MINIMIZATION OF CHANGE ORDER IN NIGERIAN CONSTRUCTION INDUSTRIES

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ABSTRACT

The production of building project is complex in nature, as it is associated with numerous activities, some of these activities are subject to changes. These changes require appropriate attention so as to avoid claims and counter claims. Change orders are usually issued to cover such variations in scope of work, material quantities, design errors, and unit rate changes Change order is one of the controversial issue in construction industries and require successful negotiations to avoid claims and possible litigation. It often have a serious consequence on the quality, time, and cost of projects. This paper aimed at investigating causes, effect and control of change order in construction. A total of sixty (60) questionnaires were distributed out of which forty eight (48) representing 80% were properly completed and returned. Data collected were organized and analyzed in consonance with the research questions. Frequency tables, weighted mean and ranking were used in the presentationand analysis of data. The results show that all the assessed indices obtained as 'very high' with relative importance index (RII) of (RII > 0.80) were: 'Modification of plans by the client'' and ''Additional work by the client'' as causes of change order. '' Increase in project cost'' and '' adjustment in program of work'' as effect of change order while '' Engagement of qualified personals'' and the use of 3D model project to detect''Errors during project design'' were rated 'as control for change order. The implementation and strict compliance with control measures highlighted in the research will go a long way in minimizing the occurrence of change order. The engagement of a consultant builder in every construction project must not be undermined, even at the design stage prior to commencement of actual production and during project construction

Key Words: Change order, minimization, construction, projects, mean, and ranking.

1.0 INTRODUCTION

A change is defined as any deviation from an agreed upon well-defined scope and schedule. A change order is the formal document that is used to modify the original contractual agreement and becomes part of project's documents. Zawawi et al (2010) defined a change order as work

that is added to or deleted from the original scope of work of a contract,this includes changes to plans, specifications or any other contract document.it alters the original contract amount or completion date.

Change orders are common to most projects and very common with large project (public projects). After the original scope for the contract is formed, complete with the total price to be paid and the specific work to be completed, a client may decide that the original plans do not best represent his definition for the finished project. Accordingly, the client will suggest an alternate approach.The engineer's review of the design may also bring about changes to improve or optimize the design and hence the operation of the project. Further, errors and omissions in engineering or construction may force a change. All these factors and many others necessitate changes that are costly and generally un-welcomed by all parties. Resolving Change Orders can also become the source of dispute between the owner and the contractor. The disputed issues become further intensified if the change order process is inadequately managed. The owner's and the contractor's diverging and competing interests relative to the changes on a project may also become a factor in judiciously resolving the differences. Regardless of its causes, change order often resulted in disputes and dissatisfactions among the parties involved, project delay and difficult to manage due to additional costs.

Common scenarios that could lead to change order are:-
➢ The project incorrectly estimated
➢ When the project team discovers obstacle or possible efficiencies that require them to deviate from the original plan
➢ When the project team is inefficient or incapable of completing their required deliverable within budget and additional money time or resources must be added to the project.
➢ When Correction of design errors and omission becomes necessary
➢ During the course of the project, additional features or options are perceived and requested.

The occurrence of any of the scenario compels the project manager to generates a typical change order document that describes the now work to be done (or not done in some cases), and the price to be paid for this now work.

Once this change order is submitted and approved it generally serves to alter the original contract such that the change order now becomes part of the contract.

2.0 LITERATURE

According to Abdel Rashid., et al. (2012), change may occur on a project for a number of reasons, such as design errors, design changes, additions to the scope, or unknown conditions. Change order will lead to strong feelings of pessimism for all involved in construction projects.a builder is to study the production information from production point of view and suggest ways by which the design could be more production friendly for the direct benefit of client/developer. The consultant/professional input of a builder is to complement the effort of the designers with the singular objective of giving clients value for their money and enhancement of the usage of the construction. (Bamisile, 2004)

Thereby reducing or immunizing change order which must have followed without the professional advice of the consultant builder on build ability and maintainability analysis.

The contractor may have no course except to make the change or get thrown out off the job and lose the ensuring legal fight or the contractor will have a valid claim for extras and the owner will bear the consequences. Informal change request may be backed up by the full force of law, in other circumstance the impact of changes will be ignored by the courts, and claims for extra payment will not be enforced.

