ADRRI JOURNAL OF ENGINEERING AND TECHNOLOGY

ADRRI JOURNALS (**www.adrri.org**)

pISSN: 2026-674X ***ISSN-L***: 2026-674X VOL. 2,No.1(1), September, 2014

Structural Equation Modeling (SEM) for the Relationship among the Factors that Contribute to the Final Cost of Building Projects in Nigeria.

Nuru Gambo[1], Nuruddeen Usman[2] and Sani Mohammed Abubakar[3]

[1, 3] Quantity Surveying Department, Faculty of Environmental Technology

Abubakar Tafawa Balewa University Bauchi.

[2] Building Technology Department, Faculty of Environmental Technology

Abubakar Tafawa Balewa University Bauchi.

[3]**Correspondence**: nusman1974@gmail.com

Received: 2nd September, 2014 **Revised**: 28th September, 2014 **Published Online:** 30th September, 2014

URL: http://www.journals.adrri.org/

[**Cite as**: Gambo, N., Usman, N., and Abubakar, M.S. (2014). Structural Equation Modeling (SEM) for the Relationship among the Factors that Contribute to the Final Cost of Building Projects in Nigeria. ADRRI Journal of Engineering and Technology, Ghana: Vol. 2, No. 1(1), Pp. 49-63, **ISSN**: 2026-674X, 30th September, 2014.]

Abstract

This paper studies the relationship among the major cost variables that contribute to the final cost of building projects in Nigeria. Data for this research work were analyzed using warp PLS-SEM 3.0. The data were obtained from projects files of completed public building in the North-Eastern States of Nigeria. SEM path model was found to produce path relationship of the major cost variables that influences the final cost of building projects and the path coefficient that had high R and R^2 values 0.99 and 0.98 respectively. These observed variables in the model would also predict the final cost of building projects. It was concluded that there is positive correlation between observed variables and the final cost

of building projects and also there is positive relationship among the independent variables that contribute to the final cost of building projects.

Keywords: Structural Equation Modeling (SEM), relationship, factors, contribute, final cost, building projects, Nigeria.

INTRODUCTION

Final cost of building project is one of the most important factors for ensuring success delivery of projects in a growing economy like Nigeria, any project completed within the initial cost, time and of required quality standard is regarded as successful project. It is hardly to find a single project particularly in developing country that was completed within initial cost or time due to certain factors that affects the final cost this is the single reason that the Standard Form of Building Contract in Nigeria SFBC 1990, JCT and other conditions of contract provides the basis and process of adjusting cost variables that contributes to the final account (final cost) of a project (SFBC, 1990; Ndekugri & Rycroft, 2014). In Nigeria about 64% of the building projects embarked upon annually by the government is ended off as abandoned projects because of inadequate budget plans against the variables that influence the final accounts. Traditionally, estimates for building projects are made on the basis of initial cost (BOQ) rather than final cost (final account). The final cost of building projects comprises the initial cost and adjustments of variables such as variation, prime cost sums, provisional sums, provisional quantities, claims, contingency sums etc. These variables have effect on the final cost of building projects whereas the initial cost of building projects comprises the costs of materials, labour, plants and equipment, profits and overheads (Elinwa & Joshua, 2001).

Ibrahim and Kano (2004), stated that in the execution of building projects, the final contract sums more often than not differ from the sums for which the contract have been awarded (initial cost). Ibrahim and Kano (2004) identified the variables responsible for the difference between the initial and final costs of building projects. The variables are variation, claims, adjustment of prime cost sums, adjustment of provisional sums, adjustment of contingency sums, adjustments of provisional quantities.

