Evaluating Change Orders and their Impacts on Construction Project Performance in Lagos, Nigeria

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Abstract

The construction of a project is a complex process, which could make orders unavoidable. Identifying the causes of change orders on construction projects is therefore imperative in order to avoid potential changes in future. This study investigated change orders and construction project performance in Lagos state, focusing on the causes of change orders on construction projects. This is to assess their impact on construction project and minimize their occurrences. The objectives are to investigate the causes of change orders; to examine the important measures to control change orders; to examine the impact of change orders on construction projects and to examine the level of occurrence. The research was carried out using convenience sampling technique. Questionnaire survey was used to elicit information in which 50 questionnaires were distributed to the building construction professionals in Lagos state. A total of 45 questionnaires representing a 90% response rate were analysed using frequency, mean and standard deviation. The result indicated that the major cause of change orders is change of plan or scope of work, the most important measure to control change orders is involving all the parties involved in projects, and the major adverse impact of change orders on construction projects is cost overrun. Conclusively, various causes of change orders can be curtailed through awareness and adequate participation of project parties. It is recommended that practitioners should be cautious of the causes of change orders on construction projects. Construction professionals should as well adopt proper planning among parties involved to control change orders.

Keywords: Change Orders, Measures, Impact, Causes, Occurrence

INTRODUCTION

Change orders are inevitable in projects, and the Nigerian construction industry is not an exception. Change orders occur mostly during the construction phase. A change order (CO) is an activity that specifies and justifies a change to the scope of a construction contract, which alters the cost and duration of a project. Parker (2002) describes change as work, state, process or methods that are different from original construction plan and specification. Most of the CO issued during the construction process has great impact on cost and time of project, and it could lead to project delay, abandonment and disputes, which are common in developing countries (Aibinu & Jagboro, 2002). Hegazy, Zanaty and Crierson (2001) opine that the reasons for CO include subsurface conditions at variance from those indicated in the contract documents; change in the regulatory legislations or code after the contract has been awarded; change of scope during construction by the owners or designers; correction of design errors and omission; non-availability of materials and equipments, and value engineering proposal. Alnuaimi, Taha, Al Mohsin and Al-Harthi (2009) posit that COs are issued to modify the original scope or design. They are done in the form of either "adding", "deleting", or

"replacement", (Ndihokubbwayo & Haupt, 2009). Numerous works have been done on change, change orders and change management. Most of these studies discussed the legal aspects of changes such as claims and disputes. For instance, Ijaola and Iyagba (2012) compared CO in construction project in Nigeria and Oman, vis-à-vis the causes, effect, benefits and remedies. This was meant to compare the scenario of CO in both countries, and subsequently determine areas for improvement. Ndihokubbwayo and Haupt (2009) also investigated the effects of changes on labour productivity. It is in response to this gap that this research investigate the causes of CO in construction projects, with a view to minimize their occurrence. The specific objectives are: to investigate the causes of CO; to examine the important measures to control CO on construction projects; to examine the impact of CO on construction projects; and to examine its level of occurrence.

Change orders on sites are very common in construction projects, because even the best plans are subject to changes during the construction phase and sometimes results to claims (Thomas & Napolitan, 1995). Ming, Martin, and Chimay (2004) revealed that project changes can be referred to as expected and developing changes. Expected changes are arranged ahead of time and happen as planned, while developing changes emerge suddenly and are not initially foreseen or expected. COs are normally initiated by the party coming up with the change in written and oral forms (Ssegawa, Mfolwe, & Kutua, 2002). In this regards, Ming *et. al.* (2004) opined that the reasons for project CO may be external or internal. External causes might be because of mechanical changes, changes in the client desires and tastes, changes in contender's exercises, changes in government and arrangements, changes in the economy and statistics changes in the general public. Internal causes may come about because of changes in administration arrangement, changes in authoritative destinations and changes in the long haul survival system of the associations included. Sunday (2010) also opined that causes of CO as clashes between contract documents, the change of arrangements or extension by clients, impediment in prompt decision making process, inadequate project objectives, contractual worker's craved productivity and temporary worker's money related troubles. On the other hand, Arain and Pheng (2006) classified reasons for CO into four starting point operators. These are client, consultant, contractor and other related changes. This implies that CO could originate from any of them.

