

Mathematical Analysis of Cost Performance of Nigerian Indigenous Construction Industry

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ABSTRACT

The study analyzed the factors that heart-rending the cost performance of Nigeria indigenous contractors. We used Lagos State as a case study. Data was collected on some factors that affect cost performance, and Yamane Taro formula was used to determine the sample size of each category of respondents' i.e the client, consultant and contractor. Data collected was analyzed using central tendency approach. The result of the analysis revealed that Variation orders/change in design made by clients on various construction projects; Poor cost control by the consultants; Poor site management /supervision; poor cost control; and Inflation are major factors that affect cost performance of indigenous contractor.

Keywords: cost performance, construction industry, indigenous contractor, Yamane Taro formula

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1. BACKGROUND OF THE STUDY

The introduction of the indigenous contractors was brought about by the Nigeria Enterprises Promotion decree of February 1972, and since then the indigenous contractors have been playing a significant role in the Nigeria construction industry. The same decree defined indigenous contractor has “an individual or a private organization established under Nigeria Enterprises Promotion Decree of February 1972, and has no other base than Nigeria and its base and ownership is entirely Nigerian.”(Owoh, 1993). Construction industries in Nigeria context is a sector of economy either small, medium and large scale depending on the level of capital, the number of staff engaged directly with them, and their annual turnover, there is erroneous believe by government and people that Nigerian Indigenous contractors does not have enough technical knowledge and experience; better managerial skills; and are more superior and efficient in funds acquisition and project execution. Consequently they have not been given a fair share of major capital intensive construction projects, as opposed to the foreign contractors Ayodeji, Owolabi, Olusola, Tunji-Olayeni, Amusan, Joshua and Akhigbe (2016), Oseni (2002).

Several factors are involve to measure the Cost performance of any contractor being foreign or indigenous. Lekan, Dosunmu and Opeyemi (2017). Insufficient cash flow, ineffective planning and scheduling, selection of inexperienced contractors, poor site management and supervision, change of scope of work during construction as some of the major factors causing poor cost performance of indigenous contractors Ayodeji et al (2016) (Ugochukwu and Onyekwena, 2014). Cost plays a most important role in the successful performance of any project done by construction firms. Consequently this research work is focus on assessment of factors that affect cost performance with respect to an indigenous contractor in Nigeria

Data will be collected on several variables that affect cost performance and suitable mathematical method will be used to analyse the data. Results obtained will be presented and conclusion/recommendation shall be drawn from the result of discussion. This work will be intended to cover indigenous contractors in Lagos, and it will be limited to small and medium scale contractors.

2. LITERATURE REVIEW

2.1 The Nigerian construction industry

“The Nigeria construction industry contributes an average of 5 percent to the annual gross domestic product and an average of about one-third of the total fixed capital investment” Omole (2000). Firms, companies, individual or organizations that carry out construction works are called ‘contractors’. They execute the project in exchange for financial reward for the skills and services offered. (Ugochukwu and Onyekwena, 2014). Ogbekor (2002) saw the construction industry generally in any country as a major contribution into the nation’s economy because it helps in sustainability of a booming economy and revives a depressed one. The construction industry has been seen has the cornerstone to any nation’s rapid economic growth. Ayodeji et al (2016) in his study affirmed that the construction industry is made up of two major sectors, the organized formal sector and the unorganized informal sector. The organized formal sector then comprises of foreign and indigenous construction companies, this two companies are further classified into small, medium and large scale Construction Company depending on their annual turnover and level of capitalization.

2.2 Stakeholders in the Construction Industry

Stakeholder in construction industries are individuals or groups who affects or can be affected by what the organization achieves. The attitude and input of stakeholders to any construction project affects the project directly Olander (2007). Three major stakeholders the client, the consultant and the contractor have the ability to affect the performance of the project either positively or negatively XiaoHua, Guomin, Junxiao, Yingbin and Jian (2016). Stakeholders manage threats, make good use of opportunities and envisage uncertainties that will affect the performance of a project, each stakeholder should be monitored in other to manage the probable effect they have on the project (Ward and Chapman, 2008). The client is the initiator of the work; he also called the employer or project owner. Kadiri (2008). The Consultant includes all professionals working with the client to ensure quality of the job, this professionals are the Architect, Structural Engineer, Mechanical and Electrical Engineer, Quantity Surveyors.

2.3 The Concept of Cost Performance on a Construction Project

Ayodeji et al (2016) in their study on Factors Affecting the Competencies and Delivery of Small-Sized Indigenous Construction Firms stated “that it is very important to know the factors that influence performance of projects in the construction industry especially indigenous contractors, these factors ranges from financial management, inadequate infrastructure, absence of motivation”. The performance of projects managed by Nigerian Indigenous Contractors are better than previous years and claimed that they can be trusted with large, highly technical and cost significant projects, meanwhile some other researchers were of the view that their projects performance is full of: cost overrun, time overruns, poor technical expertise, poor management capability, financial incapability, poor planning, and high frequency of litigation, project abandonment Odediran, Adeyinka, Opatunji, Morakinyo. 2012; Oladimeji and Ojo, 2012; Bala, Bello, Kolo, Bustani. 2009).

