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STAKEHOLDERS' PERCEPTION OF THE CAUSES AND EFFECTS OF VARIATION ORDERS IN PUBLIC CONSTRUCTION PROJECTS IN SOUTH-SOUTH ZONE OF NIGERIA

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ABSTRACT

Purpose: The construction process is a complex and risky endeavour often associated with unexpected changes which can occur at any stage of the project and may eventually lead to issuance of variation orders. Variation orders are subject to numerous factors which have significant effects on project performance. The study examines the causes and effects of variation orders in construction projects within the South-South geopolitical zone of Nigeria. The choice of the study area is determined by its socio-economic importance to the nation.

Design/methodology/approach: The study adopts the exploratory survey design approach in order to obtain the perception of professionals in the building construction industry on the causes and effects of variation order on construction projects. 241 valid questionnaires were used giving a response rate of 62.27%. Data obtained are analysed using mean score method, and Kruskal Wallis tests.

Findings: The findings reveal that change of scope of work, errors and omissions in design, change in specifications by client, client`s financial difficulties and inadequate project objectives were the dominant causes of variation orders. In addition, the major effects of variation orders include the increase in overall project duration, increase in project cost, disputes, schedule delays, and rework. The conclusion is that, there is no difference in the perception of clients, consultants and contractors concerning the causes and effects of variation orders on the performance of construction projects.

Practical implication: Professionals in the building construction industry should find the results of this research useful in enhancing their knowledge on effective project delivery and understanding the nature of causes and effects of variation order.

Originality/value: Findings reveal that all the key stakeholders in the building construction industry; clients, consultants and contractors exhibit similar perceptions of the causes and effects of variation order in construction project delivery. This attests to the fact that variation is inevitable in construction projects.

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Keywords: Construction projects; implementation; project performance; stakeholders; variation order.

1. INTRODUCTION

Project execution in the construction industry is confronted with many challenges and unexpected changes with associated effects ranging from low quality work, schedule delay, cost overrun, litigation, disputes, project abandonment to outright project failure. (Lo, Fung and Tung, 2006; Odediran and Windapo, 2014). Construction projects are recognized as complex in nature due to the large number of parties involved, internal and external factors and a myriad of environmental problems. This affirms the view by Alsuliman, Bowles and Chen (2012) who observe that the nature of the industry is complicated and uncertain. The authors attribute this to the unique features and conditions of each of the projects, with a large number of interdependent and sequential tasks. Similarly, Ijaola and Iyagba (2012) also point out that the construction process is associated with changes due to its complex nature which consequently leads to variation orders. The nature of construction activities is also pre-disposed to various factors that could change, vary or alter the outcome from the initial plan. This `change` otherwise referred to as `variation order` indicates a unique factor which contributes to a large extent, to poor performance of projects in the construction industry. Researchers in the construction industry have used different terminologies to describe this alteration or modification with such terms as "change", "variation", "change order" or "variation order".

There are different schools of thoughts about the meanings of these terminologies. According to Jadhav and Bhirud (2015) `change` is any activity on the construction site which results in modification of original scope, executing time and cost of the project. Other schools of thoughts view `change` as risk, state, process or methods that deviate from an agreed upon or original construction plan and specification (Lokhande and Ahmed, 2015; Jadhav and Bhirud, 2015; Lokhande and Ahmed, 2015). On the other hand, `variation` has been defined as any type of deviation from an agreed upon well-defined scope or schedule of work (Osuman, Omran and Foo, 2009). In the same vein, `change order` is defined as a formal document that is used to modify the agreed constraints and agreement which become part of the project document (Jadhav and Bhirud, 2015; Zawawi, Azman and Kamar, 2010). This aligns with the definition of `variation order` by some scholars who defined the term as deviation, variation or any change or modification by the owner or the owner's representative experienced in any project from base contract or work scope mutually agreed upon at contracting time (Kaene, Sertyesilisik and Ross, 2010; Alsuliman *et al*., 2012; Jadhav and Bhirud, 2015). These overviews of the subject matter of this study connote that though the terms differ, they however depict the same meaning in practice. The differences in the terminology in the literature is insignificant; consequently, the use of the term `variation order` is adopted in this study.