In the analysis of the causes and impacts of cost variables in contract sum of building projects in Nigeria, Ibrahim and Kano (2004) said that fluctuations and variations are the major factors that lead to adjustment of contract sums. The figure obtained by the researcher is 88.74% cost increase for ten (10) selected building projects in Nigeria. The value for variation order from the

same study is 22.58%, the value for claims is 0.45%, fluctuations is 37.39%, adjustments of prime cost sums and provisional sums are 30.37% and 1.5% respectively. The cost adjustment for the re-measurement of provisional quantities is minus 0.33%, this indicates that 0.33% of the contract sum has been returned to the client purse. Similarly, Omoniyi (1996) stated that changes in contract prices in Nigeria were principally as a result of number of factors. The factors are variations, claims compensations, fluctuations, delayed payments, over payment for political or corrupt motives, disputes, wrong expenditure of provisional sums and quantities, adjustments of prime cost sums and day work. The variable factors responsible for the adjustment of cost of construction projects can lead to delays or abandonment of building projects, if not properly handled.

Oyemade (2002) reported that final cost of a building project is a figure obtained according to the condition of contract after adjustments of all necessary cost variables stated in the condition of contract. Similarly, Giwa (1988) said that the average local authorities final cost figure for building projects in United Kingdom was marginally exceed the tender sums. Also Giwa (1988) reported that the standard deviation for those projects varies from 0.03 to 0.05 for three authorities indicating that individual contract varies from the mean value of the contract sum. Private clients recorded about 1.05 mean values, indicating that the final account exceeds the tender sum by 5%.

Ndekugri and Rycroft (2014), listed cost variable factors responsible for the adjustment of contract sums, these are provisional quantities, nominated subcontractors account (P.C.SUMS), and nominated suppliers account (P.C.SUMS) provisional sums, fluctuation rates of labour and materials.

This study would develop a model for the relationship among major cost variables that influences the final cost of construction projects in Nigeria.

The aim of this research is to model the relationship among the cost variables that contribute to the success of final cost of building projects in Nigeria.

The following are the objectives derived to achieve the aim of the research work

i. To identify the major variables that contribute to the final cost of building projects in Nigeria
ii. To assess the relationship among the latent variables that contributes to the final cost of building projects in Nigeria
iii. To develop a model for the relationship between/among the latent variables that contributes to the final cost of building projects in Nigeria.

LITERATURE REVIEW

Costs in Construction Projects: Estimated Total Cost

One of the peculiarities of the building project is that work is obtained in a form of contracts for projects, the workload for each project is spread over the construction period and the cost of the project is estimated based on the various activities or tasks required to accomplish the project. Hillebrandt (1985) said that costs of a building project are generally divided into estimated total cost (initial cost) and final cost. The estimated total cost is total cost of each activity required to accomplish the project, whereas final cost is obtained after adjustment of some cost variables during the progress of the work or after the defects liability period of the project.

Variables involved in the Estimate of the Total Cost of Building Projects

There are four (4) central points in estimating the total cost of a building project, these are the cost of materials, cost of plants and equipment, cost of labour, cost of profit and overhead to the contractor. Fletcher (2013) said that the estimate for the material cost includes cost of delivery to site, loading cost, unloading cost, etc. The cost of each of these items are determined and added to the real cost of materials. Then, the researcher opined that cost of material can be one of the largest single elements in the total cost of building project.

Babalola and Jagboro (2001), also viewed that the cost of labour is normally contained in the all in-rate which is the basic wage rate plus the cost of some or all of the cost of medical facilities, maternity leave with pay, compassionate or casual leave, public holidays, redundancy pay, sick leave, travel expenses, transport to site, trade union tools allowance, disturbance allowance, protective clothing, employer's liability and third party insurance, supervision, and so on.

In other words, the all-in rate is the total cost to the contractor for utilizing the services and retaining the services of plants or trades concerned. In Nigerian construction industry, the all in-rate for labour comprises of four main items, these items are statutory payments, trade requirement, welfare expenses and general expenses.

