

CHANGE ORDER: LESSONS FROM NIGERIAN ROAD CONSTRUCTION AND IRANIAN ROAD CONSTRUCTION PROJECTS

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Abstract: Due to the increasing complexity of the modern projects and the impacts of technological advancement, change orders become more prevalent on construction projects in most developing countries. This research is a comparative study aims to compare the causes of change order in the Nigerian road construction and the Iranian road construction projects so as to contain and curtail its occurrence in the forthcoming projects in Nigeria. A quantitative research approach was undertaken for this purpose. Total of 71 semi structured questionnaires were distributed to the entire respondents, 43 questionnaires were successfully retrieved representing 60% of the total, and from the survey conducted the study is able to isolate 10 critical causes of change orders in both countries. It was observed that scope of work not well defined, differing site condition, acceleration of work, quality improvement and owners' financial problem among others were some of the critical factors causing change orders in road construction projects. Further analysis was also carried out using T-test to find out if there is any significant difference in the opinion of the respondents in both countries, finding reveals that there is no difference in the opinion of respondents in both Nigeria and Iran pertaining the causes of change order in the road construction projects.

Keywords: Change order, Road Construction, Nigeria, Iran, Ranking, T-test, Construction Industry



Introduction

Construction projects involve complex processes and fragmented in nature which is susceptible to changes. Change orders have for long been an integral part of the construction industry, it is rarely to complete a project from its conception to completion without a change which normally occurs as a result of various participants and different supply chain involves (Alaryan et al. 2014). Change orders have been defined variously by many researchers, Zawawi et al. (2010) defined change order as a work that added to or removed from the original scope of work which alters the original contract sum and completion period. According to Pourrostan and Isma'il (2011) change orders are the reason why most contractors do not meet up with the time specified for completion of most contract works.

In the same vein, Osman et al. (2009) concurred that change order is any deviation from an agreed upon well defined scope of work and scheduled while Parker (2001) described change as work, process or methods that

deviate from initial scope of contract and specification. Alnuami et al (2010) averred that change orders are issued to alter the original scope or modify the design. The term Change Order often raised a negative feeling to all parties involved in construction projects, it distort the relationship between the owner, contractor and consultants viz; Quantity Surveyors, Architects and Engineers (Alaryan et al. 2014).

According to Ayodele and Alabi (2011) change orders disrupt the work flow, it requires more additional of both paper and practical work, most change orders issued during contract execution has negative effect on project cost and completion time and in worst case could lead to the subsequent abandonment of the construction work and disputes among parties involved in the project.

However, in order to contain and curtail the challenges posed by change orders in road construction projects in Nigeria due to impacts of technological advancement it is important to analytically pin point their critical causes so that efforts can be concentrated on them so as to reduce their occurrences in subsequent projects. To achieve this, the causes of change orders in Nigerian road construction and that of Iran were compared as both countries relies more on oil which provides large share of government revenues which they use for most of their infrastructural development and their economies lies between the most expensive and cheapest economies in the world and also they both experience similar scenario like corruption and unemployment among their citizenry.

Literature Review

Many researchers have made an attempt to address change orders in construction projects, 'changes' in construction has always draw attention of the different participants. Ijaola and Iyagba (2013) identifies the change order causes in Nigeria and the Oman public construction projects, among the most prevalent causes in both countries are owners instruct additional works, owner instruct modification to design and the contractors' uses the grey areas in the general conditions and request for variation. The study suggested remedies that a specialized Quantity Surveyor/ Cost Controller and Project Manager should be employed at the onset of a larger construction projects and the registration of the consultant firms should be reviewed at certain period to reflect their technical capabilities. Kasimu and Usman (2013) pin point change order as among the major causative factor of delay in the Nigerian Construction Industry which can subsequently lead to the abandonment of the work. The 'change of work scope' as the major cause of delay and cost overruns was mentioned by Apolot et al (2010) in their work, studying the delays and cost overruns in Ugandan public

construction projects. Ibn Homaid (2011) reveals that change of the project scope due to additional diminution or enhancement in client requirement was the most frequent and severe causes of change orders.

Yitmen and Soujeri (2010) developed an artificial neural network model in order to manage the change order occurs at all phases of construction projects. The model consists of two major components, viz. identifying the effects of change orders on the projects performance and the likely hood of dispute occurrence with the aim to ascertaining the impact of change order on the performance of the projects and the appropriate dispute resolution. Stare (2011) developed a project risk and change management model. Empirical quantitative data was used to test the model in 137 Slovenian firms. The results revealed that foreseeing changes reduces cost overruns as well as project delay.

