DETERMINANTS OF CHANGE ORDERS IN BUILDING CONSTRUCTION PROJECTS IN NORTHERN NIGERIA

Kolawole, A. Richard[1] Kamau.K. Peter[2] and Munala Gerryshom[3,]

[1] Department of Environmental Planning & Mgt,Kenyatta University, Nairobi, Kenya.
[2] School of Architecture & Built Environment, Kenyatta University, Nairobi, Kenya.
[3] Centre for Urban Studies, Jomo Kenyatta University of Agriculture and Technology.Nairobi, Kenya.

Abstract

The increasing rate of delays resulting from change orders is harmfully upsetting the apt delivery of building construction projects. This paper evaluated construction stakeholders' perception on the causes of change orders in Northern Nigeria and their effects on public building projects. Responses from construction stakeholders were extracted by questionnaires: a total of 33 causes and 19 consequential effects were identified from literature which formed the basis of the questionnaire. The results suggest that client and consultants action are significantly responsible for change orders in public building construction projects in northern Nigeria. The study concluded that adequate project planning; application of building information modelling (BIM); timely decision and improve expertise of construction professional can help minimize change orders.

Keywords: Determinants, Building Information Modelling, Change Order

1.0. Introduction

One common concern for the construction industry now-a-days is project changes which result from unique circumstance and condition of each construction project. Because construction project are complex, it involves many participants and take a long-time to complete render this class of project prone to changes along their development (Arian & Pheng, 2005). According to Arian and Pheng (2007), even the most carefully planned project may require changes due to diverse factors during construction. According to Ade-ojo and Babalola (2013) the efficiency of the Nigerian Construction Industry have being impacted and building construction projects in Nigeria have suffered negatively as a result of extensive change orders. Odeyinka and Yusif (1997) cited in Owolabi *et.al.,* (2014) noted that 7 out of every 10 projects are delayed due to change orders. Even though some research have argue that some change orders are beneficial as they add value to a project by decreasing duration of a construction project or even get rid of needless costs.

According to Ngwepe,Aigbavboa and Thwala (2011) change orders generate additional work, time and money for the construction projects and differ from one project to another. Hence Oloo, Munala & Githea, (2014) emphasize that change order is common in all types of construction projects and plays an important role in determining cost and time overrun. Cost overrun in construction contracts are a result of claims and change orders. According to Aibunu and Jagboro (2002) changes in the schedule of a project cause time and cost overruns, litigation, arbitration, disputes, and may result in the total abandonment of a project. Such effects have been reported variously worldwide. Time overrun to the tune of 14.35% and < 10% respectively has affected projects in America and Malaysia (Shrestha, Burns, & Sheilds, 2013; Randa, Javad, Razali, & Ali, 2009). Cost overrun affects projects at an average of 2.95% and 5-10% respectively (Shrestha et. al., 2013; Randa *et.al.,* 2009). Regionally, Ndihokubwayo (2008) observed that construction projects have a frequency of change order of 85% of the total site instruction and often arise from clients (49%), consultants (47%) and contractors (4%). In Nigeria, Oladapo (2007), Sunday (2010) believes that change orders are responsible for cost overruns of between 25 -78% and time overruns of between 27 -68%. Nigeria is a developing country and her public construction account for about 70% of construction activity and is a major industry client according to Omole (2000). Public sector projects are special because they involve tax-payer money, have to follow set procedure, and most times involved multiple entities.

