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EFFECTS OF CHANGE ORDER ON PERFORMANCE OF BUILDING CONSTRUCTION PROJECTS

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ABSTRACT

Purpose - Changes tend to occur in some aspects of building construction projects with varying effects on performance indicators. The study, therefore, determines the effects of change order on building construction projects with the aim of boosting performance.

Design/methodology/approach – A quantitative design approach adopting descriptive and survey research methods was used in determining the effects of change order on performance of building projects. Data extracted from 104 structured questionnaires were analysed using descriptive and inferential statistics.

Findings – Results reveal the following performance indicators as being affected by the effect of change order: cost overrun; quality standard enhanced; time overrun; additional money for contractor overhead; and work-on-hold.

Research Limitations - The study is limited by non-willingness of some respondents to attend to research instrument-questionnaires. Also, inability to ascertain the actual number of building construction participants in the study area hampers the coverage sought after.

Practical implications - Knowledge of the effect of change order on performance and its attendant benefit or otherwise would help to channel the construction administrative process towards maximising the benefits. Proper understanding of the effect of change order would be helpful for construction professionals and participants in managing change/variation orders.

Originality/Value - The study concludes that having effective procedure for the administrative process of change order is key to smooth project delivery with little or no disputes. The process will checkmate negative consequences while maximising the benefit of desirous ones. Government ministries, departmental agencies, private developers and infrastructure providers among others are enjoined to put in place a mechanism for managing changes and change orders to remove all shadiness and bottlenecks that usually accompany contract execution.

Keywords: Building Projects; Change; Construction; Change order; Performance; Administrative process.

1. INTRODUCTION

Building projects are conceived and constructed to meet the varying needs of mankind. Among them are shelter for accommodation or residential purpose; office space for business transaction; a place of gathering for religious/worship purpose; learning centres in form of school or skill acquisition and many others. During the various contract stages, from conception to design and then execution, changes do take place. Ibbs *et al.* (2007) understood change on a construction project to be any event that leads to an alteration of the projects' original scope, execution time, cost and/or quality of work. These changes are common and happen at any stage of the construction activities. In the opinion of Anees *et al.* (2012), changes are expected to be effectively managed as they are crucial to the success or otherwise of the project delivery. According to Olasunkanmi and Oladokun (2019), there are factors that causes change leading to change order, while Jamal and Ghaleb (2015) already identified factors affecting change order itself. Change (leading to change order) when effected, has negative effect on orderly sequence; impacting productivity adversely and accordingly leads to schedule delays and cost

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overrun (Anees *et al.* 2012). The versatility of building to mankind has necessitated many participants with different interests. Owners/clients, designers, consultants, constructors or contractors all play different roles in construction processes to justify their interests. These roles ultimately culminate in changes such as demand for amendment by the client's organisation; non-availability of complete information to the consultants; assumption by the designer; and personal experience of the contractor. The aforementioned constitute change and re-work which are done in the form of either 'adding', 'deleting' or 'replacement'. Meanwhile, in construction, where problem persists and with different behavioural pattern, the more general and acceptable option is change. Ndihokubbwayo and Haupt (2009) argued that construction has a physical manifestation, therefore construction rework is usually accompanied with the demolition of what has already been built, it come with greater and direct impact on the construction performance than the change option. The difficulty of clients to visualise the end product they requested necessitate change, therefore, in any building construction project, a degree of change should be expected. These changes are commonly referred to as change orders (Anees, 2012). The major concern of the client about change order arising from change is its escalating effect on cost and schedule of work (Shrestha and Maharjan, 2018). Mechanism must be put in place to control change at the early stages of building construction project as late changes during construction may cause serious disruption (Ibbs *et al.* 2001). Arain and Pheng (2005) observed such changes as changing resource availability; environmental conditions; contractual structures and relations often do occur in construction, which may lead to plans that are to some extent incomplete or to unrealistic forecast (Motawa, 2005).

Change in building as well as construction projects is inevitable, it has come to stay, therefore it is expected to be managed in such a way that negative consequences are prevented. So many reasons are responsible for change with attendant benefits and penalties. Lazarus and Clifton (2001) suggested that change management should be done to maximise the benefits and minimise the penalties but most importantly to ensure equitable distribution of the two. Not all building changes are detrimental, some are beneficial. Beneficial and important change may result to delay in project schedule; re-estimation of the work statement; extra demand of equipment, materials, labour and overtime. Additionally, construction programme of works, health and safety plans may also be adversely affected while some results in issues and disputes. Research by Khanzadi *et al.* (2018) concluded that change order leads to schedule delay and cost overrun. The affected performance indicators are beyond the three common traditional indicators (cost, time and quality). Low and Chuan (2006) had earlier argued that project performance or success measure has gone beyond emphasizing these traditional indicators. Having a formalised change management process do not only resolve issues arising from change but also helps to avoid some number of claims and disputes. Also, improving the administration process of change order is of great benefit to all the project participants by the reduction in the costs and risks with encouragement of more trustful relationship (A1-Dubaisi, 2000). Serag *et al.* (2010) stated that change orders are very common in almost every construction project nowadays, often resulting in increases of 5-10% in the contract price. A study on fifteen (15) different projects in Kuwait by Duaij *et al.* (2007) showed that no construction projects were completed without variation/change orders; only one (1) project was completed with net omissions in variation. This result is in line with most of the previous researchers' statement that no projects can be completed without variation. Various researchers have either studied the effects or causes of change order (Gunduz and Mohammad, 2020; Oladiran *et al.,* 2018) with limited studies emphasizing where the impact is most felt in building construction projects.

Given the foregoing background, the study evaluates the performance indicators mostly affected by change order in building construction projects in Akwa Ibom state, Nigeria, with the aim of boosting project delivery by utilising the beneficial changes effectively and reducing the detrimental ones.

1.1 Objectives of the Study

By the foregoing background, the specific objectives therefore, are to:

i. Evaluate the administrative process of change order.
ii. Determine the effect of change order on performance of building construction projects.