Babalola and jagboro (2001) stated that statutory payment includes basic wage plus sixty percent of basic wage for workmen compensation plus fifteen percent of basic wage for national providence fund (social insurance) and three percent for industrial training levy. The trade requirement includes cost of tools, safety garment/wears and supervision. The welfare expenses consist of transport and/or traveling expenses, funeral expenses, hospital expenses and leave allowance. The general expenses include firm's administrative expenses and other special facilities given by firms. Babalola and Jagboro (2001) opine that in the most unit rates, the cost of labour sometimes is less than the cost of materials.

Fletcher (2013) noted that the cost of plants includes the cost of bringing to site, setting-up and maintenance on site, dismantling and removal from site or cost of hiring. The all-in rate for hired plant consists of hired rates per day, cost of delivery, erection, maintenance and removal with running consumables. The cost of owned plant consists of ownership cost which is fixed

cost and includes capital input requirement, interest rate and cost of license. In addition to ownership is running cost which includes consumables, operations cost and maintenance cost.

Fletcher (2013) stated that the overhead cost chargeable to a project consists of many items which cannot be classified as materials, labour or plant. These costs can be divided into job or site overhead and general or office overhead. Generally speaking, overhead costs are the administrative expenses to the contractor for running his office. The contractor is entitled to administrative expenses such as rent and rate payable on the office premises, staff salaries, office stationary etc. These expenses aid indirectly in the execution of building contract.

Variables involved in the Adjustment of Final Cost of Building Projects

It is generally asserted that final cost of building projects in Nigeria more often than not exceeds the initial cost. Gambo (2010) supported the idea and stated that one of the major problems facing the Nigeria Construction Industry today is the fact that almost all projects are completed at sums higher than their initial contract sums. Similarly, in a study of forty(40) units of four (4) bedroom bungalow houses in Kaduna, Gambo (2010) concluded that there is about 60% cost difference between the initial and final costs of building projects in Nigeria after the completion of the projects. Ibrahim and Kano (2004) identified factors responsible for the difference between initial and final costs of building projects in Nigeria, these variables are variation order, fluctuations, claims, loss and expense claims, adjustments of prime cost, provisional sums and provisional quantities etc. The term "variation" is defined by the standard form of building contracts in Nigeria (SFBCN 1990 edition) as any alteration or modification of the design, quality or quantity of the work as shown upon contract drawing and described by or referred to in the contract bills and includes the addition, omission or substitution of any work, the alteration of the kind or standard of any material or good to be used in the works, and the removal from the site of any work material or good executed or brought there, or by the contractor for the purposes of the work other than work materials or goods which are not in accordance with the contract. It also includes the addition, alteration, omission of any obligations or restrictions imposed by the employer on the contract bills in regard to access to the site, inadequate provision of working space, working hours and the execution or completion of the work in any specific order. A prime cost (PC) sum is defined in the (SFBCN 1990) as sum provided for work or services to be executed by a nominated sub-contractor, a statutory authority or public undertaking or for materials or good to be obtained from a nominated supplier.

The term provisional sum is defined in (SFBCN 1990) as a sum provided for the work or for costs which cannot be entirely foreseen or defined at the time of preparation of tender documents, thus provisional sums are allowed for the works whose extent and or nature are not precisely known at the time of preparation of bill of quantities. Babaloa and Jagboro (2001) supported and stated that Provisional quantities is a bill contained in the contract to work whose actual value cannot be determined during the preparation of bill of quantities and therefore require re-measurement upon completion of the work. This is done by approximately measuring the work in the normal way but keeping it separate in to bill of quantities marking it

"provisional" e.g. where the nature of the soil is uncertain etc. The bill might be marked provisional for substructure work, any additional excavation or reduction in excavation may be adjusted. The subsequent re-measurement of work covered by provisional quantities more often than not yield quantities that are different from the initial quantities. The cost of such differences in quantities results in differences between initial and final contract sums. In practice usually certain percentage is set aside for contingent event that might be encountered during progress of the work, about 5% is usually allowed in the bill of quantities depending on the magnitude of the project. Gambo (2010) supported the argument and said that contingent event is any hazardous event that has a financial significance and is required to be executed before continuing the project e.g. blasting of rock found during excavation of foundation. But about claims Ibrahim and Kano (2004) said that the standard forms of contract in Nigeria do not specifically use the word "claim" the contractor is required to give notice of the occurrence of any certain event which entails extra cost.