As a result demand a high level of transparency and responsibility to external agencies.A review of literature show that even though extensive research on causes of change order has been done globally, these studies have been context-specific; making the studies to be limited to the culture and countries where these studies have been conducted. In Nigeria studies have focused on change order as a cause of construction cost and time overruns;these studies have also focus on the perception of respondents from either the private sector or both public and private sectors combined and these studies were mostly conducted in south-western Nigeria (Ade-ojo & Babalola, 2013; Aibunu & Jagboro, 2002; Oladapo, 2007). However, studies have shown that perception is time dependent, and it is affected by geographical location, socioeconomic and cultural changes (Boynton & Zmud ,1984; Griffith, Gibson, Hamilton, Tortora & Wilson, 1999, Toor & Ogunlana,2008). Based on this background, this paper targets to capture construction stakeholders' perception on determinants of change orders and evaluate the effects in public building in Northern Nigeria

2.0. Literature Review

2.1 Understanding construction project change:

Change orders are usually initiated by construction project participants, i.e. the owner, consultants (architect, quantity surveyor, building structural engineer, and building service engineer) and the contractor because it is a standard practice in construction contracts to allow changes in the work after the contract has been signed and during the construction period (Fisk & Reynolds, 2010). An efficient examination of change and change orders necessitate a full understanding of the root causes of changes.

2.2 Agents of change orders

Changes usually originate from either design or construction activities. For this study, the classification proposed by Arain and Pheng (2006b) is adopted because it classifies change at project level, which is the focus of this research. Arain and Pheng (2006a) identified four main origins of change orders at the project level as those related to clients/owners, consultants, contractors, and others.

Client (sponsor) – Project Management Institute (2004) defined a client /sponsor as the person or group that provides the financial resources in cash or in kind for the project,but because clients play a prime role in the construction project from start to completion, they tend to bring about changes because of their needs, policies, taste, or to satisfy certain needs (Arain & Pheng 2006a),

Consultants – "main stay building professionals (architects, quantity surveyors, building engineers, service and structural engineers) involved in building projects' procurement, and who are in charge of developing the needs of project clients, setting targets and deadlines, as well as establishing standards for meeting these needs and monitoring the conduct of contractors" (Inuwa, 2014). For this reason, the consultants have the power to effect change orders upon delegation by the client or on their behalf.

Contractor – "a corporate body that runs a contracting business that entails the provision of materials or a service to a client for a fee. The contractor can suggest changes that may be required or better construction methods because he feels that there is a definite need for them" (Chukwudi & Tobechukwu, 2014)

Other – "these are changes that are not directly related to the participants, but which result from *force majeure*. These include weather changes and changes in government bylaws and economic condition, as well as other problems that may arise" (Arain & Pheng, 2006a).

2.3 Change order and common causes:

In today's construction industry, change orders are common in all types of construction projects (Arain & Pheng, 2007). This is because the need to make changes in construction project is a matter of practical reality. According to Motowa *et.al.,* (2007) as cited in Hwang and Low (2012), changes can occur at any stage of a project due to different causes from various sources. Any addition, deletion or modification to the scope of a project is considered a change (Mohammed, Ani, Rakmat & Yusuf, 2010) and a change order is a set of instruction which allows this change (O'Brien (1998) cited in Ismail, Pourrostam, Soleymanzadeh, & Ghouyounchizad, 2012). The enormity of various factors causing changes identified over the years by researchers show that change has come to stay as part of the construction projects and it cut across all contracting parties. Table 1 shows various causes of change order and the categorization according to the source agent.

For quite awhile researches have been conducted to identify a range of causes of change orders. Arian and Pheng (2006) studied causes of change orders in institutional buildings in Singapore. Fifty - three variables were investigated. The study broken up these factors into four groups based on their source; owner related factors; consultant related factors; contractor related factors and other factors. Study results indicated that errors and omission in design, change in specification by owner, design discrepancies, change in specification by consultant and non-compliance of design with government regulation were the most considerable causes of change.

Oladapo (2007) study consisted of thirty building construction projects made up of 17 private and 13 public projects in south western, Nigeria. Seven root causes of change found in literature relevant to the Nigerian Construction Industry were ranked by the respondents. The study result indicated that changes in specification and scope initiated mostly by project owners and their consultants were the most prevalent source of project changes. Closely followed by change in scope; adjustment of Pc and Provisional sum; error/omission in contract documents; discrepancies in contract document and the effect of natural occurrences came last.