Studies in different parts of the world - Malaysia, Kuwait, South Africa, Ethiopia, Addis Ababa and in Nigeria indicate that variation orders are common and inevitable in any construction project (Memon, Rahman and Memon, 2014; Alaryan, Emadelbeltagi and Elshahat, 2014; Tadesse (2009); Ngwepe, Aigbavboa and Thwala, 2015). Variation orders can be encountered at any stage of the construction project but is easier to manage at the initial phase than at other stages of the project due to possibility of reduction in rework. The effects of variation orders on projects are generally worrisome and are not

beneficial to the clients and contractors in most projects. Msallam, Abojaradeh, Jrew and Zaki (2015) observed that variation orders are destructive and unpleasant in a project because of the impacts on cost and completion date of project.

However, studies show that not all variation orders are detrimental; they could also be beneficial though rarely, depending on the circumstance. Beneficial variation orders are those that actually help to reduce cost, schedule or degree of difficulty in a construction project or even eliminate unnecessary costs (Arain and Low, 2005; Ngwepe *et al*., 2015). Fisk and Reynolds (2015) point out that since change is inevitable in construction projects, managing the effect of change is therefore paramount and of great importance to the success of construction projects. The attention of concerned individuals and stakeholders in the industry has been drawn to the negative effects of variation orders on project delivery in developing countries particularly in the South-South zone of Nigeria. This zone is a coastal area and is predisposed to unpredictable project environment which affects project delivery. Projects are hardly completed without exceeding budgets and scheduled dates as a result of incessant alteration in design, construction programmes, project assumptions and requirements which are evidences of variation orders. Cunningham (2013) asserts that many owners involved in construction claim that they do not get the desired performance from their projects. This has serious implications on the built environment, concerned project stakeholders and the nation at large. Successful construction projects are therefore projects that are finished as and at when due, within the budget, in accordance with specifications and to stakeholders' satisfaction (Yaman, 2007; Cheng, Tsai and Sudjono, 2011).

Previous studies attempt to proffer solutions to the effect of variation orders while research is still ongoing. Some studies single out causes of variation orders (Keane *et al*., 2010; Ijaola and Iyagba, 2012; Halwatura and Ranasinghe, 2013; Alaryan *et al*., 2014), while some centre on the effects (Leonard, 1987; Osman et al., 2009; Sunday, 2010; Lokhande and Ahmed, 2015; Gokulkarthi and Gowrishankar, 2015). Other researchers combine the investigation of causes and effects of variation orders (Alnuami *et al*., 2010; Memon et al., 2014; Jadhav and Bhirud, 2015). However, there is limited research on the combined study of causes and effects of variation orders particularly in the study area. This may be due to the underestimation of the impact of the problem on project delivery by both practitioners and academia. The objectives therefore are to investigate the causes and evaluate the potential effects of variation orders on project delivery in the study area. This study is significant as it expects to provide useful insights into the causes and potential effects of variation orders with the view to enhance effective project delivery. The null hypotheses formulated for the research are:

1. There is no significant difference in the perception of clients, consultants, and contractors of causes of variation order in construction project.
2. There is no significant difference in the perception of clients, consultants, and contractors of the effect of variation orders on project performance.

2. LITERATURE REVIEW

2.1. Variation orders and construction project performance

Variation order is a critical factor during implementation of construction projects especially large scale projects. The occurrence is not only on projects in developing countries but also on projects in the developed world. Koushki, Al-Rashid and Kartam (2003) in a related study on delays and cost increases in the construction of private residential projects in Kuwait, discover that projects that experience variation orders incur more than 58%-time delay and cost increases when compared to those with no variation orders. The study by the Joint Legislative Audit and Review Commission (JLARC, 2001) on 300 road construction projects in Virginia reveals that average project change was more than 11%. Homaid, Eldosouky and AlGhmdi (2011) in another study on the change order in Saudi Linear construction projects reveal that the overall average increase in total cost of construction projects due to change orders was found to be 11.3%. A similar study of variation orders on construction projects shows that the average cost escalation was 7% of the original project cost with an average time extension of 30% more than the original project duration (Charoenngam, Coquinco and Hadikusumo, 2003). Awad's (2001) analysis and management of change orders for combined Sewer flow construction projects shows that variation orders are responsible for up to 7% of cost escalation of the original project cost. Another study on the types, causes, and frequency of construction claims in Dubai and Abu Dhabi in the UAE, relies on data from 124 claims for a variety of projects by Zaneldin (2006). The results indicate that the "variation order" claims were the most frequent type of claims with an important index of 60.5% and variation order was also the most frequent cause of claims with an important index of 55%. Since construction projects are synonymous to variation order, effective identification of the causes and effect is critical in an attempt to minimize the impact on project delivery.