Ruben (2008) and Yadeta (2016) found that CO affect project execution and the major effects are time and cost overruns. Moreover, Hanna, Calmic, Peterson and Nordheim (2002) found that tasks with many CO cause the contractual worker to achieve lower productivity levels than arranged. Arain and Pheng (2005) posit that measures and methodologies could be employed in planning stage to minimize CO, while control charter can be used in favour of clients in terms of CO reduction. Similarly, Ben-Ali (2008) suggests that CO can be lessened if all preparatory works are concluded before tendering, such as site and soil examinations. Thus, this study examines the causes, occurrence, impact and control measures of CO in Lagos.

METHOD

The research design selected for this study was the survey research. The population of this study includes all building construction professionals in Lagos state. Convenience sampling technique was used to collect sample. Questionnaires were distributed to the targeted respondents, which comprises five sections. Section A focuses on the background information about the

respondents; sections B and C centers on level of agreement of causes of CO and the important measures to control CO on construction projects. The causes were identified using a 5-point Likert scale, from strongly disagree (5) to strongly agree (1); while the control measures were measured on a 5-point Likert scale, from very high importance (5) to no importance (1). Sections D and E examined impact and occurrence of CO. The impact was measured on a Likert from very high impact (5) to no impact (1); while the occurrence was on a scale from never (4) to very often (1). A total of 50 questionnaires were distributed to the targeted respondents, 45 were completed and returned representing (90%) response rate. Mean score, standard deviation and rank was used to analyze the data.

RESULTS AND DISCUSSION

Demographic Information

The organizations' and respondents' profiles are presented in Table 1. Forty two of the organizations are indigenous organizations while three are multinational. Twenty two each are private and public organizations, while one respondent did not indicate the type of organization. Thirteen of the organizations are contracting, eight are consulting, six are client, thirteen are developers and five did not indicate the nature of their organizations. Twenty one of the organizations have existed for over 20 years, eight for 6 to 10 years, six for 16 to 20 years, and five each for 11 to 15 years and less than five years. The staff strength of 21 of the organizations is between 1 – 7, 15 have between 8-114 and nine have between 115 – 1200.

Additionally, the professions of the respondents shown in Table 1 reveals that three of them are Architects, 11 are Builders, 13 are Civil Engineers, six are Quantity Surveyors and 12 are Urban and Regional Planners. Two of them hold ordinary national diploma (OND) degree, four hold higher national diploma (HND) degree, 20 hold B.Sc degree, 17 hold Master's degree and one holds doctorate degree. Eleven respondents' work experience was between 6 to 10 years, four was between 11 to 15 years, and seven was above 20 years, while 18 were less than 5 years. Fifteen of them are members of the Nigerian Institute of Building (NIOB), five of the Nigerian Institute of Quantity Surveying (NIQS), three of the Nigerian Institute of Architects (NIA), fifteen of the Nigerian Society of Engineers (NSE), four of the American Society of Civil Engineers (ASCE), while three did not indicate whether or not they are members of any professional body. Their professional grade of membership shows that 4 are of no grade, 3 are associates, 11 are graduates, 24 are corporate and 1 each is fellow and technician.

Table 1: Demographic information

Category of organization	Indigenous	42
	Multinational	3
	Total	45
Type of organization	Public	22
	Private	22
	Total	44
Nature of organization	Contracting	13
	Consulting	8
	Client	6
	Developer	13
	Educator	5

	Total	45
Age of organization	Above 20years	21
	6-10years	8
	16-20years	6
	11-15years	5
	Less than 5years	5
	Total	45
Staff strength	1-7	21
	8-114	15
	115-1200	9
	Total	45
Respondent information	Civil engineering	13
	Building	11
	Quantity surveying	6
	Architecture	3
	Urban and regional planning	12
	Total	45
Respondents' academic qualification	HND	4
	B.Sc	20
	M.Sc	17
	PhD	1
	OND	2
	Total	44
Years of experience	Less than 5years	18
	6-10years	11
	Above 20years	7
	11-15years	4
	Total	45
Registered professional body	NSE	15
	NIOB	15
	NIQS	5
	NIA	3
	ASCE	4
	Not indicated	3
	Total	45
Respondents' professional grade of membership	None	4
	Associate	3
	Graduate	11
	Corporate	24
	Fellow	1
	Technician	1
	Total	44

Causes of Change Orders

Table 2 shows factors that causes change orders in construction projects. From Table 2, change of plan or scope of work was ranked first with mean of 1.69, this finding agrees with Alnuaimi *et al* (2009) who concluded that the major cause of change orders on most construction projects was modifying the original scope or design. This is followed in descending order by change in specifications, change in design by the consultant, change in economic conditions, change of

schedule and inadequate project objectives with mean value of 1.71, 1.76, 1.82, 1.91 and 1.93 respectively. Consultant's lack of experience with mean of 2.24, complexity of design with mean of 2.36, technology change with mean value of 2.38 and contractor not involved in the design stage with mean value of 2.49 were the least ranked. Construction organizations and clients should take note of change of plan or scope of work and change in specifications as they are the major causes of CO in construction projects.