Table 1 presents in tabular form causes of change orders in construction projects which were in different areas of the globe, fifty - five factors classified into four groups namely as owner related changes; consultant related changes; contractor related changes and other changes. Thirty - three of these factors peculiar to the Nigerian Construction Industry (NCI) were considered for further study in this paper.

2.4 Effect of change orders

Construction delays in terms of cost and time are a result of change orders and claims. Construction changes occurs either as a result of the acts of clients and his team; contractor and his team or nature i.e. social political issues, change in bye laws and force majeure. The effect of these change orders is always devastating on construction project performance. Studies conducted on the effect of change orders on project delivery have exposed that change orders are connected with time and cost overrun as well as litigation , project abandonment and building collapse (Ade-Ojo & Babalola, 2013; Aibinu & Jagboro, 2002; Ijaola & Iyagba, 2012; Haseeb, Lu, Bibi, Dyian, & Rabbani, 2011; Philip, Ebenezer & Kehinde,2012). Table 2 shows identified effect of change order in literature.

According to Li, Love and Dave (2000) when construction overrun occurs project manager are comforted with three possible situations: additional cost, a decline in quality or rework in the project. Therefore the options left for the project manager are either "prescribes overtime work and or inject additional assets in order to meet the project schedule"(Akinsiku & Akinsulire, 2012 p27). Injecting additional assert by the project manager can considerably increase project cost, lengthen overtime work may cause decline in output and performance, which may in turn breed rework.

3.0. Research Methodology

Survey research design was used to conduct this study. Data for this research were mainly gathered through structured questionnaires. The questionnaires were used to extract opinions from clients, consultants and contractors. The questionnaires were divided into three parts. The first part requested the respondent's profile, and the second and last parts consisted of questions causes and effects of change orders in public buildings. A stratified random sampling process was engage to get the required sample size of the population in the Nigerian construction industry. A total of 400 questionnaires were administered in the cities of Bauchi, Kano and Abuja out of which 323 were returned representing 80.8% response rate. This response rate is comparable to other studies in the Nigerian construction industry (Ade-ojo & Babalola 2012; Ubani, Nwachukwu & Nwokonkwo, 2012). These cities have high volume of construction activities being the nerve commercial centres in the three geo-political regions of Northern Nigeria (Usman, Inuwa, Iro & Dantong, 2012).The option of public building is informed by the reality that "government share in the construction industry is above 75 percent of the construction sector" (Omole, 2000 p.21). The respondents were experienced practitioners (with average of 10 years in the construction industry). The Statistical Package for Social Science (SPSS) Version 22 was used to run descriptive analysis correlation and reliability tests. Cronbach's alpha for reliability and consistency of the questionnaire construct measured 0.86; alpha greater that 0.7 implies the instrument is acceptable (Ogwueleka, 2011). This result it signifies high consistency and reliability of the study instrument.

Ranking of variables

Variable perceived as being important causes and effect of change orders in building construction projects by responding on a five -point Likert rating scale of 1 -5. The mean score (MS) for each factor was computed using the formula (Lew *et al.*, 2003).

$$MS = \frac{\sum(f\,x\,s)}{N}(1 \leq MS \leq 5) \quad \text{---------- Equation 1}$$

Where f is the frequency of responses to each rating; s is the score given to each factor by the respondents and ranges from 1 to 5; N is the total number of responses concerning that factor.