1.4 Factors Affecting Cost Performance of an Indigenous contractor

The performance of cost on any construction company is influenced by a number of factors, that contribute either positively or negatively to the projects performance as a whole in a research work carried out by Wiguna and Scott (2005), they assessed the critical factors affecting cost of a construction project as follows: External/site conditions of the project under which he had; unforeseen site ground condition, severe weather condition, Difficult in getting permits and ordinances, Negative Changes in government policies; Economic & financial factors; Inflation/ increased price,

Delayed payments on contract High interest rate, Poor cost control; Technical and contractual risks factors ; Improper design, Change in taste of design by the owner, Inadequately compensated variation order, Delay in providing detailed working drawing; Managerial risk factors; Defective construction work, Low labour and equipment productivity, inadequate project program, Problems with availability of labour, material and equipment In all the Aforementioned factors mentioned Inflation/increased price, improper design, Change in taste of design, delayed payments on contract and defective construction work were perceived as the most critical risk factors, starting from the highest to the lowest factors. These factors will be further discussed and also other critical factors affecting the cost performance of indigenous contractors.

3. RESEARCH METHODS

3.1 Sample Size and Sampling Technique

The sample size for each category of respondent's i.e the client, consultant and contractor will be determined using Yamane Taro formula

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

Where n = sample size

N= total population

e= margin error of 0.2

Table 3.4.1 Sample size of respective category

ORGANIZATION SIZE	TOTAL POPULATION	SAMPLE SIZE
Client	15	9
Consultancy	75	19
Construction	120	21
TOTAL	210	49

Random sampling technique was used in the collection of data in other to give equal opportunity of selection to clients and professionals; the questionnaire was administered and collected by hand so as to avoid alteration of answers.

3.2 Data Collection Instruments and Instrumentation

Choice structured questioner was used in collecting data from respondents. The questionnaire was structured in a tabular form; the answers required were indicated to be ticked so as to avoid irrelevant answer from respondent.

3.3 Data Presentation and Analysis

The data collected from the respondents was analyzed using the descriptive data methods and the data was presented using tables, pie chart, bar chart, mean score and ranking methods. The mean score being the mean value or score of certain set of data set divided by total number of value. Represented as;

$$\text{Mean score} = \frac{\sum FX}{N} \quad (2)$$

Where; \sum = summation of; F= frequency; X= ranking value; N= number of respondents;

$$\text{i.e. } \frac{(F \times 1) + (F \times 2) + (F \times 3) + (F \times 4) + (F \times 5)}{N} \quad (3)$$

4. DATA ANALYSIS AND DISCUSSION

4.1 Data Analysis

A total of 55 questionnaires were printed and distributed by hand to willing respondents within the study area, but only 50 were retrieved and valid. Hence 50 questionnaires were used for the analysis

Table I: Response rate of questionnaire administered

Number Distributed	Number Retrieved	Rate of return (%)
55	50	91

Source: Field survey (2018)

4.2 Presentation of Result and Findings

Table II: Educational Qualification of Respondent

QUALIFICATION	FREQUENCY	PERCENTAGE (%)
HND	11	22
B.Sc/B.Tech	15	30
PGD	1	2
M.Sc/M.Tech	20	40
Ph.D	2	4
Others	1	2
TOTAL	50	100

Source: Field survey (2018)

Table 2 shows the educational qualification of the respondents. The results shows that (40%) of the respondents are M.Sc./M.Tech holders, while B.Sc./B.Tech and HND holders are 30% and 22% respectively, and the PhD holder and PGD holder has the least percentage of 4%, 2% respectively.

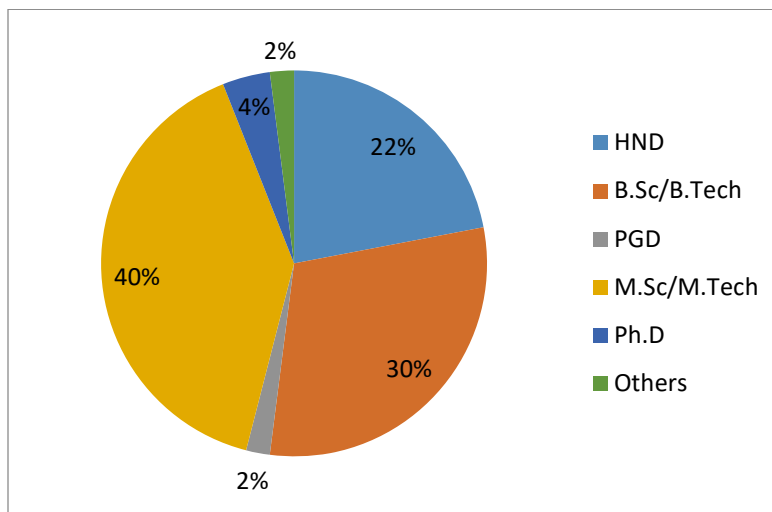


Figure 4.1: Educational qualification

Source: Field survey (2018)

Figure 4.1 shows the representation of the educational qualification of the respondents in a pie chart along with their respective percentage.

Table III: Professional Qualification

QUALIFICATION	FREQUENCY	PERCENTAGE (%)
Architect	3	6
Builder	3	6
Engineer	8	16
Quantity surveyor	33	66
Project manager	3	6
TOTAL	50	100

Source: Field survey (2018)

Table III shows the professional qualification of the respondents, the result shows that the Q.S had the highest number of response in the professional qualification with (66%), which is good since the quantity surveyors have first-hand information as regarding cost of projects, followed by the engineers with (16%) and the Architect, builder and project manager with (6%) representation each.