Table 2: Causes of change orders.

S/N	Causes	n	1	2	3	4	5	STD	Mean	Rank
1	Change of plan or scope	45	17	25	3	-	-	0.596	1.69	1
2	Change in specifications	45	19	21	4	1	-	0.727	1.71	2
3	Change in design by the consultant	45	16	25	3	1	-	0.679	1.76	3
4	Change in economic conditions	45	12	29	4	-	-	0.576	1.82	4
5	Change of schedule	45	10	29	6	-	-	0.596	1.91	5
6	Inadequate project objectives	45	14	20	9	1	-	0.789	1.93	6
7	Unforeseen conditions	45	13	25	3	3	1	0.917	1.98	7
8	Errors and omissions in design	45	13	24	4	3	1	0.929	2.00	8
9	Conflicts between contract documents	45	16	17	8	1	2	1.034	2.00	8
10	Inadequate working drawings.	45	13	21	5	4	1	0.998	2.07	10
11	Weather conditions	45	13	20	6	4	1	1.007	2.09	11
12	Defective workmanship	45	11	23	7	4	-	0.874	2.09	11
13	Lack of co-ordination	45	7	28	8	2	-	0.714	2.11	13
14	Impediment in prompt decision making	45	10	26	5	2	2	0.959	2.11	13
15	Consultant's unaware of available materials	45	8	26	9	1	1	0.815	2.13	15
16	Change in government regulations	45	8	27	3	5	1	0.947	2.18	16
17	Consultant's lack of experience	45	7	26	9	3	-	0.957	2.24	17
18	Design complexity	45	8	20	11	5	1	0.981	2.36	18
19	Technology change	45	5	26	9	2	3	0.984	2.38	19
20	Contractor not involved in design stage	45	5	22	11	5	2	0.991	2.49	20

1= strongly agree, 2= agree, 3= neutral, 4=disagree, 5=strongly disagree

Importance of Measures to Control Change Orders

The importance of the measures to control change orders on construction projects is shown in Table 3. Here, it can be deduced from the respondents' assessment that proper planning among parties involved was ranked first with mean of 4.20. The next four most important measures in descending order are placing experienced and knowledgeable executives in the engineering and design department; completing drawings at tender stage; client's clear brief of the scope of works; and consultant contract documents. The least important measure is accurate information and

research regarding procurement procedure, material and plant. This complies with Ben-Ali (2008), which revealed that change orders can be minimized if all the parties involved in projects are aware of the preliminary work before tendering are carried out.

Table 3: Level of Importance of measures to control change orders

SN	Measures	n	1	2	3	4	5	STD	Mean	Rank
1	Proper planning among parties involved.	45	3	1	5	11	25	1.160	4.20	1
2	Competent executives in the engineering and design department.	45	-	2	6	19	18	0.834	4.18	2
3	The drawings should be completed at tender stage.	45	1	2	6	15	21	0.984	4.18	2
4	Client brief	45	1	-	7	20	17	0.852	4.16	4
5	Consultant contract documents	45	1	2	5	18	19	0.952	4.16	4
6	Proper site investigations	45	2	-	8	16	19	1.005	4.11	6
7	Communication among parties	45	-	2	5	25	13	0.763	4.09	7
8	Specification within budget	45	1	2	6	20	16	0.939	4.07	8
9	Proper supervision of works	45	1	3	7	17	17	1.011	4.02	9
10	Adequate co-ordination at design stage	45	2	2	9	22	10	0.991	3.80	10
11	Forecast unforeseen conditions	45	1	3	11	23	7	0.895	3.71	11
12	Information on procurement procedure plants and materials	45	2	4	11	19	9	1.048	3.64	12

1= Not important, 2= Less important, 3= important, 4=very important, 5=very highly important

Impact of Change Orders

The impact of change orders on construction projects is shown in Table 4. Table 4 indicates that increase in project cost with mean value of 4.13 was ranked first as the major impact. This is followed in descending order by procurement delay, delay in completion schedule, and increase in overhead expenses with mean values of 4.04, 4.00, 4.00 respectively. Productivity degradation with mean value of 3.69, quality degradation with mean value of 3.67 and disputes among professionals with mean value of 3.53 were the least ranked. This is in consonance with Yadeta

Table 4: Impact of change orders.