Ibbs et al (2001) in their study proposed a comprehensive project change management system for managing any change occurrence in the process of project execution, the system was based on five major principles; promote a balance change culture, recognize change, evaluate change, implement change and continuously improved from lessons learned. Two taxonomies for change order causes and change order effects was designed by Sun and Meng (2009), this study classified the causes of change order into; external causes, organizational causes and project internal causes while that of effect into time and cost effects, relationship and people effects. According to many researchers, change order can lead to many undesirable results such as both cost and time overruns, disputes between parties involved in the project, rework and demolition and above all, sometimes lead to the abandonment of the projects entirely.

Methodology

Quantitative research approach was systematically employed for the purposes of this study were semi structured questionnaires were designed and administered to professionals in the Nigerian Construction Industry. The questions were designed to retrieve information on the most critical causes of change order in the Nigerian road Construction projects so as to compare with that of Islamic Republic of Iran.

The questionnaire is divided into two sections (A and B), section A comprises total of five (5) questions aimed at providing information about the respondents whereas section B had twenty five (25) questions which focused on the subject matter of the study i.e. causes of change orders in the road construction projects. These causes were derived from the review of previous studies from related works. However, the causes highlighted may not cover all but commenting effort was made to identify the substantial causes of change order in the

road construction project. For each question in section B the respondents had been provided with five options in the form of a Likert Scale ranging from 1(Strongly disagree); 2 (Disagree); 3 (Neutral); 4 (Agree) and 5 (Strongly agree). In addition, the respondents were also encourage to cite additional factors thought to be the causes of change order in the Nigerian road construction projects.

The sample of the study was randomly selected for Consultants and Contractors from directory of the Corporate Affairs Commission (CAC) while that of Clients was selected from the government ministries and agencies. Total of 71 questionnaires were distributed to the entire respondents; 25 each to Clients and Consultants while 21 to Contractors. 43 questionnaires were successfully retrieved representing (60% of the total), i.e. 19 Consultants (76%), 15 Client (60%) and 9 Contractors (36%) which were valid and used in the analysis. The data obtained in the returned questionnaires was analysed using the Statistical Package for Social Sciences(SPSS) software.

Results and Discussion

Description of Respondents' work

The table (1) below present the distribution of the respondents based on the nature of their work. Consultants formed the large group of the respondents with 19 representing (44.19%) out of the total in the entire survey then followed by Clients with 15 (34.88%). It can also be seen that 9 representing (20.93%) of the respondents were Contractors from various contracting firms.

Table 1: Nature of Respondents' Work

<i>Nature of Work</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Consultants	19	44.19	44.19
Clients	15	34.88	79.07
Contractors	9	20.93	100.00
Total	43	100.00	

Causes of Change Order in the Road Construction Projects

Based on reviews of previous related studies 25 factors were identified and thought to be responsible for change order in the road construction projects, these causes were adopted in the section B of the questionnaire and the data retrieved from them was further analysed. Table (2) below show the causes of change order in the road construction as used in the questionnaire.

Table 2: Causes of Change Order in the Road Construction

S/No.Causes of Change Order in the Road Construction Projects

1. Acceleration of work
2. Emergency field condition
3. Weather
4. New government regulations
5. Demolition and re-work
6. Strikes
7. Quality improvement
8. Conflict in the project site
9. Contractor desire to improve his financial conditions
10. Materials or workmanship not complying with specifications
11. Equipment and tools required are not available
12. Skilled labour required not available
13. Owners' financial problem
14. Change in scope of work by client
15. Substitution of material
16. Design change originated by client
17. Design change initiated by consultant
18. Conflict between contract documents
19. Errors and omission in design
20. Scope of work not well defined
21. Value engineering
22. Technology change
23. Lack of coordination between parties involve in the contract
24. Differing site conditions
25. Contractors' financial difficulties

The 10 most critical factors responsible for change order in road construction projects were isolated based on the respondents' (consultants, clients and contractors) opinion and this was achieved by strategically employing the descriptive statistics to compute their mean scores and further rank them accordingly as can be seen in the table 3 below.