4.0 Hypothesis Testing

To test whether construction stakeholders (consultants, contractors and owners) differ in their perception about determinants of change orders in public building projects in northern Nigeria. Kruskal -Wallis test was performed; test result reveals that construction stakeholder had the same perception about determinants of change orders for public building in northern Nigeria with H (2) = 4.63, $p < .05$

5.0 Findings

5.1 Determinant of change orders

Table III presents a descriptive statistical analysis of the combined ranking of causes by construction stakeholders. A total of 33 factors from six categories were ranked based on respondents professional judgement in order of influence.The level of importance was determined using the mean and standard deviation according to their responses.From Table III, the results of the three groups indicate that the level of significance of causes of change orders ranges between 4.29 and 4.06: error and omission in BOQ (Av.MS =4.29) change of specification by owner (Av.MS =4.24); bogus contingency sum/provision sum (Av.MS =4.10), change in plan or scope by owner (Av.MS =4.09) and conflict between content contract documents (Av.MS =4.06). This result indicates that the top five most important causes of change orders are design and document factors related to consultants and owners. This was not unexpected, because contractors rarely initiate changes, as they are often at the receiving end of site instructions from building owners and their consultants.

To assess whether there is a degree of agreement among the consultants, contractors and owners with respect to their rankings of the variables, Spearman's rank correlation (r_s) was used to test this hypothesis: there is no significant correlation between the causes of change orders in building construction projects among consultants, contractors and owners. The hypothesis was tested at the 5% level of significance. This ranking suggest that the respondents irrespective of their experience and calling in the construction industry generally have similar opinion regarding the factors causing change orders in public building in Nigeria Table IV.

5.2 Potential effects of change orders in public building in northern Nigeria

The questionnaire listed sixteen effects of change orders on building projects in Nigeria extracted from literature review. From Table V it is observed that increase in project cost (Av.MS =4.24), additional payment to contractor (Av.MS =3.93), degradation of quality standard (Av.MS =3.87), completion schedule delay (Av.MS =3.82) and increase in overhead expenses by contractor (Av.MS =3.78). The least factors are Reduce demolition and rework (Av.MS =3.08) and optimum cost reduction (Av.MS =3.09). This shows that all identified variables play a significant role in the effect of change orders on building projects in Nigeria.The result indicated that consultants, building contractors and owners ranked increase in project costs high with low values(SD =0.82) for the standard deviations, indicating a high degree of consistency in the respondents' opinions, whereas owners ranked additional payments to contractors lower.The result also shows low values for the standard deviations (SD= 0.81;0.98 & 0.94) in first, second and fourth positions, which indicate a high degree of consistency in the respondents' opinions, whereas the higher values for the standard deviations (SD = 1.08 and SD =1.04) for the third and fifth positions indicate inconsistencies in the respondents' opinions, suggesting some divergence in respondents' views on these variables.

To determine the degree of agreement among construction stakeholder on the ranking of potential effects of change order, Spearman's rank correlation coefficient (r_s) was used to test this hypothesis. The Null hypothesis will be rejected and the Alternative hypothesis accepted since the calculated (r_s) is outside the accepted region at 5% level of significance.

Meaning there is no statistically significant difference in the opinion of the stakeholder on the potential effects of change orders (Table VI). This shows that the professionals agree on the potential effect of changes in building projects in northern Nigeria regardless of their experience in the construction industry.

6.0 Discussions

The finding reveals that owners and consultants are the determinant most change orders in public buildings and the factors are human related such as error and omission in BOQ and owner changing specifications, bogus contingency, change of plan and scope by owner. This means that notwithstanding the existence of the consultant as the representative of the client on construction projects, owners seem to exercise more power when it comes to issuance of site instructions on technical issues. Thereby, not let the consultant room to execute his mandate. These findings are similar to those of Arain (2006) in Singapore and Oladapo (2007) in southern Nigeria, which also indicate that building owners and consultants are the main initiators of change orders in building projects. The consultants and owners can therefore be said to be the main determinant of change orders in building projects in northern Nigeria. The findings also substantiate the fact that Nigerian contractors hardly ever instigate changes, as they are frequently in receipt of architects' instructions from the owners and their consultants. The ranking of shortage of skilled manpower by contractor among the consultants, contractors and owners as the least cause of change order will not be unconnected to the abundant manpower due to unemployed graduates of which the contractor can engage.