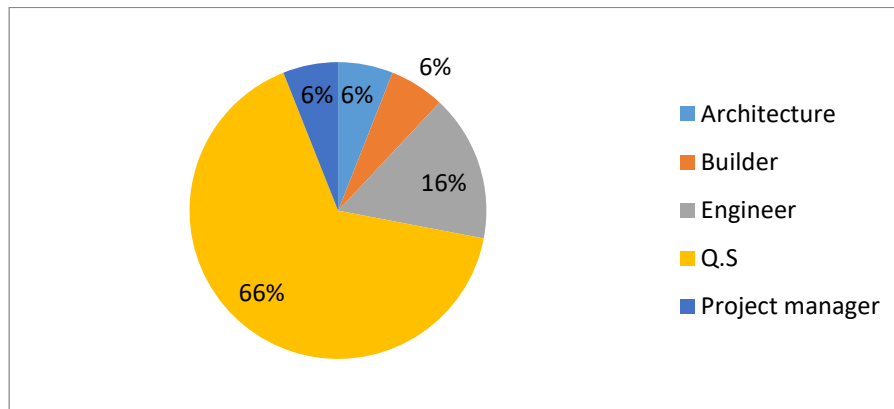


Figure 4.2: Professional qualification

Source: Field survey (2018)

Figure 4.2 above shows the pie chart of the respondent's professional qualification and their respective percentages.

Table IV: Membership Status in Professional Body

MEMBERSHIP	FREQUENCY	PERCENTAGE (%)
Fellow	11	22
Member	27	54
Probationer	12	24
TOTAL	50	100

Source: Field survey 2018

Table IV represents the respondent’s membership status in their various professional bodies. From the result the members had the highest response being (54%), followed by fellows (22%), then probationers (16%), and student members (8%).

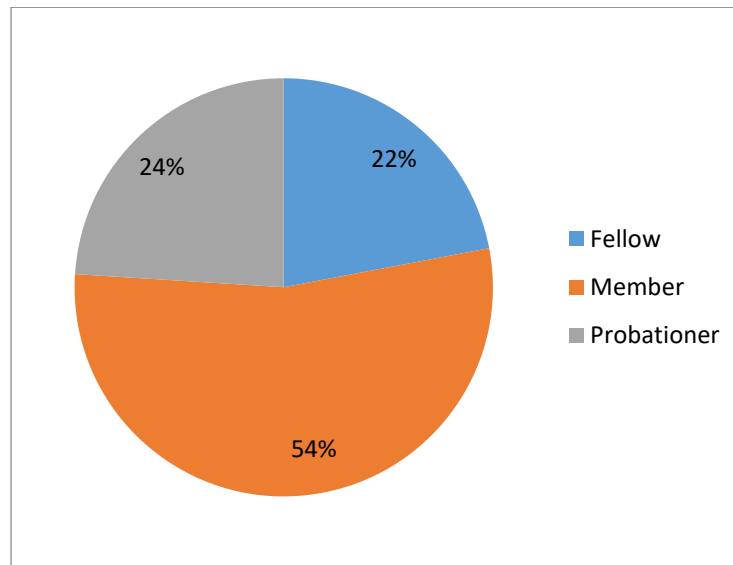


Figure 4.3: Membership status
 Source: Field survey (2018)

Figure 4.3 above shows the pie chart of the respondent’s membership status and their respective percentages.

Table V: Respondents Years of Experience in the Construction Industry

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE (%)
0-5	12	24
6-10	8	16
11-15	13	26
16-20	4	8
Above 20	13	26
TOTAL	50	100

Source: Field survey (2018)

Table V shows the respondent’s years of experience in the construction industry. The respondent’s years of experience ranking the highest was 11-15yrs and above 20years which was (26%) each, followed by 0-5yrs (24%), then 6-10yrs (16%), and 16-20yrs (8%). This shows that the respondents have enough wealth of experience in the construction industry to be able to answer the questions asked in the questionnaire.

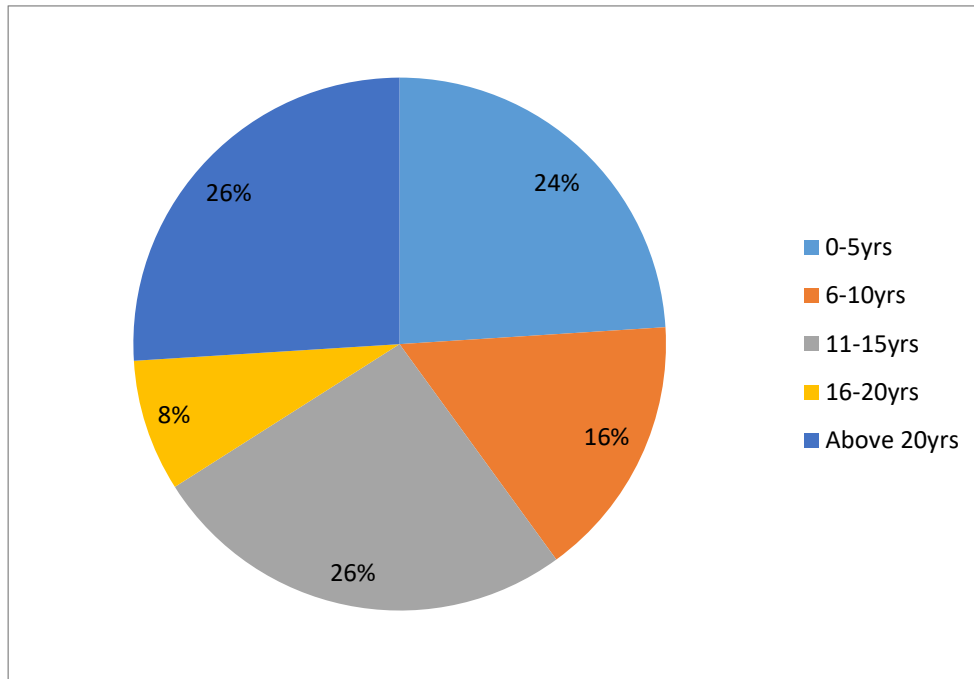


Figure 4.4: Respondents years of experience
 Source: Field survey (2018)

Figure 4.4 above shows the pie chart of the respondent’s years of experience and their respective percentages.