Ranking of Change Order Causes

Table 3: The 10 most Critical Causes of Change Order in the Road Construction

Order	Client	Rank Client	Mean Consultants	Rank Consultants	Mean Contractors	Rank Contractors	Overall Mean	
1	Change in scope of work by client	3.21	9	4.28	1	3.65	5	3.71
2	Owners' financial problem	3.11	10	4.12	2	3.15	8	3.46
3	Conflict in the project site	3.23	8	4.12	2	3.27	7	3.54
4	Quality improvement	3.25	7	3.76	5	3.15	8	3.39
5	Scope of work not well defined	4.17	1	3.28	9	4.17	1	3.87
6	Differing site conditions	3.89	3	3.98	4	3.65	5	3.84
7	Acceleration of work	4.11	2	3.45	6	3.89	4	3.82
8	Errors and omission in design	3.55	4	3.33	8	4.05	2	3.64
9	Equipment and tools required are not available	3.43	5	3.45	6	3.03	10	3.30
10	Conflict between contract documents	3.43	5	3.08	10	4.05	2	3.52

Below is a comparison of the results of this study and the results adopted from Isma'il *et al.* (2012) research work representing studies from Nigeria and Iran respectively. The first two critical causes of change order as appeared in both studies are 'scope of work not well defined' and 'change in scope of work by client'. This implies that the respondents are in the opinion that scope of work supposed to be clearly defined at the onset of any road construction projects so as to contain frequent occurrences of change order. This analysis is in compliance with the studies of Ijaola and Iyagba (2013), Isma'il *et al.* (2012) and Al-Ajishi and Al-Marzoug (2008) which depicts clients as the most frequent cause of change order.

'Differing site conditions' appears second in Nigeria while third in Iran which portrayed that coming across the contrary sub-soil as envisaged in the process of road construction lead to frequent change order in both countries (Nigeria and Iran). 'Errors and omission in design' have emerged fifth based on the analysis made in Nigeria whereas it appeared second in the study carried out in Iran. This shows how consultants regularly cause change order as a result of oversight or establishing an inaccurate design for the project.

The factor which appeared number nine cause of change order in both countries is 'quality improvement' in the process of project execution. This implies that not defining the exact feature or quality needed for a project at the beginning also lead to the frequent change order in road construction project in both Nigeria and Iran. However, 'Equipment and tools required are not available' appeared last in the list of the ten most critical causes of change order in Nigerian road construction project which shows that up to this era of technological advancement Nigeria is lagging behind in terms of construction plants and equipment. In Iran, 'Acceleration

of work' appeared last in the list of the study carried out in Iran, this indicate how fast tracking the road construction project not as scheduled at the beginning of the contract cause frequent change order.

Comparison with Previous study in Islamic Republic of Iran

Table 4: Comparison between Nigeria and Iran: Critical Causes of Change Order in the Road Construction

Causes of Change Order (Nigeria)	Ranking	Causes of Change Order (Iran)	Ranking
Scope of work not well defined	1	Change in scope of work by client	1
Differing site conditions	2	Errors and omission in design	2
Acceleration of work	3	Differing site conditions	3
Change in scope of work by client	4	Contractors' financial difficulties	4
Errors and omission in design	5	Weather conditions	5
Conflict in the project site	6	Conflict in the project site	6
Conflict between contract documents	7	Clients' financial problem	7
Owners' financial problem	8	Value Engineering	8
Quality improvement	9	Quality improvement	9
Equipment and tools required are not available	10	Acceleration of work	10

T – test to compare Means

Further analysis was also carried out to find out if there is any significant difference in the opinion of the respondent in the two countries (Nigeria and Iran) regarding causes of change orders in road construction projects in their country. T–test was used in carrying out the test because the significant difference to be identified is in two different samples; with T-test the question of whether or not the means scores of different samples vary significantly from one another is answered.

The results of T-test show that there is no significant difference in the opinion of respondents in both countries. This is because the calculated t statistic, **t = 0.685 and p = 0.511**, for significant difference to occur the calculated p value must be less than **0.05** at the 95% Confidence Interval (95% CI).

Based on the analysis, we can therefore conclude that despite different locations of the respondents they have related view concerning the causes of change order in road construction projects in their countries.

Conclusion and Recommendations

This study identified the critical causes of change order in road construction projects in Nigeria and compares it with that of Iran. The findings revealed that the most critical causes of change order in both countries are 'scope of work not well defined' before the commencement of most road projects in both countries then followed by 'differing site condition' contrary to what is envisaged that often occurs in the process of project execution and 'accelerating the work' beyond the period scheduled. The study has shown that, change order can cause many adverse effects such as cost and time overruns, disputes between parties involved in the project and above all, sometimes lead to the abandonment of the projects entirely.

In the light of the aim of this research and the findings discussed, this study makes the following recommendations;

- ✓ Clients should carry out a thorough feasibility study before the detail design stage so as to ascertain the actual scope of work in order not to alter the scope when the project takes off.
- ✓ In-depth sub-soil investigations have also been recommended to be carried out before the commencement of work to know the exact nature of the ground.
- ✓ To avoid errors and omissions in design or submitting an inaccurate design, several proof-reading has to be done by consultants' teams before onward submission to both client and the contractor.

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