Claims is a payment made to the contractor for other expenses or loss incurred in the course of carrying out the work by the contractor which is given to the contractor under the terms of the contract e.g. liquidation and ascertained damages, compensations, ex-gratia (sympathy) and interest on delayed payments.

The difference between initial and the final costs of building projects in Nigeria sometimes increase or decrease cost of a building project and Ibrahim and Kano (2004) found that the impacts of cost variables for ten (10) selected building projects in Nigeria to be 22.58% difference in cost for variation account, 30.37% difference in cost for prime cost sums account, 1.5% difference in cost for provisional sums account,-0.33% difference in cost for provisional quantities account, 0.45% claims and other cost variables accounts, and 37.39% difference in cost for fluctuations accounts..

In a study conducted by Elinwa and Joshua (1993) supported that projects in Nigeria overrun their initial contract sum by between 8 to 133%. Similarly, Omoniyi (1996) said that the differences between initial and the final cost of building projects in Nigeria were principally as a result of a number of variables. These variables includes variation, claims compensations, fluctuations, delayed payments, over-payment for political or corrupt motives, disputes, expenditure of provisional sums and prime cost sums and day-work. These variables were responsible for the differences in cost between initial and final cost of building project in Nigeria and sometimes result to delays or abandonment of some projects in Nigeria.

Ndekugri, I. & Rycroft (2014) listed the variables responsible for adjustments of final cost of building projects includes the followings variations, adjustment after re-measurement of provisional quantities, nominated sub-contractors account, nominated suppliers account (P.C sums), adjustment of provisional sums account and fluctuation rates of labour and materials. In a study of the causes and solutions of the variables that cause differences between initial and final costs for twenty (20) building projects in Nigeria based on contract drawing issued. Oyemade (2004), examined eighty percent (80%) of the projects under this study, had ninety percent (90%) difference in cost between initial and final costs of the projects. Also, asserted that

if the information given on a contract drawing is detailed enough at the tender stage, the contract sum would probably be the same as the final account figure.

Nwuba (2004) opposed and stated that government policies and program have strong impacts on the cost of building projects because of its high level of involvement in the construction industry and the fact that Nigerian economy is public sector driven and found that there was a difference between initial cost and the final cost of building projects in Nigeria from 2000 to 2010, because of inflation and government policies.

METHODOLOGY

The structural equation modeling (SEM) is the family of statistical model belonging to the second generation data analysis technique uses to develop a model that seek to explain the relationships among multiple variables simultaneously. The structure of the interrelationships expresses in the series of equations, similar to a series of multiple regression equations. These equations depict all of the relationship among constructs (independent and dependent variables) SEM has potential advantages over linear regression model because it analyzes a path diagram in the relationship among the variables in the model (Chin, 1998).

Data for this research were collected from the projects files of completed public projects in the North- eastern part of Nigeria comprising six (6) states of Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe states. The data for research work were obtained from the projects commenced and executed in the last ten (10) years.

A total of forty completed projects were selected for this study and with the initial estimated cost between 10-50 million Naira

Method of Data Analysis

Blindfolding resampling technique is used in the analysis of the collected data and the number of data resample is 500

The following equation/model is the equation that explain the relationship among the constructs in the model

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + ...+ e$$

$$b_1 = r_{xy}\frac{s_x}{s_y}$$

The correlation coefficients are calculated from using the formula below

Partial regression coefficients

$$r_{xy} = \frac{z_x z_y}{n-1}$$

Partial regression coefficients is given as

$$r_{xy} = \frac{r_{xy} - r_x r_y}{\sqrt{\left(1 - r^2{}_x\right)\left(1 - r^2{}_y\right)}}$$