2.2. Key causes of variation order

A construction business is subject to a lot of variability due to the unique nature of projects in the industry. The variation order is one of the challenges that practitioners and academia in the built environment try to manage since it cannot be totally eliminated from projects. The provision of variation clauses in the conditions of contracts suggests the variable nature of building construction, as such, variation or change is inevitable. (Ssegawa, Mfolwe, Makuke and Kutua, 2002; Finsen, 2005). Mohamed (2001) also points out that variation orders cannot be avoided completely. Researchers from different countries have made efforts to identify causes of variation orders in construction projects. Results show that variation orders are caused by several factors. Desai, Pitroda and Bhavasar (2015) identify 10 factors in a study conducted in Central Gujarat region; Ijaola and Iyagba (2012) identify 23 factors in Nigeria, Memon, Rahman and Hasan (2014) identify 18 factors in Malaysia, Lokhande and Ahmed (2015) identify 21 factors in Yemen; Alaryan *et al*. (2014) identify 20 factors in Kuwait; and Yadeta (2016) identifies 36 factors in Addis Ababa. The factors were sorted out as identified from literature with the summary presented in Table 1. The factors are further categorized into four groups based on the previous studies by Harbans (2003); Arain and Low (2006); Sunday (2010); Alnuami, Ramzi, Mohammed and Ali (2010); Enshassi, Arain and Al-Raee (2010); Ngwepe *et al*. (2015).

Table 1: Key causes of variation order in construction projects

Category of Factors	Causes of Variation Order	Authors
Client related factors	Change in design by client, change of plans or scope of work, inadequate project objectives, client`s financial difficulties, obstinate nature of client, change in material by client, change in specifications by client, impediment in prompt decision making process, replacement of contractor due to non-performance	Lokhande and Ahmed, 2015; Gokulkarthi and Gowrishankar, 2015; CII, 1990; Arain, Assaf and Low, 2004; O'Brien, 1998; Memom *et al.*, 2014; Desai *et al.*, 2015; Jadha and Bhirud, 2015.
Consultant related factors	Inadequate working drawings, change in design by consultant, errors and omissions in design, inadequate scope of work for contractor, inadequate scope of work for contractor, consultant`s lack of historical data, design discrepancies, conflicts between contract documents, design complexity, design complexity, honest wrong belief of consultant, lack of consultant`s knowledge of available manpower and equipment, obstinate nature of consultant, technology changes, change in specifications by consultant, lack of coordination/communication, consultant's lack of judgmental experience, value engineering	Fisk, 1997; Arain *et al*., 2004; Lokhande and Ahmed, 2015; Desai *et al.*, 2015; Jadha and Bhirud, 2015; Gokulkarthi and Gowrishankar, 2015.
Contractor related factors	Differing site conditions, lack of contractor`s involvement in design, change of schedule by contractor, contractor's lack of judgment and experience, unavaibility of equipment, obstinate nature of contractor, obstinate nature of contractor, shortage of skill manpower, poor procurement process, contractor`s financial difficulties, contractor`s lack of historical data, unfamiliarity with local conditions, contractor`s desired profitability, lack of strategic planning, fast tracking construction, defective workmanship	Memo *et al.*, 2014; Lokhande and Ahmed, 2015; Desai *et al.*, 2015; Jadha and Bhirud, 2015; Gokulkarthi and Gowrishankar, 2015.
Other related factors	Non-conformance or new government regulations, weather condition, change in economic conditions, unforeseen problems, health and safety considerations	Desai *et al.*, 2015; Gokulkarthi and Gowrishankar, 2015.

2.3. Effects of variation order

Previous studies reveal that variation orders affect project delivery in different ways. The effects of variation orders on construction projects as reported by some researchers include increase in project cost, additional payment for the contractor, increase in overhead expenses, completion schedule delay, rework and demolition, dispute between owner and contractor, disruption and change in work condition, low productivity (Alaryan *et al.*, 2014; Arain and Low, 2005). Koushki (2005) reports that variation orders issued during various phases of construction projects negatively affect both the completion time and cost of project. Hanna *et al.* (2002) also affirm that projects with many variation orders cause the contractor to achieve lower productivity levels than planned. Findings from the study conducted by Arain and Pheng (2005) on the effects of variation orders on institutional building projects reveal that variation orders contributed substantially to increases in construction project costs. Similarly, Ssegawa *et al.* (2002) report that more than one-third of disputes pertain to how to determine losses that stem from variation orders. Alaryan,

Emadelbeltagi, Elshahat and Dawood (2014) identify 12 effects of change orders on construction projects in Kuwait. Studies carried out by Lokhande and Ahmed (2015) also identify11 possible consequences of change request impact in construction industry of Yemen. The effects of variation order collated from studies of different researchers are presented in Table 2.