Most construction contract specifies the steps required before additional work or deduction in work is authorized. Construction contract typically provide that a change in cost or time must be described and submitted in written; must be submitted many days in advance of the work {or so many days after the owner's request}, signed by designated parties, and reviewed and approved within so many days of submission.

The contractor can have an absolutely legitimate claim, must be able to prove it in order to collect or ensure getting paid for extra work, document situations as soon as the problem becomes known, or at least within the maximum number of days allowed by the contract.

In most contract disputes problems could have been avoided if the subcontractor had notified the general contractor or owner in a timely manner. The majority of problems occur when contractors seek money for extra work done weeks, or even months, after the fact without timely documentation to back up the request.

3.0 METHODOLOGY

A survey of experts' opinion on causes, effect and control of change order in construction projects was conducted. A structured questionnaire was designed and administered to construction professionals on selected projects in Lokoja and Idah, Kogi State of Nigeria. A total of sixty (60) questionnaires were distributed out of which forty eight (48) representing 80% were properly completed and returned. The principal issues addressed in the survey include: experts opinion on causes, effect and control of change order in construction projects

PRESENTATION AND ANALYSIS OF DATA

Most of the questions in the questionnaire involved assessing some indices of change order on a five (5) grade (strongly agreed, agreed, undecided, disagreed and strongly disagreed). Data collected were organized and analyzed in consonance with the research questions on the questionnaire. Frequency, tables weighted mean and ranking were used in the presentation and analysis of data. Each table contains information on the response to the research questions.

Table 1 below shows the summary of the background information on the respondents.

Table 1: PROFESSION OF RESPONDENTS

S/NO	Profession	No. of respondents	Percentage [%]
1	Builders	18	37.50
2	Architects	12	25.00
3	Civil Engineers	5	10.42
4	Quantity Surveyors	4	8.33
5	Land Surveyors	6	12.50
6	Town Planners	3	6.25
	TOTAL	48	100

Source: Researcher's Field Survey, 2017.

Fromtable-1 above, it can be seen that the respondents were spread among the professionals in the construction industry with the builder having 37.50% followed by Architects 25%, the Civil Engineers 10.42%. TheQuantity Surveyors has 8.33%.while Land Surveyors and Town planners have 12.5% and 6.25% respectively.

Table 2: QUALIFICATION OBTAINED BY REPONDENTS

Qualification obtained	No. of Respondents	Percentage [%]
HND	10	20.83
B.SC	18	37.50
M.SC and above	12	25.00
Professional certificate	8	16.67
TOTAL	48	100

Source: Researcher's Field Survey, 2017

Table-2, indicates that most of the respondents with HND represents 20.63%, BSc, representing 37.5%. The total number of respondents with MSc and above are 25.00% and professional certificates represents 16.6.7% of the total respondents. It shows that most of the respondents involved in this study obtained qualification not less than HND which goes to show that the respondents are educated or knowledgeable enough to be able to know causes of errors and omissions that can lead change orders.

Ordinal scale was transformed to interval scale by assigning a weight to each interval. Hence, frequency intervals from (strongly disagreed) to (strongly agreed) as an interval scale from zero to four, were transformed to enable us to conduct the required parametric statistics. Sections two, three, and four on causes, effects, and controls of change order respectively scored as follow to come up with an index to indicate its importance: (strongly agreed) equals to number (4), (Agreed) equals to number (3), (Disagreed) equals to number (2), (Strongly Disagreed) equals to number (1) and (Undecided) equals to number (0).

X_0: Number of respondents answering (Undecided) = (0).

X_1 : Number of respondents answering (strongly disagreed) = (1).

X2 : Number of respondents answering (disagreed)= (2).

X3 : Number of respondents answering (agreed) = (3).

X4: Number of respondents answering (strongly agreed)= (4).

The Importance index (II) is used to get the weightage average to rank the causes, effects and control measures. The basis of calculating Importance Index is the same as adopted by Zaneldin, (2006)when he calculated the Importance Index of each cause as follows:

Weighted Average $= \Sigma WixXi/N$

Where:
i is the number of options (from 1 for "never" to 5 for "very frequent")
Wi is the weight assigned to the ith option;
Xi is the number of respondents who selected the ith option; and
N is the total number of respondents (48) in this study.