Table VI: Size of Construction Projects Handled By Respondent in the Last Five Years

SIZE OF PROJECT HANDLED	FREQUENCY	PERCENTAGE (%)
Small, under 100m	11	22
Medium, 101m-500m	23	46
Large, 500m above	16	32
TOTAL	50	100

Source: Field survey (2018)

Table VI represents the size of construction projects handled by the respondents in the last five years. The highest percentage is medium size i.e. 101-500m(46%), followed by Large, 500m above (32%), then small, under 100m(22%).

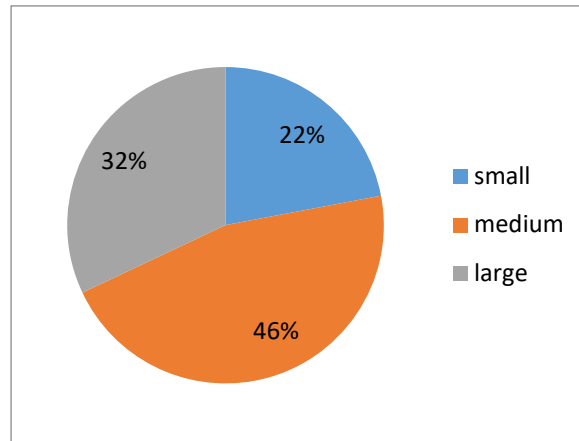


Figure 4.5: Size of construction project
 Source: Field survey (2018)

Figure 4.5 shows the pie chart of the respondent's size of project handled and their respective percentages.

Table VII: Type of Organization

TYPE OF ORGANIZATION	FREQUENCY	PERCENTAGE (%)
Consultancy	17	34
Construction	24	48
Client	9	18
TOTAL	50	100

Source: Field survey (2018)

Table 4.7 shows the type of organization the respondents are working with presently. The type of organization that had most response was the construction company with (48%), followed by the consultancy (34%), then the client organization with (18%).

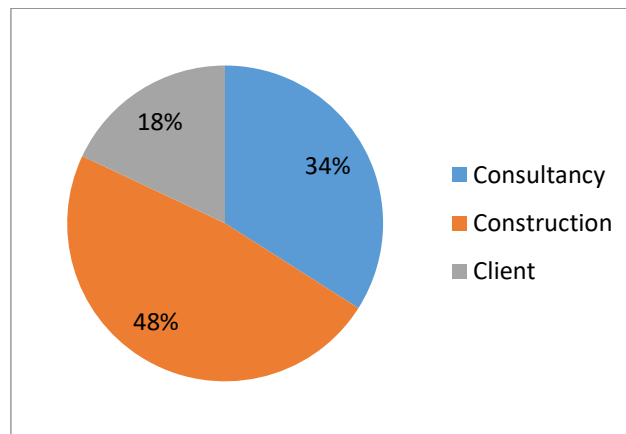


Figure 4.6: Type of organization
 Source: Field survey (2018)

Figure 4.6 above shows the pie chart of the respondent's type of organization and their respective percentages.

4.2.1 Assessment of client factors affecting cost performance : This section is set to address the first objective which is assessing the client determining factors affecting cost performance of indigenous contractors in Lagos. Likert scale was used were 1= VERY LOW EFFECT, 2= LOW EFFECT 3= MODERATE EFFECT 4= HIGH EFFECT 5= VERY HIGH EFFECT

Table VIII. Client-Related Factors Affecting Cost Performance

FACTORS AFFECTING COST PERFORMANCE	1	2	3	4	5	N	MEAN	RANK
Variation Order/ Change in design	0	2	6	19	23	50	4.26	1 st
Poor cost control	0	4	7	14	25	50	4.20	2 nd
Fraudulent practices e.g. corruption	1	4	4	22	19	50	4.08	3 rd
Patronage as a result of Nepotism(favoring relatives or friends because of their relationship instead of their abilities)	1	4	4	22	19	50	4.06	4 th
Poor brief given to consultant	2	2	11	11	24	50	4.06	4 th
Inadequate planning	0	7	9	9	25	50	4.04	6 th
Inadequate funding	3	4	6	17	20	50	3.94	7 th
Bankruptcy	1	6	6	22	15	50	3.88	8 th
Delay in honoring certificate	0	9	17	4	20	50	3.70	9 th
Unsteady material supply to contractor in cases of labour only contract	2	2	19	14	13	50	3.68	10 th
Insufficient time given to consultant to prepare drawings	3	9	10	8	20	50	3.66	11 th
Delayed payment to contractor	4	10	10	10	16	50	3.48	12 th
Shortening contract period	1	15	6	19	9	50	3.40	13 th
Project complexity	3	14	13	8	12	50	3.24	14 th

Source: Field survey (2018)

Table 4.8 shows the results entered by respondents to tackle the first objective i.e. to determine the client related factors affecting cost performance of indigenous contractors. The table above shows the frequencies of the data imputed by the respondents on each of the client-factors affecting cost performance. There were fourteen factors identified in the questionnaire and all 50 respondents ticked appropriately against the boxes. No multiple response was made, neither was any question left blank. The table also shows the ranking of the client factors affecting cost performance of indigenous contractors.