Table 2: Major effects of variation order

Factor	Authors
Decrease in productivity	Jadhav and Bhirud, 2015; Ibbs, 1997; Hanna and Gunduz, 2004.
Delay of completion schedule	Mohamed, 2001; Koushki, 2005; Gokulkarthi and Gowrishankar, 2015.
Dispute between owner and contractor	Jadhav and Bhirud, 2015; Charoenngam *et al.*, 2003; Bower, 2000.
Decrease in quality of work	Gokulkarthi and Gowrishankar, 2015; Smallwood, 2000; Keane *et al*., 2010.
Increase in construction cost	Jadhav and Bhirud, 2015; Ibbs, 1997; Ssegawa *et al*., 2002; Arain and Pheng, 2005.
Additional money for contractor	Jadhav and Bhirud, 2015; Gokulkarthi and Gowrishankar, 2015.
Delay of material and tools	Gokulkarthi and Gowrishankar, 2015.
Work on hold	Gokulkarthi and Gowrishankar, 2015.
Increase in overhead expenses	Gokulkarthi and Gowrishankar, 2015; Osman, Omran and Foo, 2009.
Delay in payment	Gokulkarthi and Gowrishankar, 2015.
Demolition and re-work	Jadhav and Bhirud, 2015; Osman *et al*., 2009.
Health and Safety issues	Arain and Pheng, 2005

3. RESEARCH METHODOLOGY

The research adopts the exploratory survey design approach and Questionnaire sare used for data collection. Questionnaires are widely used for descriptive and analytical survey of this nature to find out facts, opinions and views of respondents (Enshassi, Arain and Al-Raee, 2010). The area under study is South- South geo-political zone of Nigeria prominent among other zones in Nigeria as a result of its natural endowment with oil and gas production. The socio-economic status of this zone determined to a large extent, its choice for this study. The target population is the construction sector. The sample frame of 577 for the study is established based on the list of registered contractors with various clients` organizations at state and federal levels, public institutions and parastatals while that of the professionals is obtained from the directories of registered professionals with their respective bodies. This comprises of the Nigerian Institute of Architects (NIA), the Nigerian Institute of Builders (NIB), the Nigerian Institute of Engineers (NSE), and the Nigerian Institute of Quantity Surveyors (NIQS). The sample size of the study is determined using Taro Yamane formula (Udofia, 2011). The breakdown of sample frame and sample size for each category is shown in Table 3. Thus, sample size of 387 which also determines the number of questionnaires to be administered on the respondents using random sampling technique is adopted for the study.

Pilot survey involving seven experts in the industry both in practice and academic is conducted for the purpose of verifying the completeness of the questionnaire before distribution of the final questionnaire. Their various inputs are collated and used to produce the final questionnaire administered on the respondents. The exercise which results to 46

variable factors of variation order and 12 factors of effects of variation order is used for the study. The variables that constitute causes of variation order used for the study are categorised into four groups based on the previous studies (Harbans, 2003; Arain and Low, 2006; Sunday, 2010; Alnuami, Ramzi, Mohammed and Ali, 2010; Enshassi *et al.*, 2010; Ngwepe *et al*., 2015). The groups are: client related (with 10 factors); consultant related (with 16 factors); contractor related (with 15 factors) and order factors (which constituted 5 variable factors). Random sampling technique is adopted for the study.

Table 3: Sample frame and sample size of the study

Professional	Clients	Consultants	Contractors	Total
Sample frame	223	152	202	577
Sample size	143	110	134	387