SN	Impacts	n	1	2	3	4	5	STD	Mean	Rank
1	Increase in project cost	45	-	2	5	23	15	0.786	4.13	1
2	Procurement delay	45	1	2	7	19	16	0.952	4.04	2
3	Delay in completion schedule	45	1	2	6	23	13	0.905	4.00	3
4	Increase in overhead expenses	45	1	-	7	26	10	0.778	4.00	3
5	Rework and demolition	45	1	3	8	18	15	0.999	3.96	5
6	Delay in payment	45	2	4	7	18	14	1.107	3.84	6
7	Construction progress is affected	45	1	2	7	28	6	0.815	3.82	7
8	Poor professional relations	45	-	5	9	23	8	0.883	3.76	8
9	Additional payment for contractor	45	-	4	10	23	7	0.839	3.75	9
10	Productivity degradation	45	1	2	9	31	2	0.733	3.69	10
11	Quality degradation	45	2	2	12	22	7	0.953	3.67	11
12	Disputes among professionals	45	1	-	22	18	4	0.757	3.53	12

1= No impact, 2= low impact, 3= Medium impact, 4=High impact, 5=very high impact

(2016), which showed that increase in project cost, time, overhead expenses and contractors payments, in addition to effect on work progress as the main impacts of change orders on public building projects.

Occurrence of Change Orders

The level of occurrence of change orders on construction projects is shown in Table 5. A change in design has the highest level of occurrence with mean value of 2.13. This is followed in descending order by change in specification, unforeseen conditions, defective workmanship, errors and omissions in design, change of plan or scope with mean values of 2.18, 2.18, 2.20, 2.27 and 2.40 respectively. Change in government regulations with mean value of 2.64 and technology change with mean of 2.67 were the least ranked.

Table 5: Level of occurrence of change orders

S/N	Change orders	n	1	2	3	4	Std	Mean	Rank
1	Change in design by the consultant	45	9	21	15	-	0.726	2.13	1
2	Change in specifications	45	7	24	13	1	0.716	2.18	2
3	Unforeseen conditions	45	9	19	17	-	0.747	2.18	2
4	Defective workmanship	45	4	28	13	-	0.588	2.20	4
5	Errors and omissions in design	45	5	24	15	1	0.688	2.27	5
6	Change of plan or scope	45	2	23	20	-	0.580	2.40	6
7	Change in economic conditions	45	2	22	21	-	0.583	2.42	7
8	Inadequate working drawing	45	4	19	17	4	0.792	2.48	8
9	Change of schedule	45	3	17	25	-	0.626	2.49	9
10	Conflicts between contract documents	45	3	19	21	2	0.695	2.49	9
11	Weather conditions	45	2	20	20	3	0.694	2.53	11
12	Design complexity	45	3	20	17	5	0.786	2.53	11
13	Inadequate project objectives	45	2	18	24	1	0.625	2.53	11
14	Impediment in prompt decision making	45	1	20	22	2	0.624	2.56	14
15	Lack of co-ordination	45	1	21	20	3	0.659	2.56	14
16	Lack of contractor's involvement in design	45	3	18	19	5	0.783	2.58	16
17	Consultant's lack of judgement and experience	45	-	20	24	1	0.543	2.58	16
18	Lack of consultant's knowledge of available materials	45	-	21	21	3	0.618	2.60	18
19	Change in government regulations	45	1	15	28	1	0.570	2.64	18
20	Technology change	45	1	16	25	3	0.640	2.67	20

1= very often, 2= often, 3= sometimes, 4= never

CONCLUSIONS AND RECOMMENDATIONS

This study investigated the causes, measures, impacts and level of occurrences of change orders in construction projects. It is concluded based on the findings that:

a) The major cause of change orders in projects is change of plan or scope of works. It implies that clients and designers are the major contributors to CO since they are solely capable of influencing the scope and plan of projects.

b) The most important measure to control change orders is involving all the parties in projects to control it. The implication of this is that projects where there are conflicts of interest and absence of team work will be difficult to curtail CO on them.

c) Cost overrun is the major impact of change orders on construction projects. Thus, substantial amount of money can be saved if CO are minimized or completely eliminated.

The following recommendations are made based on the findings of this study:

a) Practitioners should be cautious of the causes and impact of change orders on construction projects. This can be achieved through adequate awareness and conscious efforts to avoid them.

b) Construction professionals should implement the identified measures to control change orders such as proper planning among parties, proper site investigations, and competent executives in the engineering and design department. This can be achieved by engaging competent professionals in the project team and ensure their adequate participation.

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