The essence of implementation of change order in building construction project is to improve project performance. Project performance is the assessment of the project satisfying the intended purpose, having fulfilled the objective of cost and within the set time frame by the stakeholders. The criteria for assessment of these objectives are usually stated upfront and are sometimes explicitly stated in the contract document. The construction stakeholders sometimes use this as yardstick for ascertaining the level of performance of construction project.

1.2 Research Hypothesis

The only hypothesis postulated for the study states that there is no significant difference in the perception of construction participants on the effects of change order on performance of building construction projects.

The outcome of this hypothesis will enable the construction stakeholders to understand the effect of change order on performance of building projects.

2. REVIEW OF RELATED LITERATURE

The extant literature on concepts definition of change, variation and change order are reviewed in this section.

2.1. Definition of Change, Variation and Change Order

Jarrett *et al.* (2011) defined change from an engineering perspective as any alteration made to a part, drawing or software when the product design process and life cycle was already completed, notwithstanding the scale or type.

Change may include any modification to the form, either a whole or in part; which may be a variation in mode of interactions and dependencies of the constituent element of the product (Jarrett *et al.* 2011). Ibbs *et al.* (2007) defined change in construction project as any action that leads to a variation in the initial project scope, delivery schedule, cost and quality. It may affect either the product or the related documentation to the product. According to Mottawa *et al.* (2007), changes are categorised based on time (anticipated/emergent, proactive/reactive, pre-fixity/post-fixity); need (elective/required, discretionary/non-discretionary, preferential/regulatory) and effect (beneficial/neutral/disruptive).

Some authors swapped the terms variation, change and change order for one another or alternately. Keane *et al.* (2010) gave the clarity as thus; any type of departure from an initial agreement on a defined scope or schedule of work is termed variation or change. Whereas, change order is document that orders changes; it gives authorisation with respect to the agreement contained in the contract document and thus automatically forms part of the project documentation (Keane *et al.* 2010). A change order is an order by the client/developer empowering or authorising a variation to be carried out on a construction project (Charoenngam *et al.* 2003). A change request is different from change order; it represent the request for a variation while the order represents the client/developer's authorised instruction for it. The change order at times involves a complex process that may need the engagement of the construction team in substantial amount of information. Charoenngam *et al.* (2003) further said that this information has to be properly sent, checked, corrected, approved, requested, clarified, transmitted or submitted.

2.2. Project Performance

Different indices such as cost, time, quality, client satisfaction, and business satisfaction known as performance indicators are used to assess the performance of construction projects (Cheung *et al.*, 2004). Meanwhile, Enshassi *et al.* (2009) asserted that the three main evaluation parameters are time, cost, and quality. Others were recommended by Pinto and Mantel (1990) to include obvious value of the project, measuring process implementation and customers' satisfaction upon completion of the project. An all-encompassing framework based on short-term and long-term objectives is required in assessing project success (Shenhar *et al.* 2001). The framework according to Shenhar *et al.* (2001) includes; efficiency (which is completing the project according to budgeted cost and time schedule); customer benefits from the final product; business success; and planning for future (market opportunities). These properties were designed to be time and technological uncertainty dependent. Muller and Turner (2007) posited that, project performance and outcome had been measured widely based on finishing the project within time, cost, and meeting the specifications. Satisfying customer's expectations was subsequently added to that list by Mullaly (2006) while Doolen and Hacker (2003) suggested addition of the level of project team satisfaction by working together. Project performance was divided by Dvir *et al.* (2006) into two concepts: project efficiency (which is satisfying the objectives of cost, time, and quality or specifications), and project effectiveness (meeting the requirements of customer satisfaction and project team satisfaction).

Cost Performance

The cost performance of construction project is measured by either cost overrun or cost underrun. However, construction projects in most cases do experience more of former than the latter. Avots (1998) defined cost overrun as when the final cost of construction project is higher than the initial estimated cost. There is always existence of variation in the process of construction works which inevitably do have

significant effect on labour productivity. Overtimes, cost has shown its usefulness as the principal factor for the success of construction project. Elchaig *et al.* (2005) described as qualitative some of the important factors such as construction time being a client priority, planning abilities of contractors, methods of procurement and markets condition with the level of construction activity affecting project costs. Until and unless a project satisfies the cost limitation applied to it, such completed project is not deemed a successful endeavor (Rizwan and Azhar, 2008). Hartley and Okamoto (1997) believed that averagely, the construction project does experience about 33% increase in cost. Based on a-very-exhaustive research made by Flyvbjerg *et al.* (2002), on a cost-overruns in global construction, it was discovered that of every ten (10) projects, nine (9) had overruns, overrun to the tune of 50-100% were common and had been constant for the seventy (70) years for which data were available. Cost overrun is a critical problem that requires more study so as to ameliorate it in the nearest future (Angelo and Reina, 2002). According to Angelo and Reina (2002), cost overruns are major challenge in both developing and developed counties. Many construction companies fail due to inability to control construction cost so as to prevent cost overruns (Sriprasert, 2000). Wrong cost estimation method adopted at the initial phase of building projects had been adjudged the reason for overrun (Ogunsemi and Jagboro,2006. In the opinion of Angelo and Reina (2002), many reasons that are either uncontrollable or to some extent; are unmanageable, are responsible for cost overruns. They are: Accuracy of original cost estimate; Degree of government regulation and control; Construction completion delays; Number of design changes and Labour-related matters such as: availability, skills and increase in fringe benefits. Meanwhile, five reasons were identified by project owners for causing cost overruns, they include: Incomplete drawings; Poor pre-planning process; Escalating cost of materials; Lack of timely decisions; and Excessive change orders (Wakjira, 2011).

Schedule Performance

Delivery of construction project within the stipulated time frame is one of the indices of ascertaining its success. More often than not, construction project experience schedule delay otherwise known as schedule overrun, just as the case with cost. Overrun in schedule takes place when the project extends beyond the original time allotted for its completion. Odusami and Olusanya (2000) noted that many research works have established that almost all projects encounter cost or time overrun in the course of their execution. Hanna *et al.* (2004) said that average delay of 51% which leads to cost overrun was experienced yearly. User's Guide (2005) recognises the following factors which change the cost of the construction project over the time: Poor project management; Design changes; Unexpected ground conditions; Inflation; shortages of materials; Change in exchange rates; Inappropriate contractors; Funding problem and Force majure.