The questionnaire is divided into three sections. Section A of the questionnaire solicits data from on gender, educational status, profession, work experience, company`s classification and type of organization. The aim is to establish a relationship between responses and organisational characteristics of the respondents. Section B uses a 5-point Likert scale ranging from 1 (nil) to 5 (very high) to establish the level of prevalence of variation orders in construction projects. Section C seeks for the perception of the respondents on the effect of the factors on project performance using a five-point Likert scale ranging from 1 (no effect) to 5 (very high effect). 364 questionnaires are received in which 123 feedbacks are identified as invalid due to incomplete information. 241 valid questionnaires are used for the analysis giving a response rate of 62.27%. This consists of 91 clients, 64 consultants and 86 contractors with response rates of 63.64%, 58.18%, and 64.18% respectively. Data collected is processed using Statistics Package for Social Sciences (SPSS). The difference in the perceptions of clients, consultants, and contractors on causes and effects of variation orders are analysed using Kruskal Wallis tests. Mean Score (MS) is used to determine the level of significance of each factor by 5 expressions defined by the intervals 0.8 with 3.4 as a cut-off for high significance based on Kazaz, Manisali and Ulubeyli, 2008). The ranking of the factors is determined based on the mean item score of each item which is calculated using the following equation:

$$MS = \sum_{i=1}^{5} \frac{\mathrm{R}_{pi} R_i}{n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1 \leq II \leq 5) \ldots\ldots\ldots\ldots\ldots Equation\ (1)$$

(Where R_{Pi}= Rating point; *i* ranges from 1 to 5; Ri= response to rating point, *i*; and n = total responses = summation of Ri from1-5

4. RESULTS AND DISCUSSION OF FINDINGS

Results arising from the analysis of the data collected for the study are presented below. This includes the evaluation of causes of variation orders, effects of variation order on project performance and comparison of agreement among the responding groups.

4.1. Evaluation of causes of variation orders

There are several factors responsible for variation orders of construction projects. Based on the objectives of the study, 46 factors constituting causes of variation orders in the construction industry are identified through literature review and a pilot survey. The factors are later categorized into four major groups to reflect the sources and originators of the factors. The groups are: client related, consultant related, contractor related, and other related group. The responses of the respondents on the factors are measured as described in the methods of the study. Data collected are scored, processed, and analysed using Mean Score (MS). The results are presented in Table 4.

As presented in Table 4, change of plan or scope of work, errors and omissions in design, change in specifications by client, client`s financial difficulties and inadequate project objectives are the first five key important causes of variation orders in construction projects based on the collective ranking of the respondents. The change of plan or scope of work is the most highly ranked among these factors responsible for variation orders by all three groups of respondents with mean scores of 4.65, 4.61 and 4.70 for clients, consultants and contractors respectively. This implies that this factor is a predominant cause of variation orders of construction projects in the study area. The importance of this factor can be attributed to inadequate planning at the project definition stage **(**Arain *et al*., 2004**).** This result agrees with the findings of the Construction Industry Institute (CII) (1990) which identifies change of plan or scope of project as one of the most significant causes of variations in construction projects.

Errors and omissions in design are ranked second overall as well as in the ranking orders of consultants and contractors with mean scores of 4.62, 4.60 and 4.67 respectively. However, the clients group considers the factor as third and have the same MS with the consultants group of 4.60. It is established in literature and practice that projects with insufficient information at design stage or a situation whereby the designers are given inadequate time to translate client`s brief into designs, amount to errors and mistakes which are often discovered late at the construction stage. This is in agreement with the observation of Enshassi *et al.* (2010) who note that if errors in design are not immediately rectified during the design phase, they would eventually show up in the construction phase and may degenerate into issuance of variation orders to implement the corrective measures. Ssegawa *et al.* (2002) point out that clients and architects are the major cause of omission which is attributed to financial issues and changes in designs. Results of the analysis presented in Table 4 also indicate that changes in specifications by clients was ranked third overall which is also in agreement with the ranking order of contractors with mean score of 4.58 and 4.58 respectively. Clients and consultants group however differ on the importance of the factor based on the result of the findings. The clients rank the factor second with mean score of 4.61 while contractors rank it sixth with mean score of 4.56. O`Brien (1998) observes that change in specifications is consequential action of inadequate project objectives which according to Memon *et al.* (2014) often lead to variation orders in the form of delay and increased overall cost in an attempt to make the changes.

The results in Table 4 show that client`s financial difficulties ranks fourth based on the overall ranking. The three groups of participants however differ in the ranking of the factor. While the ranking of the contractors was in agreement with the overall ranking with MS of 4.55 and 4.60 respectively, the clients rank it seventh while consultants rank it sixth with the same MS of 4.53. Sound client`s financial status is very critical in achieving overall project success. Lack of accessibility and inadequate supply of funds impedes progress of construction projects and may eventually lead to work stoppage.