On the effect of change orders, this study revealed that increased project cost (cost overrun) is the most important effect of change orders in public building projects This result is not utterly shocking because any improvement in design will affect the project's total direct and indirect costs (Arain & Pheng, 2006). The findings indicate that the contingency provision of 10% in building contracts in Nigeria needs to be reconsidered because changes are nonstop and the 10% net contract sum (excluding provision sums and day works) is often used up by change orders. This finding is similar to those of Memon and Rahman, (2014), Oloo (2014) and Rahman *et al.,* (2013), who found cost overruns to be a potential effect of change orders.

7.0 **Conclusion**

This study was conducted in northern Nigeria to capture the perception of construction stakeholders. Based on the survey conducted and the results, the following can be concluded; the findings are similar to that of Oladapo (2007). The study result indicate that apart from weather and labour supply variable, which may differ in the north, construction stakeholder perception on determinants of change orders are same. In addition, finding from this study reveals that that human and design related issues such as changes in drawing; specification; client initiated changes are responsible for most change order which are effect of inadequate planning. These issues indicate that construction professional need to up the professional expertise, because these are issues that can be controlled by proper design process management application. Therefore, it is vital for project participants to setup very clear, realistic and measureable goal during project briefing. Based on the findings of the study the following recommendations are proposed to lessen cases of change orders and its effect on building project:

- The use of Building Information Modelling (BIM) techniques and timely decision making will help to assess if a change is practicable and spot what the downstream consequences are.
- Elaborate and detailed project brief need be provided to project participants. This would take care of all information and explanation needed, thus minimising design inadequacies.

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TABLE I: : Causes Of Change Orders and Their Grouping

Source: Oloo (2014); Sunday (2010)

Grouping	Cause of Changes	Author(s)
Owner	Change of plan or scope by owner; Change of schedule by owner; Owner financial problem; Inadequate project objectives; Replacement of material/procedure; Impediment in prompt decision making; Obstinate nature of owner; Change in specification by owner; Client change of mind force	Arain *et al* (2004); Arain & Pheng (2005a); Chappell & Wills (1996); Clough & Sears (1994); CII(1990); Fisk(1997); Gray & Hughes (2001); Ibbs & Allen (1995); Sanvido et. al (1992); O'Brien (1998); Wang (2000);Priyantha,Karunasena &Rodrigo(2011)
Consultant	Change in design by consultant; Error and omissions in design; Conflict between contract documents; Inadequate scope of work for contractor; Technology change; Value engineering; Lack of coordination; Design complexity; Inadequate work drawing details; Inadequate shop drawing details; Consultant lack of judgment and experience; Lack of consultant's knowledge of available materials and equipment, Honest wrong belief of consultant; Consultant's lack of required data; Obstinate nature of consultant; Ambiguous design details; Design discrepancies (inadequate design): Non- compliance design with owner's requirement; Change in specification by consultants; Adjustment in PC and Provisional sums; Lack of coordination between Oversea and local designers; Poor estimation; additional preliminaries due to time extension	Al-Hammad & Assaf (1992); Arain (2002);Arain *et al* (2004) ;Ayodele (2010);Fisk (1997); Assaf *et. al* (1995); Chappel & Wallis (1996); CII(1986); CII(1994); CII (1990); Dall'Isola (1982); Mokhtar *et. al* (2000); Geok(2002);Cox & Hamilton (1995); O'Brien (1998);Clough & Sears (1994);Wang (2000); Oladapo(2007);Oloo(2014); Halwatura & Ranasinghe(2013)
Contractor	Lack of contractor's involvement in design; Unavailability of modern equipment; Unavailability of skills; Contractor's financial difficulties; Contractors desire profitability; Differing site conditions; Defective workmanship; Unfamiliarity with local conditions; Lack of specialized construction manager; Fast track construction; Poor procurement process; Lack of judgment & experience; Long lead procurement; Honest wrong belief by contractor; Complex design and technology; Lack of strategic planning; Contractor's lack of required data; Contractor's obstinate nature	Al- Hammed & Assaf (1992); Arain (2002); Arain & Pheng (2005) Assaf *et. al* (1995);CII (1994);Clough & Sears (1994);Fisk (1997); Thomas & Napolitan (1994)
Others	Weather condition; Safety considerations; Change in government regulation; Change in economic conditions; Social-cultural factors; other Unforeseen problems	Arain *et.al* (2004); Arain & Pheng (2005); Clough & Sears (1994); Fisk (1997); Kumaraswamy *et. al* (1998); O'Brien (1998); Wang (2000)