The factors are ranked to show in a descending order the client factors that affect cost performance of indigenous contractors. The mean values of the factors were used to rank each of the factors. The first five (5) factors that has high effect on cost performance from the table are Variation order/change in design which ranked 1st with a mean score of 4.26, followed by poor cost control which ranked 2nd with mean score of 4.20, followed by fraudulent practice e.g. corruption this ranked 3rd with a mean score of 4.08, two factors ranked 4th with mean score of 4.06 which are Patronage as a result of Nepotism and poor brief given to consultants. The least ranked from the table is project complexity with a mean score of 3.24 which shows that although it is the least ranked it still as a moderate effect on the cost performance.

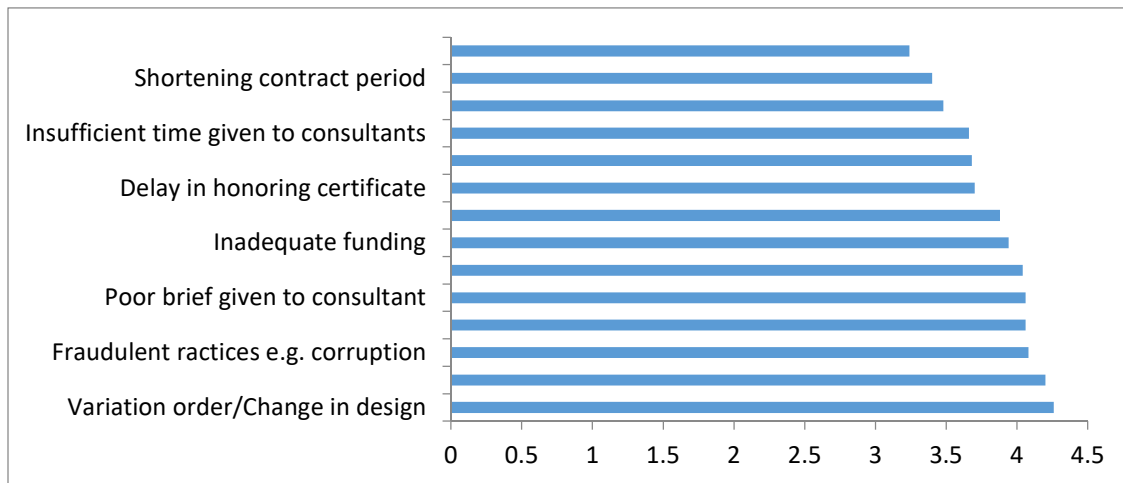


Figure 4.7: Client related factors affecting cost performance
 Source: Field survey (2018)

4.2.2 Assessment of consultant factors affecting cost performance: This section is set to address the second objective which is assessing the consultants determining factors affecting cost performance of indigenous contractors in Lagos. Likert scale was used where 1= VERY LOW EFFECT, 2= LOW EFFECT 3= MODERATE EFFECT 4= HIGH EFFECT 5= VERY HIGH EFFECT

Table 4.9 Consultant-Related Factors Affecting Cost Performance

FACTORS AFFECTING COST PERFORMANCE	1	2	3	4	5	N	MEAN	RANK
Poor cost control	1	0	5	10	34	50	4.52	1 st
Lack of experience	1	3	1	19	23	50	4.32	2 nd
Variation order/ design change	0	2	6	19	23	50	4.26	3 rd
Faulty estimate	1	4	7	8	30	50	4.24	4 th
Unclear/wrong specification	1	1	5	24	19	50	4.18	5 th
Unforeseen site ground conditions	4	2	5	14	25	50	4.08	6 th
Inadequate planning	1	7	4	14	24	50	4.06	7 th
Errors in bill of quantities	1	2	8	23	16	50	4.02	8 th
Poor detailed drawings	0	5	13	8	24	50	4.02	8 th
Lack of sub-soil investigation	0	5	18	20	7	50	3.58	10 th
Project complexity	3	3	24	6	14	50	3.50	11 th
Fraudulent practices e.g. over measurement during valuation	12	3	7	10	18	50	3.38	12 th
Delay in providing detailed working drawing	1	16	12	9	12	50	3.30	13 th
Delay in honoring certificate	0	16	13	12	9	50	3.28	14 th
Delay in approaching claims	0	13	20	11	6	50	3.20	15 th
Inadequate number of drawings	6	18	11	9	6	50	2.82	16 th
Lack of contractors involvement in design	7	14	17	10	2	50	2.72	17 th

Source: Field survey (2018)

Table 4.9 shows the results entered by respondents to tackle the second objective of the research work i.e. to determine the consultant related factors affecting cost performance of indigenous contractors. The table above shows the frequencies of the data imputed by the respondents on each of the consultant-factors affecting cost performance. There were seventeen factors identified in the questionnaire and all 50 respondents ticked appropriately against the boxes. No multiple response was made, neither was any question left blank. The table also shows the ranking of the consultant factors affecting cost performance of indigenous contractors.