Table 4: Causes of variation order in construction projects

S/n.	**Factors**	Client		Consultants		Contractors		Overall	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
	Client related factors								
1	Change of plans or scope of work	4.65	1	4.61	1	4.70	1	4.65	1
2	Change in specifications by client	4.61	2	4.56	3	4.56	6	4.58	3
3	Client`s financial difficulties	4.53	7	4.53	6	4.60	4	4.55	4
4	Inadequate project objectives	4.58	4	4.44	10	4.58	5	4.53	5
5	Impediment in prompt decision making process	4.49	10	4.56	3	4.39	18	4.48	8
6	Change of schedule by client	4.44	15	4.39	15	4.61	3	4.48	9
7	Change in design by client	4.33	20	4.19	26	4.54	7	4.36	19
8	Replacement of contractor due to non-performance	3.88	34	4.28	20	4.05	29	4.07	27
9	Change in material	4.12	27	4.23	24	3.81	37	4.05	28
10	Obstinate nature of client	3.25	44	3.11	46	3.18	45	3.18	45
	Consultant related factors								
11	Errors and omissions in design	4.60	3	4.60	2	4.67	2	4.62	2
12	Inadequate working drawings	4.56	5	4.49	8	4.54	7	4.53	6
13	Change in design by consultant	4.49	9	4.53	5	4.51	9	4.51	7
14	Design complexity	4.51	8	4.39	13	4.47	11	4.46	12
15	Inadequate scope of work for contractor	4.26	22	4.44	11	4.44	14	4.38	16
16	Design discrepancies	4.46	12	4.33	18	4.35	21	4.38	16
17	Change in specifications by consultant	4.46	13	4.25	23	4.39	19	4.36	18
18	Conflicts between contract documents	4.19	24	4.28	20	4.19	26	4.22	23
19	Lack of coordination/communication	4.07	28	4.18	27	4.32	22	4.19	25
20	Consultant`s lack of historical data	4.33	19	4.16	28	3.82	35	4.11	26
21	Lack of consultant`s knowledge of available manpower and equipment	3.96	32	4.09	31	3.98	32	4.01	30
22	Consultant's lack of judgment and experience	4.00	29	3.60	40	4.04	31	3.88	34
23	Honest wrong belief of consultant	3.42	40	3.91	33	4.11	28	3.81	35
24	Value engineering	3.28	43	4.12	29	3.65	38	3.68	39
25	Obstinate nature of consultant	3.37	42	3.39	41	3.51	40	3.42	41
26	Technology changes	3.07	46	3.32	43	3.47	41	3.29	44
	Contractor related factors								
27	Fast tracking construction	4.47	11	4.49	7	4.44	13	4.47	10
28	Differing site conditions	4.54	6	4.37	16	4.47	10	4.46	11
29	Defective workmanship	4.44	14	4.46	9	4.42	15	4.44	13
30	Contractor`s financial difficulties	4.35	18	4.42	12	4.39	17	4.39	15
31	Lack of contractor`s involvement in design	4.21	23	4.30	19	4.46	12	4.32	21
32	Contractor's lack of judgment and experience	4.30	21	4.25	22	4.35	20	4.3	22
33	Change of schedule by contractor	4.18	25	4.11	30	4.30	24	4.19	24
34	Lack of strategic planning	4.00	30	3.95	32	4.18	27	4.04	29
35	Shortage of skill manpower	3.89	33	3.79	37	4.26	25	3.98	31
36	Contractor`s lack of historical data	4.12	26	3.86	35	3.88	34	3.95	33
37	Poor procurement process	3.77	36	3.63	38	3.81	36	3.74	37
38	Unavailability of equipment	3.65	38	3.82	36	3.60	39	3.69	38
39	Contractor`s desired profitability	3.65	37	4.19	25	3.16	46	3.67	40
40	Obstinate nature of contractor	3.47	39	3.37	42	3.19	44	3.35	42
41	Unfamiliarity with local conditions	3.39	41	3.25	44	3.32	42	3.32	43
	Other related factors								
42	Change in economic conditions	4.40	16	4.39	14	4.40	16	4.4	14
43	Unforeseen problems	4.37	17	4.33	17	4.32	22	4.34	20
44	Weather condition	3.98	31	3.89	34	4.04	30	3.97	32
45	Health and safety considerations	3.79	35	3.63	39	3.96	33	3.8	36
46	Non-conformance or New government regulations	3.09	45	3.14	45	3.21	43	3.15	46

More studies show that financial difficulties lead to change in work schedules and specifications, and compromise on the quality of the construction (Memon *et al.*, 2014). O`Brien (1998) agrees that owner`s financial problems can affect progress and quality of construction project. Inadequate project objective is identified by the clients and contractors as one of the top five highly ranked factors that causes variation orders but the ranking is at variance with the consultants` ranking order of tenth with MS of 4.44. The results show that the clients rank it fourth while the contractors rank it fifth with the same MS of 4.58. Inadequate project objectives could be the result of ineffective communication among the stakeholders which may lead to ambiguities in planning and execution. The impact of the factor on project performance can be very detrimental and could be responsible for issues such as rework, increase in project cost, and change of schedule.