Project Quality

Until recent time, quality has not been prioritized in the life cycle of construction projects compared to factors like cost and schedule. Producer's perspective and customer's perspective with regards to quality are different. To producers, the level of conformance to the described design standards and quality specifications is quality while to the customers; it is satisfaction of expectations and requirements. However, Total Quality Management (TQM) had established basis for success of construction project not only on anticipated time, budgeted cost and targeted technical expectation but also acceptance by customer. According to Chinchu and Ambili (2017), the ability of a product or service to meet complete customer satisfaction upon the use of such product is termed quality. Quality has been described as the world's oldest documented profession (Collins, 1996). Project quality has been defined in various ways by quality professionals. One of such definition is 'meeting the customer's expectations,' or 'compliance with customer's specification'. The more we attempt to define quality, the more complex it becomes especially when put into actual practice. Ledbetter (1994) defined quality as the conformance to the established requirements which are regarded as the characteristics of product, process or services specified by the contracts. To the user of a product or service, quality is achieved only when there is feeling of satisfaction with the appearance, performances and reliability of the project for a given price range. According to Project Management Institute Guide Book (2004), the success of projects had been measured through timely delivery, on cost and targeted quality parameters. Rose (2005) said development of quality performance has been from the Dark Age period where the craftsmen were responsible for the quality of item through design, tools, sales and customers' feedback. The success performance based on quality had changed attention from craftsmen to the process. However, in recent time, the emphasis of contemporary theories on quality performance has shifted to understanding of customer requirement (Atkinson, 1999; Rose, 2005). Customer's requirement establishes the performance goal and is one of the measures for quality performance.

2.3. Variables

In order to achieve the second objective of the study and provide answer to the research question, the extant variables were extracted from the literature as developed by previous researchers. Anees (2012) and Anees *et al*. (2012) used variables of effect of change order, these were modified into sixteen based on the peculiarity of the study area. The variables are as shown in Table 1.

Table 1: Effect of change order on performance.

1	Time overrun (delay in completion schedule)
2	Cost overruns (increases in project cost)
3	Disputes between parties to the contract (clients and contractors)
4	Additional specialist equipment/personnel
5	Complaints of one or more of the parties to the contract
6	Quality standard enhanced
7	Professional reputation of one or more parties to the contract adversely affected
8	Additional health and safety equipment
9	Degradation of quality standard (decrease in quality)
10	Decrease productivity
11	Additional money for contractor overhead
12	Work-on-hold
13	Demolition and rework
14	Optimum cost reduction
15	Time reduction
16	Degradation of health and safety

3. METHODOLOGY

3.1 Data Collection

The research method adopted by the study were exploratory and descriptive survey approach with questionnaire used as an instrument for gathering data. The population consist of four (4) categories of respondents namely: the clients, the contractors' organisation, the consultants and others (project team (for non-profit making organisation), community liaison officers (CLO) (for community-based projects)) in Akwa Ibom State. Population frame couldn't be ascertained due to non-availability of data on the construction participants in the study area. Hence, the adoption of purposive sampling technique. This is also due to the units to be investigated with focus on a particular feature of the population of interest, which enabled the research question to be answered. Purposive sampling was used to select the respondents among the construction stakeholders in the study area based on their level of education and experience in the industry as adjudged by the researcher. Primary data for the study were obtained by distributing a total of 125 questionnaires, this is justified by Anih and Ekpa (2019) on similar research in the study area. Shown in Table 2 is the distribution and return rate across the three senatorial districts of the state. Uyo has 66 respondents, Eket with 35 and Ikot Ekpene with 24 respondents.

Table 2: Order of allocation in the study area

District of operation	Administered per district	Returned per district	% per district
Uyo	66	61	58.7
Eket	35	28	26.9
Ikot Ekpene	24	15	14.4
Total	**125**	**104**	100

While 104 were received with valid responses and used for data analysis. As shown in Table 2, of the questionnaires distributed, Uyo has 58.7%; Eket and Ikot Ekpene have 26.9% and 14.4% respectively. Some questionnaires were distributed directly to respondents and others through the chosen research assistants. The questionnaires were divided into two sections. Section one captured the respondent's characteristics such as sex, educational qualification, stake in the projects, professional affiliations, membership status of professional body (if any), years of experience, senatorial district where project is domiciled, project owner type, type of

construction, contract type and others. While the second parts sought the perception of construction participants on the effect of change order on performance of building construction projects.

3.2 Measures

Scales of measurement used were nominal, interval and ordinal scales. The respondents' characteristics in the first section were accessed using both nominal and interval scales while ordinal scale of measurement was used for the second section. The ordinal scale was on a five point-likert scales of: 1) Very Low; 2) Low; 3) Moderate; 4) High; 5) Very High for level of ranking of effects. Likert scale was used in the study to measure respondents' perception of the concept under investigation; their level of agreement on the impact of change order on performance of building construction projects. Note, the five-point scale used excluded neutral response category and was deemed appropriate because respondents were considered to possess requisite knowledge and experience about the subject matter under scrutiny (Shiu *et al.* 2009).

3.3 Data analysis

Respondents' characteristics were analysed descriptively, ranking of perceptions and opinions done with relative agreement index (RAI). Relative agreement index of factors' rating for each group of respondents (clients, consultants, contractors and others) was computed and ranked. Based on the approach used by other researchers (Aibinu and Jagboro, 2002; Cheung *et al*., 2004; Ugwu and Haupt, 2007) for similar studies, computation and ranking of weighted average of each factor for all groups was carried out, this represents perception of the group. RAI for the study was calculated from the mean scores gotten from each group of respondents using the equation (I)

$$RAI = \sum w \div AN \quad \text{... I}$$

Where w = weighted average given to each factor by the respondents; it ranges from 1 to 5

A = the highest weight (which is 5 for this study)

N = the total number of respondents (104 for this study)

RAI = relative agreement index.

Kruskal Wallis (H) test was conducted for both hypothesis testing and to determine the significant variations/differences in the perception and the level of agreement on the effect of change order on performance.