The factors are ranked to show in a descending order the consultant factors that affect cost performance of indigenous contractors. The mean values of the factors were used to rank each of the factors. The first five (5) factors that have high effect on cost performance from the table are; poor cost control which ranked 1st with a mean score of 4.52, followed by Lack of experience which ranked 2nd with a mean score of 4.32, the factor that ranked 3rd was Variation order/ design change with a mean score of 4.26, followed by Faulty estimate which ranked 4th with a mean score of 4.24, the factor that ranked 5th was Unclear/wrong specification with mean score of 4.18. The least ranked from the table is Lack of contractor's involvement in design with a mean score of 2.72.

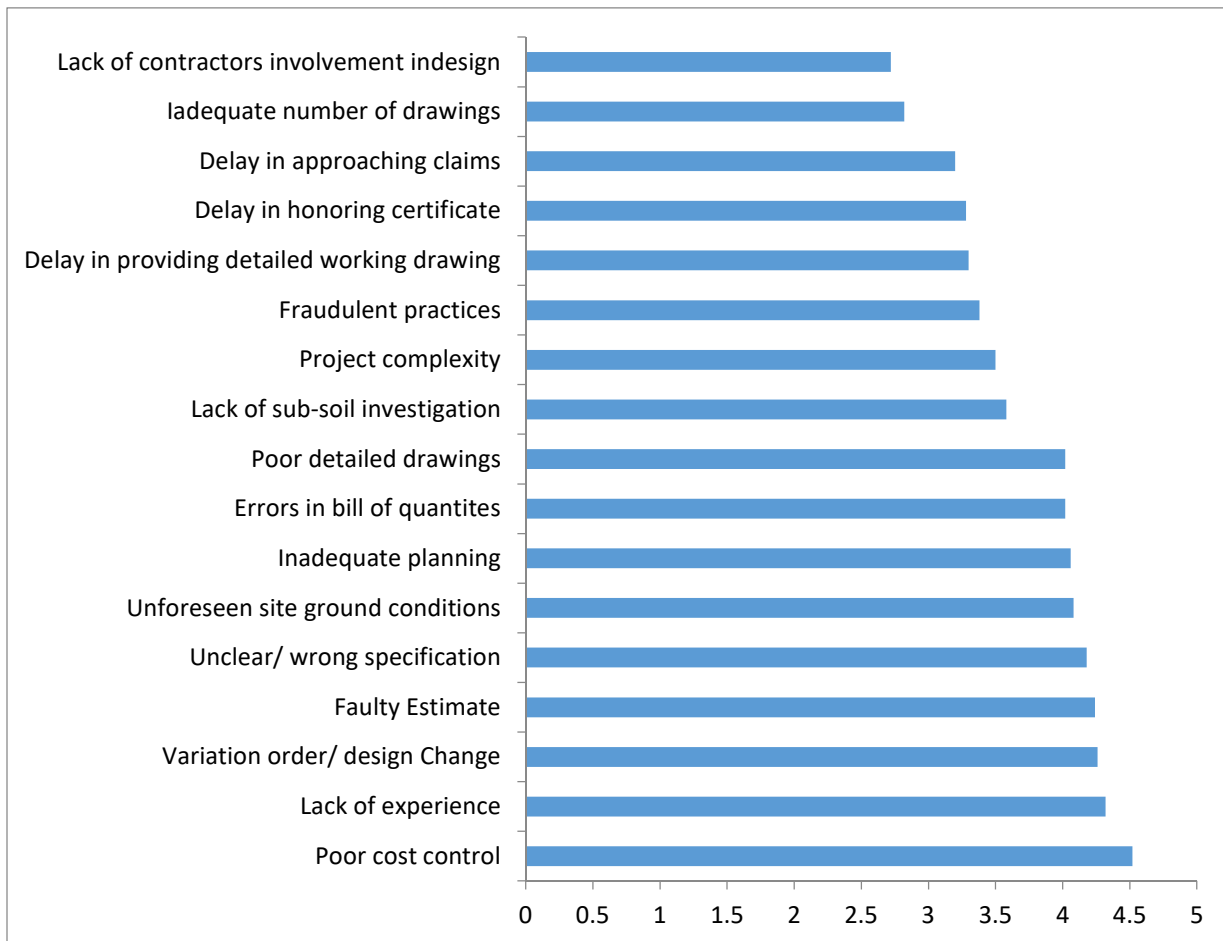


Figure 4.8 : Consultant related factors affecting cost performance

Source: Field survey (2018)

4.2.3 Assessment of contractor's factors affecting cost performance: This section is set to address the third objective which is assessing the contractor determining factors affecting cost performance of indigenous contractors in Lagos. Likert scale was used where 1= VERY LOW EFFECT, 2= LOW EFFECT 3= MODERATE EFFECT 4= HIGH EFFECT 5= VERY HIGH EFFECT