TABLE II: *Potential Effects of Change Orders*

S/N	Potential Effects of Change Orders	Identified Author(s)
1	Progress Degradation	Arain & Low (2005); Assaf *et al*. (1995); CII (1994);
2	Cost overrun	Aibunu & Jagboro (2002);Arain & Low (2005); *Assaf et al.* (1995); CII (1995); Clough & Sears (1994);
3	Hiring New Professionals	Arain & Low (2005); Fisk (1997); CII (1995)
4	Increase in Overhead Expenses	Arain & Low (2005); O'Brien (1998)
5	Delay Payment	CII (1990); CII (1995)
6	Quality degradation	CII (1995); Fisk (1997)
7	Productivity degradation	Lee *et al.* (2005); Moselhi *et al*. (2005); Reichard & Norwood (2001); Ibbs (1997); Thomas & Napolitan (1995); Hester et al. (1991)
8	Delay in procurement process	Arain & Low (2005); O'Brien (1998); Hester *et al*. (1991)
9	Rework and Demolition	Arain & Low (2005); Clough & Sears (1994); CII,(1990);Oke & Ugoje (2013)
10	Logistics delays	Fisk (1997); Hester *et al.* (1991)
11	Damage to firm's reputation	Kumaraswamy et al. (1998); Fisk (1997);
12	Safety conditions	Arain & Low (2005); Arain *et al.* (2004); O'Brien (1998)
13	Poor professional relations	Fisk (1997)
14	Additional payments for contractor	O'Brien (1998)
15	Disputes among professionals	Arain *et al.* (2004); CII (1986)
16	Time overrun	Aibunu & Jagboro (2002);Kumaraswamy *et al.* (1998); Ibbs (1997); Zeitoun & Oberlender (1993); Reichard & Norwood (2001)
17	Litigation	Aibunu & Jagboro (2002);Haseeb, Lu, Bibi, Dyian, & Rabbani, (2011)
18	Project Abandonment	Aibunu & Jagboro (2002); Ayodele & Alabi (2011);Haseeb, Lu, Bibi, Dyian, & Rabbani, (2011)
19	Building Collapse	Philip, Ebenezer & Kehinde (2012)

Source: Arain and Pheng (2006)

TABLE III : Mean Score (MS), Standard Deviation (SD) And Rank(R) of Causes Of Change Orders