4. PRESENTATIONAND DISCUSSION OF RESULTS

4.1 Sample Characteristics

Construction stakeholders (both internal and external) were identified as the major participants in construction projects through a pilot study. Hence, the structured questionnaire as instrument of data collection was administered on construction participants across the three senatorial districts in the state. Table 3. shows the group of respondents covered by the study, the total number of questionnaires distributed, the quantity returned and used for the study as well as the corresponding percentage returned for each group of respondents.

Table 3: Return rate of questionnaire administered

Group of Respondents	Administered	%	Returned	%
Clients	25	20	18	17.3
Consultant	40	32	35	33.6
Contractor	45	36	39	37.5
Others	15	12	12	11.5
Total	**125**	100	**104**	100

Return rate of questionnaires as displayed in Table 3. shows an average response rate of eighty three percent (83%) on the overall. One hundred and twenty five(125) questionnaires were sent in the order of; twenty five(25) for clients, forty five(45) for contractors, forty(40) for consultants and fifteen(15) for others(project team (for non-profit making organisation such as churches); community liaison officers (for community based public projects)), one hundred and four(104) were received in the following order; clients-eighteen(18), contractors-thirty nine(39), consultants-thirty five(35) and others-twelve(12). The high rate of response recorded is essentially due to the incentives given to the research assistants and availability of professional colleagues in these locations. Therefore, a total of 104 questionnaires representing eighty three percent (83%) were used for the study.

The characteristics of the respondents whose perception were investigated such as sex, educational qualifications, stake in the projects, professional affiliation, membership status, years of experience used for the study were evaluated and presented in Table 4. Also, project characteristics the respondents were involved in such as construction type, contract type and project ownership type were also evaluated.

Table 4: Descriptive results of respondents' characteristics

Features	Sub features	N	%
	Male	94	90.4
Sex	Female	10	9.6
	Total	104	100
	OND	2	1.9
	HND	26	25.0
	BSc	34	32.7
Educational Qualification	PGD	11	10.6
	MSc/Mtech	12	11.5
	PhD	11	10.6
	Others	8	7.7
	Total	104	100
	Client	18	17.3
Stake in the project	Consultant	35	33.7
	Contractor	39	37.5
	Others	12	11.5
	TOTAL	104	100.0
	NIA	26	25.0
	NIOB	19	18.3
	NSE	20	19.2
Professional affiliation	NIQS	12	11.5
	NITP	2	1.9
	NIESV	2	1.9
	Others	23	22.1
	TOTAL	104	100.0
	Technician	1	1.0
	Licenciate	13	12.5
Membership status	Associate	38	36.5
	Graduate	32	30.8
	Corporate	4	3.8
	Fellow	16	15.4
	TOTAL	104	100.0
	1-5yrs	13	12.5
Years of experience	6-10yrs	30	28.8
	11-15yrs	18	17.3
	16-20yrs	18	17.3
	Above 20yrs	13	12.5
	Others	12	11.5
	TOTAL	104	100.0
	Uyo	61	58.7
Senatorial district of operation	Eket	28	26.9
	Ikot-ekpene	15	14.4
	TOTAL	104	100.0
	Private	54	51.9
Project owner type	Government	38	36.5
	NGOs	11	10.6
	Others	1	1.0
	TOTAL	104	100.0
	New	89	85.6
	Addition	3	2.9
Type of construction	Renovation	7	6.7
	Rework	1	1.0

	Others	4	3.8
	TOTAL	104	100.0
	Unit price	43	41.3
	Lump sum	54	51.9
Contract type	Actual cost plus profit margin	7	6.7
	TOTAL	104	100.0

It is noteworthy that, the presence of women or female gender in the Nigeria construction industry is similar to other African nation as rightly pointed out by Verwey (2008), Haupt and Fester (2012). As shown in Table 4, while female participants are 9.6%, male counterparts are 90.4%. Most respondents were male and possessed mostly HND and BSc as minimum qualification, this was more than required an educational qualification adequate to understand the implication of the research work. Majority of the respondents (74%) are core construction professionals (that is Architects, Builders, Engineers and Quantity surveyors) with membership status ranging from associate to fellow as the highest, this indicates the level of proficiency in construction work. In terms of work experience, about 76% of the respondents have acquired the necessary experience, having between or more than 10 years' experience, hence were conversant with happenings in the industry. The result also revealed that the project handled by the respondents were majorly private and government owned and 86% of them are new building projects and the contract were awarded mostly in lump sum.

4.2 Evaluating the Administrative Process of Change Order.

The following were considered to do justice to objective one, which helps to evaluate the administrative process of change order in the study area.

Change Order Initiation

Clients were considered by respondents as the foremost initiator of change order. This is as observed in the fifty-seven percent (57%) score shown in Table 5. Clients as initiators of change were followed by consultants, thirty-three percent (33%) and contactors (11%).

Table 5: Change initiation

	Frequency	Percent
Clients	59	56.7
Consultants	34	32.7
Contractors	11	10.6
Total	104	100.0

Compensation Method for Change Order

The compensation method for change order is shown in Table 6., as observed, lump sum (negotiated fixed prices) was found to be the commonest form of compensation with thirty-six percent (36%). Others (fixed unit prices, adjusted fixed prices and actual cost-plus margin) were ranked at 23%, 14% and 24% respectively.

Table 6: Change order compensation method

	Frequency	**Percent**
Not sure	3	2.9
Unit price	24	23.1
Lump sum	37	35.6
Adjusted fixed price	15	14.4
Actual cost plus	25	24.0
Total	**104**	**100.0**

Change Order Approval

Figure 1 shows that 59% of respondents agreed that there must be a written approval before proceeding with implementation of change order, thirty-nine percent (39%) insists that change order could be

implemented without written approval. It is therefore concluded that verbal approval may not be ideal except for urgent changes which must be done in the presence of the client (employers) or his representative under specific conditions.