Importance Index $= Weighted\ Average \times \dfrac{100}{4}$

Where Wi the weight is assigned to the ith option of cause; Xi is the number of respondents who selected the ith option of cause; and N is the total number of respondents. To better understand the Importance Index percentage is calculated as follows:

$$ImportanceIndex = Weighted\ Average \times \dfrac{100}{4}$$

$$Importance\ Index = \dfrac{4(x1)+3(x2)+2(x3)+1(x4)+0(x5)}{x1+x2+x3+x4+x5} \times \dfrac{100}{4}$$

Ranking of the items under consideration based on their RII values. The item with the highest RII value is ranked first (1) the next (2) and so on.

Interpretation of the RII values as follows:

RII < 0.60, item is assessed to have low rating

$0.60 \leq$ RII <0.80, item assessed to have high rating.

RII ≥ 0.80, item assessed to have very high rating.

Table 3: CAUSES OF CHANGE ORDER

S/N	Causes of Change Order	X0 (0)	X1 (1)	X2 (2)	X3 (3)	X4 (4)	MEAN	RII	RANK
1.	lack of coordination between contractor and consultant	2	4	12	14	16	2.79	70	8th
2.	Conflict between contract documents	1	0	10	16	21	3.17	79	4th
3.	Substitution of materials or procedures	5	2	11	13	17	2.73	68	9th
4.	improvement in design by consultant	3	6	13	11	15	2.60	65	10th
5.	Additional work by the client	0	2	4	18	24	3.33	83	2nd
6.	modification of plans by the client	1	0	4	15	27	3.42	86	1st
7.	Errors and omissions in design	0	2	17	14	25	3.29	82	3rd
8.	Ineffective quality control check	7	0	8	12	21	2.83	71	7th
9.	Poor planning by contractor	0	1	8	21	18	3.17	79	4th
10.	The objective of the project not well defined	9	3	10	14	12	2.35	59	12th
11.	Owners financial problems	2	12	9	11	14	2.48	62	11th
12.	Adjustment due to unavailability required equipment	10	5	8	12	13	2.27	76	6th

Source: Researcher's Field Survey, 2017.

Causes of change order and their frequency

The third section of the survey focused on causes of change order. In this section, a table was provided with twelve (12) possible causes of change order. Construction professionals were asked to indicate their opinion from five possible options as frequency of each cause of change order.

For example, item 1 in table 3 above, indicate that 2 respondent were undecided, 4 strongly disagreed, 12 disagreed, while '', 14 respondents agreed, 16 respondents strongly agreed that ''lack of coordination between contractor and consultant'' could cause change order.. Data received from respondents were analyzed and a weighted average was calculated using equation (1) as shown earlier.

For example, the average mean for the item 1 in table 3 above, analysed frequency of respondent for ''lack of coordination between contractor and consultant'' as possible cause of change order thus:

''lack of coordination between contractor and consultant'' = (0*2 + 1*4 + 2*12 + 3*14 + 4*16)/48 = 2.79.

The importance index percentage was then calculated using equation (2) for each cause of change order, as shown in Table 3.

For example, the importance index for item 1 ''lack of coordination between contractor and consultant'' as possible cause of change order = (2.79*100)/4 = 70% and was ranked 8th in table 3
The results of this analysis indicate that

TABLE4: EFFECT OF CHANGE ORDER

S/N	Effect of Change Order	X0 (0)	X1 (1)	X2 (2)	X3 (3)	X4 (4)	MEAN	RII	RANK
1.	Increase in overhead expenses	9	7	6	13	11	2.12	53	12th
2.	Lead to Demolition and re – work	2	6	9	11	20	2.85	71	5th
3.	Delay in completion due date	0	4	8	14	22	3.12	78	3rd
4.	Lead to adjustment in program of work	1	0	4	19	24	3.35	84	2nd
5.	Working behind schedule	2	4	9	14	19	2.92	73	4th
6.	Sometimes results to litigation	7	0	10	13	18	2.73	68	6th
7.	Delay in material delivery	3	11	8	11	15	2.29	57	10th
8.	Dispute between owner and contractor	6	8	11	10	13	2.33	58	9th
9.	Decrease in quality of work	2	12	9	11	14	2.48	62	8th
10.	Increase in project cost	4	6	10	15	23	3.39	85	1st
11.	Delay in payment to contractors	1	10	8	12	17	2.71	68	6th
12.	Additional revenue for contractor	11	5	8	13	11	2.17	54	11th

Source: Researcher's Field Survey, 2017.