Table 4.10 Contractor-Related Factors Affecting Cost Performance

FACTORS AFFECTING COST PERFORMANCE	1	2	3	4	5	N	MEAN	RANK
Poor site management and supervision	1	0	2	19	28	50	4.46	1 st
Poor cost control	0	3	4	10	33	50	4.46	1 st
Material wastage	1	0	4	17	28	50	4.42	3 rd
Project complexity	0	1	10	14	25	50	4.26	4 th
Contractors project inexperience	1	1	4	24	20	50	4.22	5 th
Poor workmanship	1	2	4	22	21	50	4.20	6 th
Abandonment of project	1	3	4	20	22	50	4.18	7 th
Fraudulent practices e.g. pilfering	1	2	6	20	21	50	4.16	8 th
Contractors inefficiency	1	2	3	26	18	50	4.16	8 th
Unavailability of skilled labour	2	2	8	19	19	50	4.02	10 th
Errors in bill of quantities	2	7	8	6	27	50	3.98	11 th
Frequent claim submission	1	6	6	25	12	50	3.82	12 th
Shortage of craftsman	2	1	22	12	13	50	3.66	13 th
Inadequate planning	1	15	5	15	14	50	3.52	14 th
Unsteady material supply	1	11	15	13	10	50	3.40	15 th
Inaccurate estimate	11	2	13	10	14	50	3.28	16 th

Source: Field survey (2018)

Table 4.10 shows the results entered by respondents to tackle the third objective of the research work i.e. to determine the contractor related factors affecting cost performance of indigenous contractors. The table above shows the frequencies of the data imputed by the respondents on each of the contractor-factors affecting cost performance. There were sixteen factors identified in the questionnaire and all 50 respondents ticked appropriately against the boxes. No multiple response was made, neither was any question left blank. The table also shows the ranking of the contractor factors affecting cost performance of indigenous contractors.

The factors are ranked to show in a descending order the consultant factors that affect cost performance of indigenous contractors. The mean values of the factors were used to rank each of the factors. The first five (5) factors that have high effect on cost performance from the table are; Poor site management and supervision and Poor cost control which ranked 1st with mean score of 4.46, followed by material wastage which ranked 3rd with a mean score of 4.42, the factor that ranked 4th was project complexity with mean score of 4.26, followed by Contractors project inexperience which ranked 5th with mean score of 4.22. The factor with the least rank is inaccurate estimate with a mean score of 3.28.

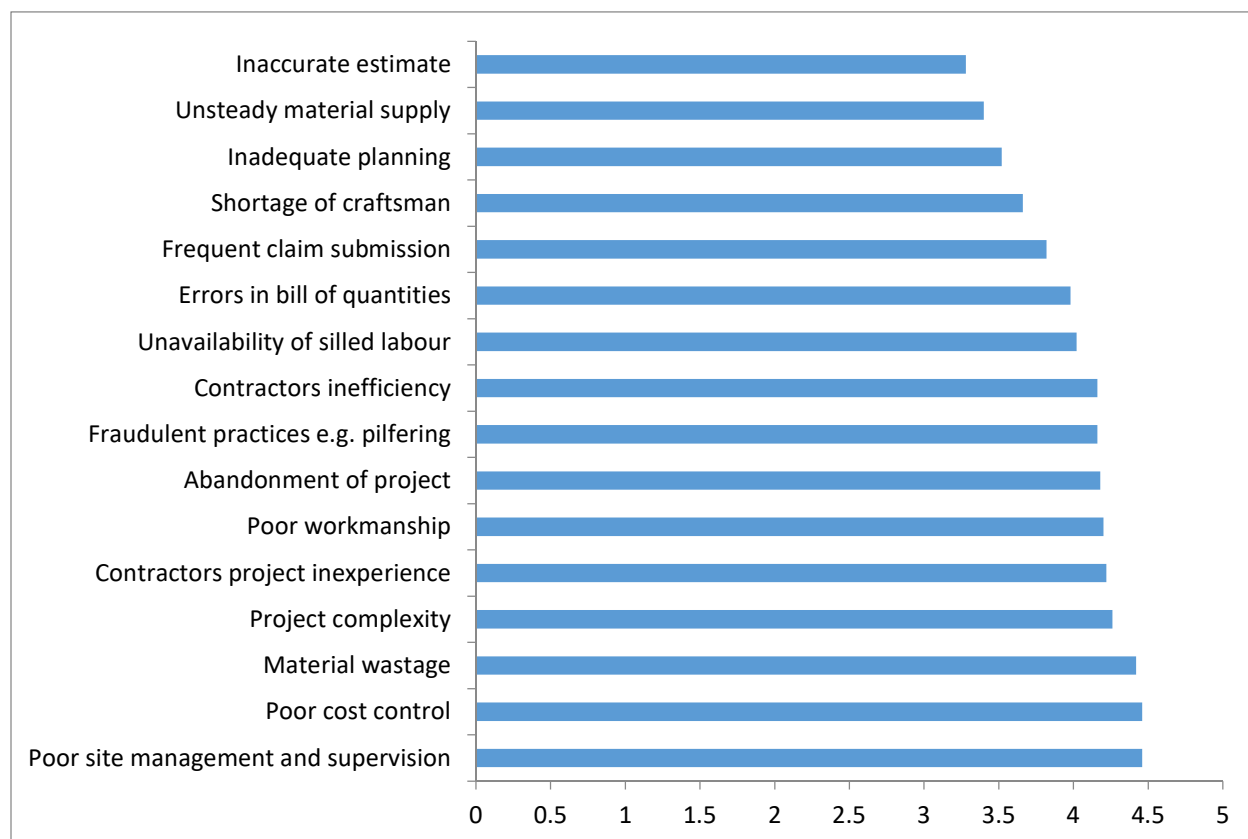


Figure 4.9: Contractors related factor affecting cost performance

Source: Field survey (2018)