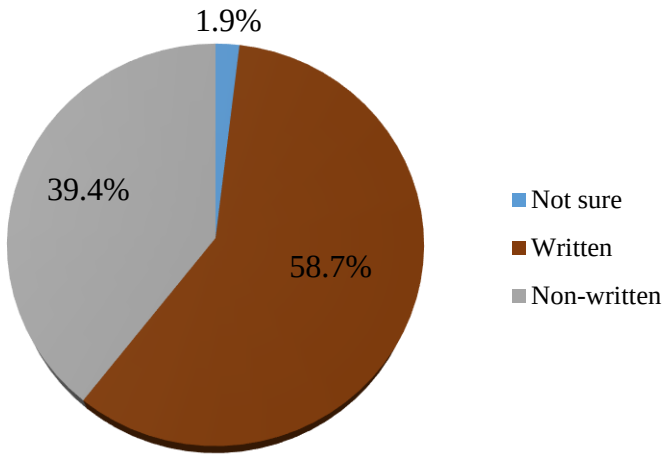

Figure 1: Type of approval

On the other hand, eighty-two percent (82%) of the respondents agreed that one (1) or two (2) numbers of approvals are required for change order as shown in figure 2, only twelve percent (12%) went for more than three (3) numbers of approval. The implication is that change order is such an important document that implementing and reversing it may require more than one level of responsibility.

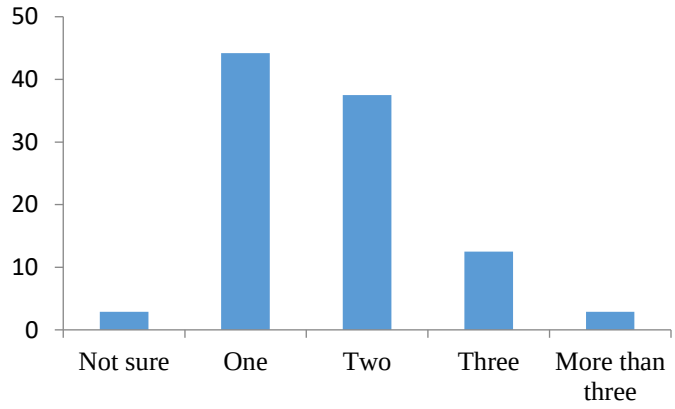

Figure 2: Number of approvals required for change order.

Change Order Primary Driving Factor

The primary driving factors for change orders is shown in Table 7. It could be observed that fifty-one percent (51%) of the respondents chose quality as the greatest driving factor, thirty-four percent (34%) for cost and ten percent (10%) for schedules

Table 7: Change order primary driving factor

	Frequency	Percent
Cost	35	33.7
Schedule	11	10.6
Quality	53	51.0
All/others	5	4.8
Total	**104**	**100.0**

Change Order Generated from Construction Experts/Crafts

The distribution of change order generated from different construction experts and crafts is as shown in Table 8, architecture with forty-two percent (42%) is the expert/craft that has greatest number of change order generation, finishes have twenty-four percent (24%) and structural with eighteen percent (18%).

Table 8: Change order generated from construction expert/craft

Construction experts/crafts	Frequency	Percent
Architecture	44	42.3
Structural	19	18.3
Electrical	3	2.9
Mechanical	4	3.8
Finishes	25	24.0
All/others	9	8.7
Total	**104**	**100.0**

Change Order Administration and Control

The research examined the responses from construction participants on change orders administrative process, control and management. Figure 3 shows the percentage of respondents that agree not to have or have a contract clause for change/variation orders' rules and procedure as an essential feature of any construction contract. From the chart, forty-five percent (45%) of the respondent agreed to have a clause that regulates change orders while fifty-five percent (55%) do not. The implication of this is that most building contracts were executed without inclusion of change order in the study area.

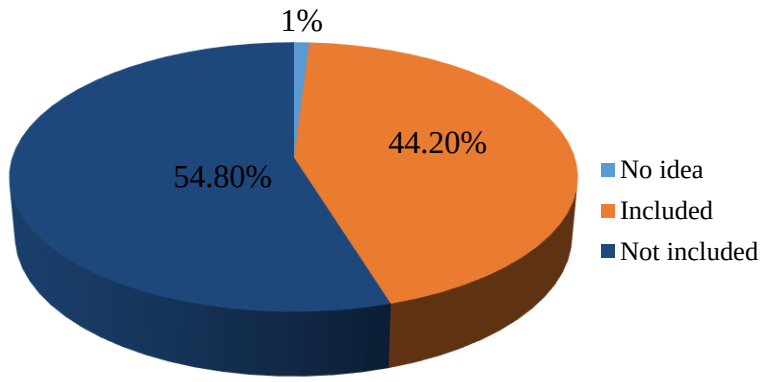

Figure 3: Contract Clause for Change Order

4.3 Effect of Change Order on Performance of Building Construction Projects

Three major performance indicators (cost, time or schedule and quality) among others were presented to respondents as primary driving factor for change order and fifty one percent (51%) chose quality. Further investigation conducted on project cost and schedule (time) overruns reveals that, based on change order, as shown in Table 9; fifty one percent (51%) of the respondents agreeing that the percentage cost overrun for the project is between 0-5% and 6-10% while twenty nine percent (29%) goes for between 16-20% and above 20%. Also revealed in Table 9 is that fifty-four percent (54%) believe 10-20% schedule overrun is prevalent, 30% says less than 10% delay is experienced on the project delivery time while 21-50% delay is experienced by 11% of the respondents.

Table 10 summarises the perception of the respondents who participated in the survey on the prevalent effects of change orders on various performance indicators of building projects. Relative agreement indexes were calculated and ranked accordingly; the top five most prevalent effects are as follows: Cost Overrun (increase in project cost); Quality Standard Enhanced; Time Overrun (delay in completion schedule); Additional Money for Contractor Overhead; Work-on-hold.