Effect of change order and their frequency

The fourth section of the survey focused on the In this section, a table was provided with twelve possible causes of change order. Similar to causes of change order in table 3. professional were asked to choose one of five possible options for the frequency of each effect of change order: (strongly agreed) equals to number (4), (Agreed) equals to number (3), (Disagreed) equals to number (2), (Strongly Disagreed) equals to number (1) and (Undecided) equals to number (0).

for example, item 1 in table-4 indicate that 9 expert responded "undecided", 7responded as "strongly disagreed", 6 responded as "disagreed", 13 responded as "agreed", while 11 responded as "strongly agreed"'. Data received from respondents were analyzed and a weighted average was calculated using equation (1) for each effect of change order, as shown in Table 4. For example, the average mean for the

"Increase in overhead expenses'' = $(0*9 + 1*7 + 2*6 + 3*13 + 4*11)/48 = 2.12$.

The importance index percentage (II) was then calculated using equation (2) for each of effect of change order index, as shown in Table 4.

For example,

The importance index for the effect of change order

"Increase in overhead expenses" = $(2.12*100)/4 = 53\%$ and was ranked 12th in table 4.

TABLE-5: CONTROL OF CHANGE ORDER

S/N	Control of Change Order	X0 (0)	X1 (1)	X2 (2)	X3 (3)	X4 (4)	MEAN	RII	RANK
1.	Adequate communication is essential	6	9	8	12	13	2.35	59	10th
2.	All building under construction are	5	8	12	11	12	2.35	59	10th

	approved by planning board							
3.	Ensure that Change order is negotiated by Contract document	1	5	11	13	18	2.88	72	4th
4.	Professionals should insist on the use of 3D model project	0	9	13	12	14	2.65	66	6th
5.	Errors can be detected easily by the use of 3D model project	0	2	5	18	23	3.29	82	1st
6.	Use of computer visualization tool should be implemented	5	10	9	13	11	2.31	58	12th
7.	contractors should engaged supervisors to supervise their project	2	4	11	12	19	2.88	72	4th
8.	Strict adherence to specification	1	0	7	23	17	3.15	79	3rd
9.	Regular site meetings for frequent appraisal work in progress	6	5	10	13	14	2.50	63	7th
10.	Ensure that Change order is negotiated by Contract document	4	8	11	12	13	2.46	61	8th
11.	Ensure that Contract document are checked and reviewed	5	9	9	10	15	2.44	61	8th
12.	Engaging qualified personals	0	2	5	18	23	3.29	82	1st

Source: Researcher's Field Survey, 2017.

Discussion of Results

4.1 CAUSES OF CHANGE ORDER

In table 3: The result of the survey conducted and analysed indicated that the opinion of experts in construction rated three out of the twelve causes highlighted as "very high" with (RII > 0.80) thus:

Item 6: '' Modification of plans by the client'' with 86% was ranked 1st position,

Item 5: Additional work by the client with 83% ranked 2nd and

Item 7: ''Errors and omissions in design'' with 83% ranked 3rd

Eight other indexes in the same table 3 were rated "high" with (0.60≥ RII <0.8) thus:
Item 2:''Conflict between contract documents'' with 79% was ranked 4thand

Item 9:''Conflict between contract documents'' with 79% was ranked 4th

Item 12:''Adjustment due to unavailability required equipment''with 76% was ranked 6th

Item 8:''Ineffective quality control check 'with 71% was ranked 7th

Item 1:''lack of coordination between contractor and consultant with 70% was ranked 8th

Item 3:''Substitution of materials or procedures with 68% was ranked 9th

Item 4:''improvement in design by consultant with 65% was ranked 10th

Item 11:'Owners financial problems' with 62% was ranked 11th

Finally,the only item with (RII < 0.60,) was rated thus;