Hypotheses

The following hypotheses are developed to test the relationship among the constructs the hypothesis are developed base on the null hypotheses

H_{o1} = There is no significant relationship between the variables that contributes to the final cost and final cost of building projects in Nigeria

H_{o2} = There is no significant relationship among the independent variables that contribute to the final cost of building projects in Nigeria

RESULTS

Figure 1 below shows the path model (SEM) for the relationship among the major observed variables that contributed to the final cost of building projects in Nigeria. The model shows both the path coefficients and P_{values} for the path coefficients

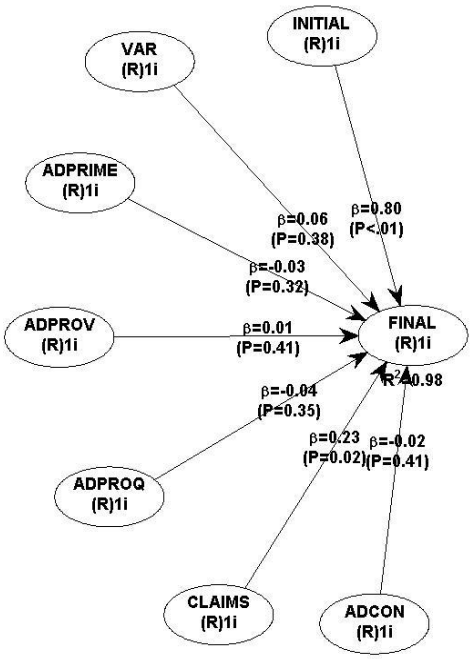

Figure 1: shows the path coefficients for the model

Model fit indices and P values

The model provided three indices: average path coefficient (APC) = 0.169 with a significance $P_{value}<0.001$ this has shown that the average path coefficients of the latents variables Initial estimates, variations, Adjustments of Prime Cost Sums, Adjustments of provisional Sums, adjustments of Provisional quantities, Project Claims and Adjustments of Contingency Sums are significant at 5%. Average R-Squared (ARS) is 0.975 and is significant at 5% level with a $P_{value}<0.001$. The average variance Inflation Factor (AVIF) is 2.35 and significant at 5% level with a $P_{value}< 0.001$

The coefficient of determination $R^2 = 0.98$ this explains the endogenous latent variable variance which is substantial or high as 98%.

Path Coefficients

The path coefficients of the latent variables are shown in the table 1.0 below

TABLE 1.0

	INITIAL	FINAL	VAR	ADPRIME	ADPROV	ADPROQ	ADCON	CLAIMS
FINAL	0.800		0.057	-0.033	0.011	-0.038	-0.016	0.232

From the table above the result indicates model coefficients of the seven independents constructs that predicts the dependents construct final cost; initial cost, variation, adjustments of provisional sums and claims are the only four constructs that are positively related to the final cost of building projects. The other three variables that negatively related to the final cost of building projects are; adjustments of prime cost sums, adjustments of provisional quantities and adjustments of contingency sums.

P-VALUES OF THE PATH COEFFICIENTS

The P_{values} of latent variables coefficients are shown in the table 1.1 below

TABLE 1.1

	INITIAL	FINAL	VAR	ADPRIME	ADPROV	ADPROQ	ADCON	CLAIMS
FINAL	<0.001		0.378	0.316	0.413	0.355	0.406	0.020

The table 1.1 above has shown that only two constructs initial cost sums and projects claims are significant at 0.05 level of significance with P_{values} of 0.001 and 0.020 respectively. Other constructs such as variations adjustments of prime cost sums, adjustments of provisional sums, adjustments of provisional quantities and adjustments of contingency sums were insignificant at 0.05 level of significance.