Table 9: Percentage cost and schedule overrun

Percentage cost overrun	Frequency	Percent	Percent cum	Percent schedule overrun	Frequency	Percent	Percent cum
No Idea	3	2.9	-	No idea	2	1.9	-
Below 0%	7	6.7	9.6	Less than 10%	31	29.8	31.7
0-5%	20	19.2	28.8	10-20%	56	53.8	85.5
6-10%	33	31.7	60.5	21-50%	11	10.6	96.1
11-15%	10	9.6	70.1	Above 50%	3	2.9	99
16-20%	16	15.4	85.5	Others	1	1.0	100
Above 20%	15	14.4	99.9	**Total**	**104**	**100.0**	100
Total	**104**	**100.0**	99.9				

Table 10: Perception of the effects of change order on performances by construction participants

S/N	Effect of change order	Clients N=18		Consultants N=35		Contractors N=39		Others N=12	
		RAI	Rank	RAI	Rank	RAI	Rank	RAI	Rank
1	Quality standard enhanced	0.856	1	0.748	3	0.728	3	0.800	2
2	Additional money for contractor overhead	0.778	2	0.720	4	0.672	5	0.784	3
3	Cost overrun	0.374	3	0.822	1	0.806	1	0.884	1
4	Time overrun	0.666	4	0.778	2	0.770	2	0.666	4
5	Work-on-hold	0.666	4	0.714	5	0.718	4	0.584	6
6	Disputes between parties to contract	0.522	6	0.674	7	0.652	7	0.634	5
7	Professional reputation of one or more parties to the contract adversely affected	0.500	7	0.698	6	0.666	6	0.416	9
8	Complaints of one or more parties to contract	0.484	8	0.634	8	0.626	9	0.434	8
9	Demolition and rework	0.484	8	0.634	8	0.642	8	0.416	9
10	Additional health and safety equipment	0.444	10	0.554	10	0.534	12	0.316	12
11	Additional specialist equipment and personnel	0.388	11	0.612	9	0.620	10	0.384	10
12	Degradation of health and safety	0.378	12	0.526	11	0.558	11	0.316	12
13	Time reduction	0.356	13	0.394	13	0.416	15	0.450	7
14	Decrease productivity	0.334	14	0.526	11	0.518	13	0.334	11
15	Degradation of quality standard	0.312	15	0.486	12	0.508	14	0.234	14
16	Optimum cost reduction	0.312	15	0.348	14	0.390	16	0.284	13

N: Frequency; RAI-Relative agreement index

Further analysis of respondents' opinions and views based on different construction participant's perception are as shown in Table 11. It shows that all the construction participants have four (4) of the top five prevalent effects in common. These prevalent effects are cost overrun, quality standard enhanced, time overrun and additional money for contractor overhead. Clients, consultants and contactors also ranked work-on-hold among the top five prevalent effects while others (project team and CLO) share a divergent view.

Table 11: Prevalent effects of change order based on construction participants' perceptions**.**

The Clients	The Consultants	The Contractors	Others
Quality Standard enhanced	Cost overrun	Cost overrun	Cost overrun
Additional Money for contractors overhead	Time Overrun	Time Overrun	Quality standard enhance
Cost overrun	Quality standard enhance	Quality standard enhance	Additional Money for contractors overhead
Time Overrun	Additional Money for contractors overhead	Work-on-hold	Time Overrun
Work-on-hold	Work-on-hold	Additional Money for contractors overhead	Disputes between parties to contract

Test of Hypothesis on the Effect of Change Order on Performance of Building Construction Projects.

In order to ascertain if the variation in the effects of change order on performance of building construction projects is significant or not, the research hypothesis was postulated as stated. In testing this hypothesis, the confidence level was set at 95% significance and the decision rule was; if the p-value is < 0.05, null hypothesis is rejected and the alternative is accepted.

Kruskal Wallis test was conducted to ascertain the difference in the perception of construction participants on the effect of change order on performance of building construction projects. The result is shown in Table 12. According to the table, seven (7) variables have p-values greater than 0.05 and are not significant therefore null hypothesis is accepted and alternative rejected. However, nine (9) variables are significant with p-values less than or equal to 0.05, hence the rejection of null hypothesis while alternative is accepted. The implication of this is that, those seven (7) variables with p-value > 0.05, the construction participants believe there is no difference on their having effect on performance as a result of change order while the nine (9) variables with p-value < 0.05, according to construction participants, believe there is difference on their having effect on performance as a result of change order.

Table 12: Variation on the perception of construction participants on effects of change order on performance of building construction projects

S/N	Effect of change order on performance	Respondent designation				Chi sq	Sign	Re
		Client (N=18)	Consultant (N=35)	Contractor (N=39)	Others (N=12)	DF=3		
			Mean rank					
1	Time overrun	41.22	58.19	56.17	40.92	6.575	0.087	NS
2	Cost overrun	39.83	56.14	51.65	63.63	5.988	0.112	NS
3	Disputes btw parties to contract	37.64	57.69	55.04	51.42	6.025	0.110	NS
4	Additional specialist equipment/personnel	30.67	60.26	62.63	29.71	24.508	0.00	S
5	Complaints of one or more of the parties to the contract	37.94	60.86	58.29	31.13	15.522	0.001	S
6	Quality standard enhanced	67.81	49.47	46.38	58.25	7.937	0.047	S
7	Professional reputations adversely affected	35.97	63.83	59.03	23.04	25.585	0.000	S
8	Additional health and safety equipment	43.53	60.39	57.88	25.46	16.102	0.001	S
9	Degradation of quality standard	35.17	59.59	62.83	24.25	25.013	0.000	S
10	Decrease productivity	34.08	60.91	58.78	35.17	16.215	0.001	S
11	Additional money or contractor overhead	61.69	51.90	45.55	63.04	5.674	0.129	NS
12	Work-on-hold	49.06	55.53	56.53	35.75	5.476	0.140	NS

13	Demolition and rework	41.47	57.99	58.74	32.75	11.062	0.011	S
14	Optimum cost reduction	48.17	52.01	58.28	41.63	3.993	0.262	NS
15	Time reduction	46.36	51.99	53.72	59.25	1.596	0.660	NS
16	Degradation of health and safety	34.72	58.57	63.45	25.88	24.362	0.000	S

N: Frequency, Sign.: level of significant, Re.: Remark, S: Significant, NS: Not significant

5. Summary, Conclusion and Recommendations

The result of findings on the effect of change order on the performance of building construction projects shows that on the general notes, cost overrun is the most prevalent effect followed by quality standard enhanced, time overrun, additional money for contractor overhead and work-on-hold (in descending order). This outcome is in tandem with the result of Anees *et al*. (2013). But in contrast with the submission of Alzara (2022), where meeting the needs of the project, disputes among parties of the project, and the development of project specifications were the major impacts of change order. Whereas, Mega and Hendrik (2022) concluded that on road construction projects in Saudi Arabia, the impact of change order is mostly felt in the area of cost, quality, time, organization and others.