Inadequate working drawings rank sixth overall but the respondents disagree on the ranking of the factor due perhaps to differing priority they placed on it. The factor ranks fifth by the clients, eighth by consultants and seventh by the contractors with overall ranking of sixth position. These rankings show that the factor is among the top 10 factors, considered by the respondents that are responsible for variation orders in the study area. The significance of this factor lies in the fact that contractors programme of work is based on the scope of work as interpreted by the drawings which must be clear and concise (Geok, 2002), otherwise, the expectation of the stakeholders on project objectives may be jeopardized. Ranking among the first 10 top factors responsible for variation orders is change in design by consultants with overall ranking of seventh. The clients and contractors were in agreement on the ranking of the factor as ninth with mean scores of 4.49 and 4.51 respectively. Incidentally, the factor is however ranked among the first five major factors by the consultants who rather placed it fifth with MS of 4.43.

Impediment in prompt decision making is an organizational based responsibility of the client in every construction project. According to the results in Table 4, this factor is ranked eighth in the overall ranking with MS of 4.48. The consultants rather rank the factor third as a reflection of the priority placed on the factor in the delivery of construction projects. The priority given to this factor by the contractors is however very low as implied in the ranking as eighteenth factor with MS of 4.39. The contractors` perception regarding this factor could be as a result of their non-involvement in decision making regarding projects especially at pre contract stage. The effect of this factor can only be felt by the contractor at construction stage when it takes a considerable length of time for the client's organization to respond to a critical issue bothering on the project especially in traditional contract methods. Failure to make effective decisions at the right time may result in delay, temporary work stoppage and the need for change order due to cost increments (Memon *et al.*, 2014). The factor is however ranked tenth by the clients with MS of 4.49. Change of schedule by client is ranked ninth overall but is however ranked fifteenth by the clients and consultants group with MS of 4.48, 4.44 and 4.39 respectively. The importance placed on this factor by the contractors as a cause of variation order is reflected in the ranking order of third position with MS of 4.61. Change of schedule by client can disrupt contractor`s work programme resulting in reallocation of project resources with additional cost implications. These could be the reasons that informed the contractors on the choice of the ranking position of this factor. The result of the study is also in agreement with Alajishi and Marzong (2008) who reports that owners are the main originator of changes in projects. The last factor among the first 10 top factors that cause variation order is fast tracking construction with the overall MS of 4.47. The factor is however ranked eleventh by the client group, seventh by the consultant group and thirteenth by the contractor group with MS of 4.47, 4.49 and 4.44 respectively.

4.2. Evaluation of the effects of variation order on project performance

Variation order affects performance of construction projects. It impacts on client`s value, disrupts workflow and strains the relationships among the owners, engineers, contractors, subcontractors, and others stakeholders involved in the construction process. In order to achieve the second objective of the study twelve variables constituting effects of variation order are identified from literature review. The perception of clients, consultants and contractors are sought on the effect of variation order on project performance. The effects are measured as earlier described in the method of the study. The results are presented in Table 5.

Table 5: Effects of variation order on project performance

Factors	Client		Consultant		Contractor		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Increase in construction cost	4.79	1	4.86	1	4.91	1	4.85	1
Delay in completion schedule	4.67	2	4.7	2	4.56	3	4.64	2
Demolition and re-work	4.42	3	4.49	3	4.77	2	4.56	3
Dispute among consultants	4.33	4	4.26	4	4.44	4	4.34	4
Work on hold	3.88	7	4.12	5	4.33	5	4.11	5
Decrease in productivity	4.16	5	3.98	6	3.4	9	3.84	6
Increase in overhead expenses	3.74	8	3.74	7	3.77	7	3.75	7
Delay of material and tools	4.09	6	3.56	8	3.05	10	3.57	8
Delay in payment	2.63	9.5	3.16	10	4	6	3.26	9
Decrease in quality of work	2.63	9.5	3.37	9	2.63	11	2.88	10
Additional money for contractor	2.05	11	2.42	11	3.56	8	2.67	11
Health and Safety issues	1.88	12	2.12	12	1.95	12	1.98	12