4.2.4 Assessment of other related factors affecting cost performance: This section is set to address the fourth objective which is assessing the contractor determining factors affecting cost performance of indigenous contractors in Lagos. Likert scale was used where 1= VERY LOW EFFECT, 2= LOW EFFECT 3= MODERATE EFFECT 4= HIGH EFFECT 5= VERY HIGH EFFECT

Table 4.11 Other-Related Factors Affecting Cost Performance

FACTORS AFFECTING COST PERFORMANCE	1	2	3	4	5	N	MEAN	RANK
Inflation	0	0	4	5	41	50	4.74	1 st
Material price fluctuation	0	0	6	7	37	50	4.62	2 nd
Unstable economy	0	1	8	18	23	50	4.26	3 rd
High interest rate charged by bank on loan	0	1	12	12	25	50	4.22	4 th
Negative change in government policies	1	6	9	24	10	50	3.72	5 th
Force majeure	0	8	18	13	11	50	3.54	6 th
Differing site condition	3	3	25	16	3	50	3.26	7 th
High cost of transportation	2	16	12	8	12	50	3.24	8 th
Site conflicts	5	6	21	17	1	50	3.06	9 th
Unpredictable weather condition	4	16	13	12	5	50	2.96	10 th

Source: Field survey (2018)

Table 4.11 shows the results entered by respondents to tackle the fourth objective of the research work i.e. to determine the other related factors affecting cost performance of indigenous contractors. The table above shows the frequencies of the data imputed by the respondents on each of the other-factors affecting cost performance. There were ten factors identified in the questioner and all 50 respondents ticked appropriately against the boxes. No multiple response was made, neither was any question left blank. The table also shows the ranking of the other-factors affecting cost performance of indigenous contractors. The factors are ranked to show in a descending order the consultant factors that affect cost performance of indigenous contractors. The mean values of the factors were used to rank each of the factors. The first five (5) factors that have high effect on cost performance from the table are; Inflation which ranked 1st with mean score of 4.74, followed by material price fluctuation which ranked 2nd with mean score of 4.62, the factor that ranked 3rd was unstable economy with mean score of 4.26, followed by High interest rate charged by bank on loan which ranked 4th with mean score of 4.22, the factor which ranked 5th was Negative change in government policies with mean score of 3.72. The factor which ranked least was unpredictable weather condition which ranked 10th with mean score of 2.96.

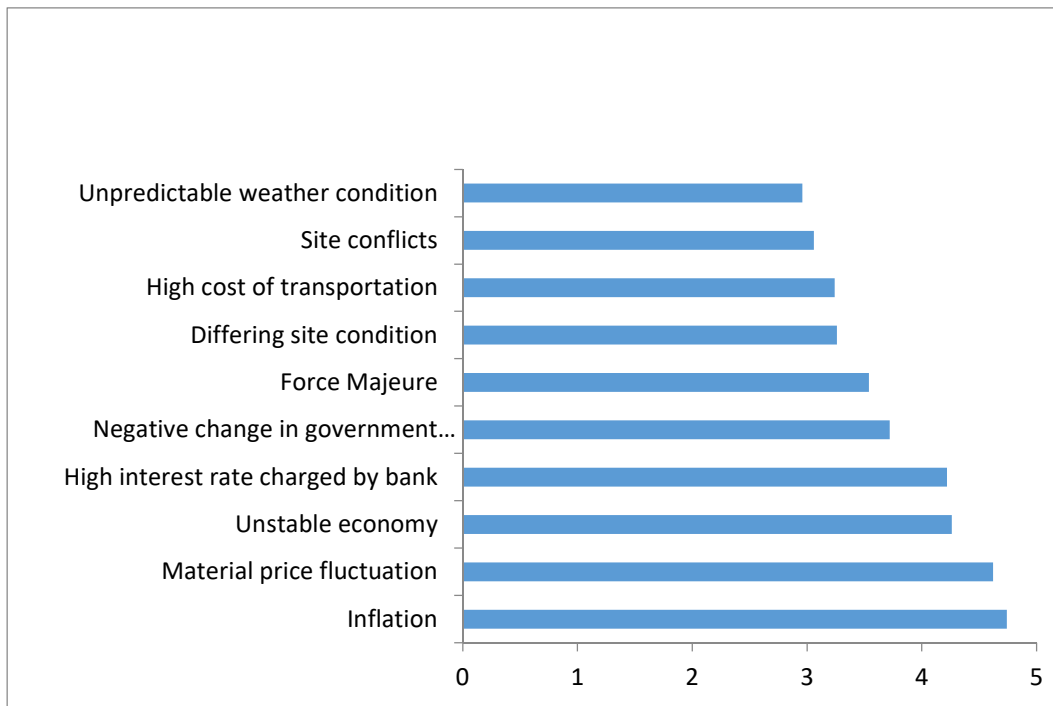


Figure 4.10: Other related factors affecting cost performance

Source: Field survey (2018)

5. CONCLUSION AND RECOMMENDATION

Based on the study, the assessment of the factors affecting cost performance of Nigeria indigenous contractors in Lagos, the following conclusions has been reached: Variation orders/ change in design made by clients on various construction projects has the highest effect on the cost performance of indigenous contractors; Poor cost control by the consultants has the highest effect on the cost performance of indigenous contractors; Poor site management /supervision and poor cost control by the contractors has the highest effect on the cost performance of indigenous contractors; and Inflation under other factors has the highest effect on cost performance of indigenous contractor.

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