The effect of change order is prevalent on the three (3) main building project performance indicators; increase in project cost, delay in delivery time or schedule and quality standard enhanced. Further investigation of the opinions of different building construction stakeholders (clients, consultants, contractors and others) is in agreement with the above findings. They all agree that cost overrun, time overrun and quality standard enhanced are the major performance indicators being affected by change order.

Changes in construction projects leading to change order has come to stay, but the effect should be such that the attendant benefits should be maximised while minimising the detriments. The findings of extant literature on change and change order had been reviewed by this paper. Therefore, an understanding of the effects of change order by construction professional and participants would help in its administration so as to maximise the benefits. The effects of change order on performance are complex and influenced by numerous interrelated factors. Quality standard was regarded as the primary driving force for change order in the study area, cost overrun (increase in initial project cost) and time overrun (delay in delivery time or schedule) are the most prevalent effect change order has on building construction projects.

There is need to intensify awareness among construction professionals and stakeholders at large on the essence of incorporating change order clause in their contract system. Rather than submission of variation at the completion of construction project. All such agencies of Government, private developers and infrastructure providers should embrace an established procedure of administering change order. Also, establishment of a comprehensive database of unit price of construction materials, equipment, labour rates without excluding contractor/constructor, supplier and specification, which should be updated periodically will boost change order implementation and administration. A framework that incorporates change request form should be developed, adopted and included in project/construction management practice to enhance smooth implementation of change order. This will guide against dispute that may arise due to change in scope of contractual agreement.

The findings from the study would also be valuable for all construction professionals and participants in general.

6. Limitation of The Study

The study is limited by non-willingness of some respondents to attend to research instrument-questionnaires. Also, inability to ascertain the actual number of building construction participants in the study area hampers the coverage sought after.

REFERENCES

Aibinu, A. A. and Jagboro, G. O. (2002), "The effects of construction delays on project delivery in Nigeria construction industry", *International Journal of Project Management,* 20 (8): 593-599.

Al-dubaisi, A. H. (2000). Change Orders in Construction Projects in Saudi Arabia, M.Sc. Thesis. The College of Graduate Studies, KFUPM. Dhahran, Saudi Arabia.

Alzara, M. (2022). Exploring the impacts of change orders on performance of construction projects in Saudi Arabia, *Hindawi Advances in Civil Engineering*, Volume 2022, Article ID 5775926, 11 pages https://doi.org/10.1155/2022/5775926

Anees, M. M. (2012). Evaluation of Change Management Efficiency of Construction's Contractors, M.Sc. Thesis, College of Engineering and Technology, Arab Academy for Science, Technology and Maritime Transport AASTMT, Cairo, Egypt.

Anees, M. M., Mohamed, H. E. and Abdel Razek, M. E. (2012). Evaluation of change management efficiency of construction contractors. *Journal of Housing and Building National Research Center (JHBRC*), (8): 77-85.

Angelo, W. and Reina, D. (2002). Megaprojects need more study up front to avoid cost overruns, *Journal of Construction Management and Economics,* (30):31-44.

Anih, P. C. and Ekpa, U. N. (2019). Dynamics of human resource management for real estate competencies among estate surveyors and valuers in Uyo. *Journal of Contemporary Research in the Built Environment,* 3(2): 61-73.

Arain, F. M. and Pheng, L. S. (2005). The potential effect of variation orders on institutional building projects. *Facilities*, 23 (11/12): 496 - 510.

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria. *International Journal of Project Management,* 17(6).

Avots, E. (1983). Cost-relevant analysis for overrun control. *International Journal of Project Management,* 1 (3): 142 - 148.

Charoenngam ,C., Coquinnco, S. T. and Hadikusumo, B. H. W. (2003). Web-based application for managing change order in construction projects. *Construction Innovation: Information, Process, Management,* (3):197-215.

Cheung, S., Suen, H., and Cheung, K., (2004), *PPMS:* A Web-based construction project performance monitoring system. *Automation in Construction* 13: 361–376.

Chinchu, M. J. and Ambili, S. (2017). Critical factors influencing quality performance in construction projects. *International Journal of Recent Trends in Engineering & Research*, 3(4): 65-72.

Collins, Jr., F. C. (1996) Quality: The Ball in your Court (New Delhi, India: Tata McGraw-Hill).

Doolen, T. L. and Hacker, M. E. (2003). The impact of organisational context on work team effectiveness: a study of production team, *IEEE Transactions on Engineering,* 50 (3).

Duaij, J., Awida, T. and Kollarayam, A. (2007). Performing value analysis on construction project variation orders. *Journal of Cost Engineering,* 49 (6): 23 - 27.

Dvir, D., Sadeh, A. and Malach-Pines, A. (2006). Project and Project Managers: the relationship between project manager's personality, project types and project success, *Journal of Project Management,* 37: 36-48.

Elcharig, T., Boussabinaine, A. and Ballal, T. (2005). Critical determination of construction tendering costs: quality surveyors' standpoint. *International Journal of Project Management,* (23):538 - 545.

Enshassi A, Mohamed S, and Abushaban S. (2009). Factors affecting the performance of construction projects in the Gaza strip. *Journal of civil engineering and management,* 15(3): 269–280.

Flyberg, B., Holm, M. and Buhl, S. (2002). Understanding costs in public works projects: error or lie? *Journal of the American Planning Association,* 68 (3):279 - 295.

Hanna, A., Camlic, R., Peterson, P. and Lee, M. (2004). Cumulated effect of project changes for electrical and mechanical construction. *Journal of Construction Engineering and Management,* 130 (6): 762 - 771.

Hartley, J. and Okamoto, S. (1997). Concurrent Engineering Shortening Lead Times, Raising Quality and Lowering Cost, Productivity Press, Shelfin, Connecticut.