Observed Variable Correlations

The observed variables correlations coefficients are shown in the table 1.2 below

	INITIAL	FINAL	VAR	ADPRIME	ADPROV	ADPROQ	ADCON	CLAIMS
INITIAL	**(1.000)**	0.971	0.563	0.371	0.390	0.409	0.429	0.560
FINAL	0.971	**(1.000)**	0.620	0.470	0.461	0.428	0.450	0.720
VAR	0.563	0.620	**(1.000)**	0.738	0.437	0.550	0.436	0.444
ADPRIME	0.371	0.470	0.738	**(1.000)**	0.442	0.189	0.227	0.451
ADPROV	0.390	0.461	0.437	0.442	**(1.000)**	0.283	0.073	0.430
ADPROQ	0.409	0.428	0.550	0.189	0.283	**(1.000)**	0.516	0.253
ADCON	0.429	0.450	0.436	0.227	0.073	0.516	**(1.000)**	0.308
CLAIMS	0.560	0.720	0.444	0.451	0.430	0.253	0.308	**(1.000)**

From the table 1.2 above the correlation coefficient between observed independents and dependents variables, the degree of the relationship between final cost and initial cost r = 0.97, this shows that 97% correlation between initial and final cost. The correlation coefficient between final cost and claims is r = 0.72 i.e. 72% correlation, also between final cost and variation, adjustment of prime cost sums, provisional sums, provisional quantities and adjustments of contingency sums are 0.56, 0.37, 0.39, 0.41, 0.43 respectively. This indicates that adjustments of prime cost sums, adjustments of provisional sums shows low degree of correlation.

The correlation among the independent latent variable in the above table shows that there is high correlation between variation and adjustment of prime cost sums r = 0.74 i.e. 74%, then followed by the correlation between variation and initial cost r = 0.56 i.e. 56% and between initial cost and claims r = 0.56 i.e. 56%. All other latent variables are having low correlation such as between adjustments of provisional sums and contingency sums r = 0.07 i.e. 7% and between adjustments of prime cost sums and provisional quantities r = 0.19 i.e. 19%.

P_{values} for Correlations

The significance of the latent variables P_{values} for the correlations are shown in the table 1.3 below

	INITIAL	FINAL	VAR	ADPRIME	ADPROV	ADPROQ	ADCON	CLAIMS
INITIAL	**(1.000)**	<0.001	<0.001	0.019	0.013	0.009	0.006	<0.001
FINAL	<0.001	**(1.000)**	<0.001	0.002	0.003	0.006	0.004	<0.001
VAR	<0.001	<0.001	**(1.000)**	<0.001	0.005	<0.001	0.005	0.004
ADPRIME	0.019	0.002	<0.001	**(1.000)**	0.004	0.243	0.159	0.004
ADPROV	0.013	0.003	0.005	0.004	**(1.000)**	0.076	0.656	0.006
ADPROQ	0.009	0.006	<0.001	0.243	0.076	**(1.000)**	<0.001	0.115
ADCON	0.006	0.004	0.005	0.159	0.656	<0.001	**(1.000)**	0.053
CLAIMS	<0.001	<0.001	0.004	0.004	0.006	0.115	0.053	**(1.000)**

The above table shows the significance of the correlations between observed independent variables and dependent latent variable and also among independent latent variables. The table shows that the correlation between the final and initial costs P = 0.001 which is significant at 95% confidence level, similarly the correlations between final cost and variations, adjustments of prime cost sums, adjustments provisional sums, adjustments of provisional quantities, adjustments of contingency and claims are all significant at 95% confidence level with $P_{values}$of 0.001, 0.002, 0.003, 0.006, 0.004 and 0.001 respectively.

The correlations among the independent latent variable are all significant except between adjustments of prime cost sums and provisional quantities, adjustments of prime cost sums and contingency sums, adjustments of provisional quantities and provisional sums and claims are not significant at 95%confidence level.