Item 10:''The objective of the project not well defined 'with 59% was ranked 12th

EFFECT OF CHANGE ORDER
In table 4, The result of the analysis conducted indicate that the opinion of construction professionals on effect of change order in construction rated two out of twelve indexes analysed as;" very high" with important index of (RII > 0.80) thus:
Item 10: ''Increase in project cost'' with 85% was ranked 1st position, and

Item 6: ''Lead to adjustment in program of work'' with 84% was ranked 2nd

Six others, out of the twelve effect of change order highlighted in (table 4) above, were rated ''high'' with (0.60≥ RII < 0.8) as follows:
Item 3: ''Delay in completion due date'' with 78% was ranked 3rd position,

Item 5:'' Working behind schedule''with 73% ranked 4th and

Item 2: ''Errors and omissions in design''with 71% ranked 5th

Item 6:''Sometimes results to litigation'' with 68% was ranked 6th and

Item 11:''Delay in payment to contractors'' with 68% was ranked 6th

Item 9:''Decrease in quality of work''with 62% was ranked 8th

Items rated as ''low'' with (RII < 0.60,) were;

Item 8:''Dispute between owner and contractor''with 58% was ranked 9th

Item 7:''Delay in material delivery '' with 57% was ranked 10th

Item 12:''Additional revenue for contractor''with 54% was ranked 11th

Item 1:''Increase in overhead expenses'' with 53% was ranked 12th

CONTROL OF CHANGE ORDER
Table 5, indicated that the opinion of construction professionals on control of change order in construction rated two out of twelve indexes analysed as;" very high" with important index of (RII > 0.80) thus:
Item 5: ''Errors can be detected easily by the use of 3D model project'' with 82% was ranked 1st position, and

Item 12: ''Engaging qualified personals'' with 82% was ranked 1st

Other seven indexes out of the twelve possible control of change order highlighted in (table 5) above, were rated ''high'' with (0.60≥ RII < 0.8) as follows:

Item 8: ''Strict adherence to specification'' with 79% was ranked 3rdposition,

Item 3:'' Ensure that Change order is negotiated by Contract document''with 72% ranked 4thand

Item 7:'' contractors should engaged supervisors to supervise their project'' with 72% ranked 4th

Item 4:''Professionals should insist on the use of 3D model project'' with 66% was ranked 6th

Item 9:''Regular site meetings for frequent appraisal work in progress'' with 63% was ranked 7th

Item 10:''Change order should be negotiated by Contract document''with 61% was ranked 8th

Item 11:''Contract document should be checked and reviewed''with 61% was ranked 8th

Items rated ''low'' with (RII < 0.60,) were;

Item 1:''Adequate communication is essential''with 59% was ranked 10th

Item 2:''All building under construction are approved by planning board ''with 59% was ranked 10th

Item 6:''Use of computer visualization tool should be implemented '' with 58% was ranked 12th

5.0 CONCLUSION AND RECOMMENDATION
5.1 Conclusion
The research revealed that Modification of plans by the client, ''Additional work by the client'' and 'Errors and omissions in design'' are causes of change order rated ''very It was indicated that Increase in project cost''and '' Lead to adjustment in program of work are significant effect change order while ''Errors can be detected easily by the use of 3D model project''and ''Engaging qualified personals'' The implementation and strict compliance with control measures highlighted in the research will go a long way in minimizing the occurrence of change order. The findings in this work corroborate the work of (Zawawi, et al. 2010) in (Alaryan et al, 2014).' It is work that are added to or deleted from the original scope of work of a contract which alters the original contract amount or completion date. (Odeh and Battaineh, 2002), (Assaf S., & Al-Hejji S. 2006) also concluded that many projects experience extensive delays due mainly to change orders and thereby, exceed initial time and cost estimates

5.2 RECOMMENDATION

1. The engagement of a consultant builder in every construction project must not be undermined, even at the design stage prior to commencement of actual production and during project construction.

2. Regular workshops should be held to improve the professional competence of members and regular consultations between allied professionals of the building industry should be encouraged or enhanced.

3. The 3D building model design concept should be explored at the designing stage

4. Adherence to Specifications and relevant Code should be strictly enforced.

5.

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