Haupt, T. and Fester, F. (2012), "Women owned construction enterprises: a South African assessment", *Journal of Engineering, Design and Technology*, Vol. 10 No. 1, pp. 52-71. https://doi.org/10.1108/17260531211211881.

Ibbs, C. W., Wu, C. K. and Kwak, Y. H. (2001). Project change management system. *Journal of Management in Engineering*, 17 (3): 159 - 165.

Ibbs, W., Nguyen, L. and Lee, S. (2007). Quantified impacts of project change. *Journal of Professional Issues in Engineering Education and Practice*, 133 (1): 45 -52.

Jamal M. A. and Ghaleb J. S. (2015). Factors affecting change orders in public construction projects, *International Journal of Applied Science and Technology* 5(6).

Jarrett, T. A. W., Eckert, C. M., Caldwell, N. H. M. and Clarkson P. J. (2011). Engineering change: an overview and perspective on the literature. *Research in Engineering Design*, 22 (2): 103 - 124.

Khanzadi, M., Nasirzadeh, F. and Dashti, M. S. (2018). Fuzzy cognitive map approach to analyze causes of change orders in construction projects. *Journal of Construction Engineering and Management*, 144(2), 04017111. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001430

Keaned, P., Sertyesilisik, B. and Ross, A. (2010). Variation and change orders on construction projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 2 (2): 89 -96.

Lazarus, D. and Clifton, R. (2001). Managing Project Change: A Best Practice Guide, CIPRIA (556), London. UK.

Ledbetter, W. B. (1994). "Quality Performance on Successful Project." *Journal of Construction Engineering and Management.* 120(1): 34-46.

Low, S. P. and Chuan, Q.T. (2006), Environmental Factor and Work Performance of Project Managers, International Journal of Project Management, 21 (1): 24-37

McLeod, S. A. (2008). Likert scale. Retrieved from https://www.simplypsychology.org/likert-scale.html

Mega Waty and Hendrik Sulistio (2022), Impact of change orders on road construction project: consultans' perspective, *Journal of Applied Engineering Science* DOI:10.5937/0-35894

Motawa, I. (2005). A systematic approach to modelling change processes in construction projects. *Australian Journal of Construction Economics and Building*, 5 (1): 23-31

Motawa, I. A., Anumba, C. J., Led. S. and Pena-Mora, F. (2007). An integrated system for change management in construction. *Automation in Construction*, 16 (3): 368 - 377).

Mullaly, M. (2006). Longitudinal analysis of project management maturity. *Project Management Journal*, 37(3):62–74.

Muller, R. and Turner, R. (2007), "The Influence of Project Managers on Project Success Criteria and Project Success by Type of Project," *European Management Journal*, 25(4): 298–309.

Murat Gunduz and Khaled Omar Mohammad (2020). Assessment of change order impact factors on construction project performance using analytic hierarchy process. *Technological and Economic Development Economy*, 26(1): 71-85.

Ndihokubbwayo, R. and Haupt, T. (2009). Variation orders on construction projects: value adding or waste. *International Journal of Construction Project Management*, 1(2): 1-17.

Odusami, K. and Olusanya, O. (2000). Clients' contribution to delay on completion cost housing projects in nigeria: the quantity survey of Nigeria. *Journal of Construction and Management*, 2 (1): 81 - 86.

Ogunsemi, D. and Jagboro, G. (2006). Time-cost model for building projects in Nigeria. *Journal of Construction Management and Economic*, 24 (3): 253 - 258.

Oladiran, O. J., Umeadi, C. N. and Onatayo, D. A. (2018). Evaluating change orders and their impacts on construction project performance in Lagos, Nigeria**.** *FUTY Journal of the Environment*, 12 (2).

Olasunkanmi, O. F. and Oladokun, M. G. (2019). Evaluating causes of change in building construction projects. *Journal of Contemporary Research in the Built Environment*, 3(2): 101-120.

Pinto, J. and Mantel S.J. (1990), The cause of project failure, *IEEE Transaction on Engineering Management* Vol. 37 pp. 269-276.

Project Management Institute Guide Book (2004). A Guide to the Project Management Body of Knowledge, Third Edition. Newtown Square: PA.

Rizwan, S. and Azhar, B. (2008). Cost Overrun Factors in Construction Industry of Pakistan, In: *1st International Conference on Construction in Developing Countries (ICCIDC-1)* Karachi, Pakistan, Aug 4-5.

Rose, K. H. (2005). Project Quality Management: Why, What, How? J. Ross Publishing.

Serag, E., Olufa, A., Malon, L. and Radwan, E. (2010). Model for quantifying the impact of change order on project cost for U.S. roadwork construction. *Journal of Construction Engineering and Management*, 136 (9): 1015 - 1027.

Shenhar, A, Dvir, D., Levi, O. and Maltz, A. (2001), *Project success: a multidimensional strategic concept*, Long-Range Planning, 34: 699-725.

Shiu, E., Hair, J.F., Bush, R. and Ortinau, D. (2009). Marketing Research, European edition. McGraw-Hill, Berkshire.

Shrestha, P. P. and Maharjan, R. (2018). Effects of change orders on cost growth, schedule growth, and construction intensity of large highway projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *10*(3), 04518012. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000264

Sriprasat L, E. (2000). Assessment of Cost Control System: A Case Study of the Construction Organisations. MSc Thesis, Asian Institute of Technology, Bangkok.

Ugwu, O. O. and Haupt, T. C. (2007), "Key performance indicators and assessment methods for infrastructural sustainability – a South Africa construction industry perspective", *Building and Environment*, Vol. 42, No. 2, pp. 665-680.

Users' Guide (2005). Understanding and Monitoring the Cost - Determining Factors of Infrastructure Project.

Verwey, I. (2008), Women helping women: outcome of a South African pilot project, *Journal of Engineering, Design and Technology*, Vol. 6 No. 2, pp. 162-177. https://doi.org/10.1108/17260530810891298.

Wakjira, T. (2011). Risk Factors Leading to Cost Overrun in Ethiopian Federal Road Construction Projects and Its Consequence. MSc Thesis (Construction Technology and Management), School of Graduate Studies, Addis Ababa University, Ethiopia