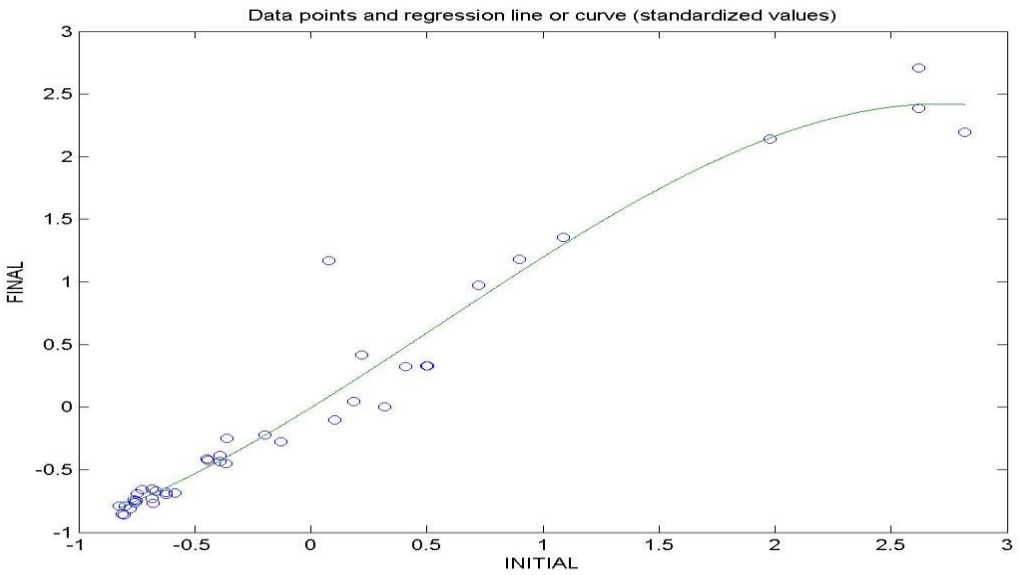

Figure 2: shows the warped relationship initial and final costs of building projects the line seems to be slightly curve-linear of the standardized values of the data points

The above figure 2 shows almost warp linear relationship between initial and final cost of building projects in Nigeria with most of the points are within the straight line. This shows that there is a positive linear relationship and initial cost contributes significantly to the final cost of the project.

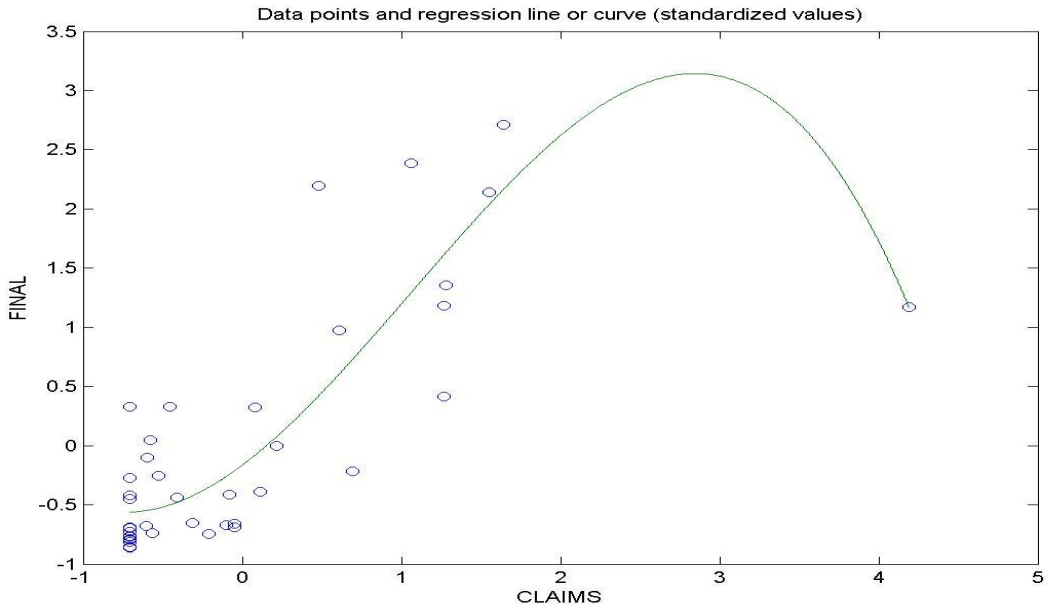

Figure 3: shows the warped relationship initial and final costs of building projects the line seems to be slightly curve-linear of the standardized values of the data points

The above figure 3 shows curve relationship between claims and final cost of building projects in Nigeria with most of the points are away from curved line. This shows that claims have curve-linear positive relationship with final cost and it also contributes significantly to the final cost of the project.

