17. Zhao, L., Mbachu, J. and Doming, N. (2017), "Exploratory factors influencing building development costs in New Zealand, Building, 7,57,16pages; available at doi: 10.3390/buildings 7030057.
18. Zhao, L; Wang, B; Mbachu, J and Liu, Z (2019), New Zealand Building Project Cost and its Influential Factors: A Structural Equation Modelling Approach, Advances in Engineering, Article ID 1362730, Accessed at <https://doi.org/10.1155/2019/1362730>.



**Impact Factor:
7.569**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details