The results of Table 5 show that all the stakeholders individually rank increase in construction cost as the most significant effect of variation order on cost performance of construction project with the MS of 4.79, 4.86 and 4.91 for the clients, consultants and contractors respectively. The ranking of this factor as the most important may be attributed to the fact that any alteration, omission or addition to design at production or implementation stage may result in demolition or rework of any cost sensitive component of the structure which invariably adds to the cost of the project (Clough and Sears, 1994). This is also similar to the findings of Memon *et al*. (2014) who identifies increase in cost as the most common effect of variation order in Malaysian Public Works Department (PWD) known as Jabatan Kerja Raya, Malaysia (JKR). The delayed completion schedule is ranked second overall which is also in agreement with the ranking of the clients and consultants as second with MS of 4.64, 4.67 and 4.70 respectively. The factor is however ranked third by the contractor with MS of 4.56. The difference in the ranking suggests the practical disposition of the contractors as the first and direct professionals to the actual work on site. This is also in line with the result of the study of Zawawi (2010) who observes that schedule delay is one of the major effects of variation order on project performance. The clients and consultants also agree on the ranking of demolition and re-work as third factor with MS of 4.42 and 4.49 respectively but are however ranked second by the contractors with MS of 4.77. The results in Table 5 also show that the three least ranking factors based on the overall ranking includes decrease in quality of work, additional money for contractor

and health and safety issues as tenth, eleventh and twelfth factors with MS of 2.88, 2.67 and 1.98 respectively.

4.3. Comparison of agreement among the responding groups

The hypotheses of the study which were earlier stated to determine if there are significant differences in the perception of the respondents of the causes and effects of variation orders in the construction projects were both tested using Kruskal Wallis Test at $p \leq 0.05$. The decision rule is that if p-value > 0.05, the hypothesis is accepted, but if p-value ≤0.05, the hypothesis is rejected. The results of the tests are presented in Table 6.

Table 6: Result of Kruskal Wallis test

Groups	N	Client Mean Rank	Consultant Mean Rank	Contractor Mean Rank	U-value	P-value	Sig. level	Decision
Causes of Variation Order	46	68.9	67.64	71.97	0.29	0.87	0.05	Accept
Effects of Variation Order	12	17.8	18.33	19.42	0.15	0.93	0.05	Accept

The results of the Kruskal Wallis Test presented in Table 6 shows that the range of p-values is $0.87 \geq 0.05$. This implies acceptance of the first hypothesis that there is no significant difference in the perception of clients, consultants, and contractors of the causes of variation orders in construction project. Table 6 also shows that p-values of $0.93 \geq 0.05$ which implies the acceptance of the second hypothesis that there is no significance difference in the perception of clients, consultants, and contractors of the effects of variation orders on project performance. The agreement in the perceptions of the respondents is an indication of the prevalence of variation orders in construction projects of the study area. The clients, consultants, and contractors involved in the procurement and delivery of construction projects in the south-eastern part of Nigeria should give priority to the factors and its effects as identified in this study especially during planning and implementation.

5. CONCLUSION

This study investigated the causes and effects of variation order in construction projects. Based on the findings of the study, it was concluded that the five dominant causes of variation orders are: "the change of plans or scope of work", "errors and omissions in design", "change in specifications by client", "client`s financial difficulties", and "impediment in prompt decision making process". These causes can be further categorized into four major groups, namely; client related, consultant related, contractor related, and other related group. It was also concluded that, the prevalent effects of variation orders on performance of construction projects are: "increase in construction cost", "delay completion schedule", "demolition and re-work", "dispute among consultants", and "work on hold". Further conclusion was that there is agreement among stakeholders of the causes and effects of variation orders in construction projects executed in the South-South zone of Nigeria. Finally, the study adds that since variation orders cannot be practically eliminated from the projects, its occurrence and effect on project performance can be minimized if

adequate measures are taken at planning and design stages. The design team should therefore focus on the key decisions that are fundamental to the project and realization of the set goals through proactive approach of minimizing variation order. The study also recommends that the project team should ensure complete documentation before award of project; it should also be verified and approved by the necessary authorities before commencement of the project.

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