Causes		Overall			Consultants			Owner	Contractors				
	N	Mean	Std Dev	Rank	Mean	Std Dev	Rank	Mean	Std Dev	Rank	Mean	Std Dev	Rank
Design and Document related factors Error and Omission in BOQ	322	4.2888	0.7769	1	4.2770	0.7910	1	4.3725	0.6621	2	4.2586	0.8284	2
Change of specification by owner	323	4.2384	0.7814	2	4.1729	0.8124	2	4.3922	0.6349	1	4.3448	0.7620	1
Bogus Contingency sum Prime cost Sums	322	4.1025	0.7726	3	4.0282	0.8179	3	4.2353	0.5861	4	4.2586	0.7147	2
Change of plan/ scope by owner	323	4.0867	0.8553	4	4.0187	0.8931	4	4.2353	0.6808	4	4.2069	0.8326	5
Conflict between content contract documents	323	4.0588	0.8150	5	4.0140	0.8474	5	4.1176	0.7112	6	4.1724	0.7754	6
Change in design by consultant	323	4.0186	0.8150	6	3.9299	0.8501	6	4.3137	0.6161	3	4.0862	0.7787	9
Change in specification by consultants	323	3.9938	0.8303	7	3.9299	0.8105	6	4.0588	0.7592	7	4.1724	0.9391	6
Design discrepancies/ ambiguous design details	323	3.9628	0.8332	8	3.8879	0.8372	9	3.9804	0.7068	8	4.2241	0.8794	4
Unrealistic contract duration imposed by owner	323	3.9195	0.8738	9	3.8925	0.8840	8	3.8627	0.9169	10	4.0690	0.7916	10
Change of schedule by owner	322	3.8509	0.9151	11	3.8498	0.8986	12	3.7059	0.9009	12	3.9828	0.9828	12
Inadequate shop drawing details	323	3.8483	0.8908	12	3.8598	0.8928	11	3.7451	1.0167	11	3.8966	0.7652	13
Consultant's lack of judgment and experience	323	3.7368	0.9031	14	3.6168	0.9943	20	3.6275	0.8708	15	3.8793	0.8181	14
Complexity of design	323	3.7183	0.8693	16	3.7477	0.8402	13	3.5098	1.0074	19	3.7931	0.8326	16
Non-compliance of design with owner's requirements	323	3.6192	0.9940	19	3.6495	1.0179	18	3.4510	1.0259	21	3.6552	0.8696	22
Non-compliance of design with government regulations	323	3.4861	1.0613	27	3.5935	0.9825	22	2.9216	1.2139	33	3.5862	1.0602	24
Lack of Value Engineering	322	3.3913	0.9614	31	3.4159	0.8827	31	3.2400	1.0796	29	3.4310	1.1256	28
Site Management related factors Inadequate project objectives by owner	322	3.8789	0.8469	10	3.8826	0.9009	10	3.6078	0.6026	16	4.1034	0.7652	16
Impediment in prompt decision making by owner	321	3.6324	0.9297	18	3.5915	0.9403	23	3.6800	0.8675	13	3.7414	0.9470	19

Defective Workmanship by contractor	321	3.5953	0.9704	20	3.5540	0.9382	26	3.5490	1.1191	17	3.7895	0.9399	17
Contractor's lack of judgment and experience	323	3.5910	1.0000	21	3.7243	0.9312	15	3.4118	0.9418	24	3.6552	1.0687	22
Contractor's poor procurement process	318	3.5314	1.0733	24	3.5714	1.0152	24	3.4800	1.2493	20	3.4310	1.1256	28
Lack of strategic planning by contractor	322	3.5311	0.9409	25	3.5587	0.9329	25	3.3922	1.0968	25	3.5517	0.8201	25
Financial Management related factors Contractor's financial difficulties	322	3.7484	0.9837	13	3.7277	0.9862	14	3.5294	1.0835	18	4.0172	0.8269	11
Owner financial problem	323	3.7307	0.9868	15	3.6682	0.9724	17	3.9608	1.0384	9	3.7586	0.9789	18
Contractor's desire to improve his profitability	323	3.4644	0.9943	28	3.4813	0.9480	29	3.3725	1.2483	26	3.4828	0.9222	27
Corruption within the rank & file of client organization	322	3.4130	0.9732	30	3.4601	1.0161	30	3.2353	0.8622	30	3.3966	0.8971	30
Information and Communication related factors Conflicting instructions from consultant	323	3.6997	0.9052	17	3.7056	0.8840	16	3.6471	0.9343	14	3.7241	0.9695	20
Lack of communication by contractor	322	3.5435	0.9982	23	3.6150	0.9070	21	3.2549	1.2303	28	3.5345	1.0631	26
Human related factors Lack of specialized sites manager on construction site	323	3.5201	1.0757	26	3.4907	1.2092	28	3.3414	0.7811	23	3.7069	0.7010	21
Shortage of skilled manpower by contractor	323	3.4180	0.9852	29	3.4953	1.0380	27	3.2941	1.0255	27	3.2414	0.6834	33
Non -Human related factors Change in technology approach	320	3.5875	0.9527	22	3.6209	0.9402	19	3.1373	0.9595	31	3.8621	0.8675	15
Unavailability of required construction equipments	323	3.3808	0.9782	32	3.3879	0.9757	32	3.4510	0.9447	21	3.2931	1.0261	32
Unfamiliarity with local conditions by contractor	322	3.2950	0.9905	33	3.3474	0.9474	33	3.1096	1.1914	32	3.3444	0.9652	31