CONCLUSION

The results of the PLS- SEM analyze the relationship among the seven (7) identified time independent cost variables that includes initial cost, variations, adjustments of prime cost sums, adjustments of provisional sums, adjustment of provisional quantities claims and adjustment of contingency sums. These variables influence the total or final cost of construction projects in Nigeria. It was found from the analysis that there is a high correlation between initial cost, claims and final cost of a building project and the path coefficient between the two latent variables is also significant at 95% confidence level. The results indicate low correlation between final cost and other latent variables. It can be concluded that those variables that depict positive relationship can contribute toward increasing final cost, while those that contribute negatively decreases final cost.

REFERENCE

Babalola, O. and Jagboro G.O. . (2001). An Evaluation of the Relationship between Cost Items of Preliminaries and Total Copnstruction Cost. *NIQS, 34*(1), 14-22.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern methods for business research, 295*(2), 295-336.

Elinwa, A. U and Joshua M. . (2001). Construction Cost Factors in Nigerian Construction Industry. *Construction Engineering and Management A. S. C. E, 127*(5), 419-425.

Fletcher, R. (2013). *Practical methods of optimization*: John Wiley & Sons.

Gambo, N. (2010). *Mathematical Modelling of Final Cost of Construction Projects in Nigeria*. Bayero University Kano Nigeria. BUK.

Giwa, S. L. (May 1988). *Differences between Initial and Final Contract Sums of Construction Projects in Nigeria "Causes and Solutions"* Paper presented at the NIQS Seminar, Lagos-Nigeria.

Hackett, M., Robinson, I. & Statham, G. (2007). *The Aqua Group guide to procurement, tendering & contract administration*: Blackwell.

Hillebrandt, P. M. (1985). *Economic theory and the construction industry*: Macmillan London.

Omonoyi M. I. (1996). A Critical Analysis of Abandoned Projects in Nigeria *The Builders, 3*(2), 4-10.

Ibrahim, A. D. and Kano H. A. (2004). Causes and Impacts of Differentials in Contracts Sums of Building Projects in Nigeria. *NIQS, 49*(8), 26-33.

Ndekugri, I. & Rycroft, M. (2014). *JCT98 Building Contract: Law and Administration*: Routledge.

Nwuba, C. C. (2004). An Evaluation of Housing Construction Costs Trends in Nigeria. *NIQS, 47* (6), 4-9.

Oyemade B. O. (2002). The impacts of Contract Drawing on Projects Final Cost *NIQS, 39*(2), 11-15.

SFBC. (1990). *Standard Form of Building Contract*. Lagos.

This academic research paper was published by the Africa Development and Resources Research Institute's Journal of Engineering and Technology. ***ADRRI JOURNALS*** are double blinded, peer reviewed, open access and international journals that aim to inspire Africa development through quality applied research.

For more information about *ADRRI JOURNALS* homepage, follow: http://journal.adrri.org/aj

CALL FOR PAPERS

ADRRI JOURNALS call on all prospective authors to submit their research papers for publication. Research papers are accepted all yearly round. You can download the submission guide on the following page: http://journal.adrri.org/aj/

ADRRI JOURNALS reviewers are working round the clock to get your research paper published on time and therefore, you are guaranteed of prompt response. All published papers are available online to all readers world over without any financial or any form of barriers and readers are advice to acknowledge *ADRRI JOURNALS*. All authors can apply for one printed version of the volume on which their manuscript(s) appeared.