TABLE IV : *Spearman's Rank Correlation For Causes Of Change Order*

Respondents	Consultants	Contractors	Owners
Consultants	1	0.937	0.853
Contractors		1	0.847
Owners			1
Correlation is significant at the 0.1 level (2-tailed)			

TABLE VI : *Spearman's Rank Correlation Potential Effects For Change Order*

Respondents	Consultants	Contractors	Owners
Consultants	1	0.894	0.862
Contractors		1	0.932
Owners			1
Correlation is significant at the 0.1 level (2-tailed)			

TABLE V : *Mean Score (MS), Standard Deviation (SD) And Rank(R) Of Potential Effect Of Change Orders*

Potential Effect		Overall			Consultants			Owner			Contractors		
	N	Mean	Std Dev	Rank	Mean	Std Dev	Rank	Mean	Std Dev	Rank	Mean	Std Dev	Rank
Increase in projects cost (Cost overrun)	323	4.2446	0.8184	1	4.1449	0.8517	1	4.4706	0.6435	1	4.4138	0.7731	1
Additional payment to contractor	322	3.9317	0.9898	2	3.8357	1.0307	2	3.8235	1.0527	5	4.3793	0.5872	2
Degradation of quality standards	323	3.8669	1.0824	3	3.7991	1.0754	4	4.1176	1.1251	3	3.8966	1.0544	4
Completion schedule delay (Time overrun)	321	3.8193	0.9445	4	3.8255	0.9552	3	3.8627	1.0003	4	3.7586	0.8647	6
Increase in overhead expenses by contractor	320	3.7781	1.0373	5	3.6542	1.1099	7	4.1458	0.7986	2	3.9310	0.8348	3
Rework and Demolition(Enhanced)	322	3.7267	0.9730	6	3.6761	0.9728	5	3.8039	0.9196	6	3.8448	1.0225	5
Procurement process	321	3.6355	1.0493	7	3.6745	1.0223	6	3.5098	1.1379	10	3.6034	1.0750	9
Degradation in health and safety	320	3.5094	1.1253	8	3.4645	1.1391	9	3.5686	1.1533	9	3.6207	1.0567	8
Delayed payment process	322	3.5093	1.0829	9	3.4206	1.1051	10	3.7200	0.8815	7	3.6552	1.1324	7
Slow progress	321	3.4860	1.0609	10	3.5117	1.0398	8	3.3200	1.1858	12	3.5345	1.0296	12
Productivity	318	3.4434	1.0955	11	3.3684	1.0711	11	3.6078	1.3126	8	3.5690	0.9571	11
Improved quality	320	3.3281	1.0864	12	3.2723	1.0510	12	3.2600	1.2089	13	3.5965	1.0833	10
Improved payment process	323	3.2848	1.1445	13	3.2617	1.1369	13	3.3333	1.3515	11	3.3276	0.9803	13
Improved procurement process	321	3.1589	1.2182	14	3.1557	1.1960	15	3.2549	1.2781	14	3.0862	1.2605	15
Optimum cost reduction	317	3.0915	1.2733	15	3.1818	1.2805	14	3.1400	1.2779	15	2.7241	1.1963	16
Reduce demolition and rework	317	3.0757	1.1476	16	3.0286	1.1192	16	3.1000	1.2163	16	3.2281	1.1954	14