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MANAGEMENT**

EARLY STAKEHOLDER ENGAGEMENT PRACTICE IN MANAGING CHANGE ORDERS

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DECLARATION

I, **MARVIN ALINDE**, hereby declare that this report is my original work arrived at through reading and research and has not been published or submitted to any higher institution of learning for any academic award.

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DATE *04/10/2022*

APPROVAL

This dissertation was carried out under my supervision and has accordingly been submitted for review with my approval.

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DATE 4th - 10 - 2022

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ABSTRACT

In the construction of buildings usually, problems occur because of the causes of change orders. The main causer of change orders is the owners, consultants, and contractors. These changes lead to conflicts among them which result in influencing building projects. Therefore, it is necessary to analyze the causes of change orders to reduce them and facilitate management. This paper determines the most critical factors that cause change orders, a study of the reality of the management of change orders when undertaking projects. The method employed in this research is a field survey questionnaire which was sent to experts working in the construction industry. Furthermore, the questionnaire was distributed manually and electronically.

In findings, it would appear that the major source of change orders is the client and he does so through change of scope. The analysis led to the following conclusions: the major source of change orders is the client that this is done through change of scope and instructing a change in design. Current engagement practice suggest that the architect is the most engaged stakeholder followed by the client followed by the structural engineer. The Mechanical / electrical engineer take on the fifth position. Suppliers were least engaged followed by building contractors and then government bodies. In addition, 65% were of the view that not all relevant stakeholders are engaged in the design and planning while 33% agreed that all relevant stakeholders are engaged in the design and planning of a project. The most important hinderance was identified to be limited project planning time. Next was inadequate stakeholder engagement guidelines. Followed by Procurement methods tying with costs involved. Next was Complexity of the construction projects and unpredictability. Then Government policies and lastly shortage of professionals at. Relative importance index (RII) was used to rank the factors.

Keywords: Change orders, Stakeholder, Engagement, Involvement, Planning, Design, Construction, Project.

LIST OF ABBREVIATIONS

CO	Change Order
PM	Project Manager
UIPE	Uganda Institution of Professional Engineers
UNABCEC	Uganda National Association of Building & Civil Engineering Contractors
ARB	Architects Registration Board
SRB	Surveyors Registration Board
NEC	New Engineering Contract
RII	Relative Importance Index

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background study

Construction projects are very complex in nature. Each activity involves multiple varying tasks. (Khosro et al., 2019). Changes are consistently inevitable in the project lifecycle especially at the production stage (Adu et al., 2020). Change orders can be defined as modifications to the contract documents through adding, modifying or deducting something in the original agreement (Alshiefat, 2017). A change order is an activity that specifies and justifies a change to the scope of a construction contract, which alters the cost and duration of a project (Oladiran et al., 2018). Consideration must be given to this construction phenomena from the early stages of the project until commissioning. A contract change clause is added to define the way that the owner, consultant and contractor will handle changes.

Oladiran et. al. (2018) suggested that clients and designers are the major contributors to change orders since they are solely capable of influencing the scope and plan of projects. Alsuliman, (2014) also pointed out that there are currently no formalized approaches to the management of change orders at the design stage. He added that change orders are complex in nature as they involve the key stakeholders together with a lot of information that needs to be requested, sent, checked, corrected, approved, clarified, transmitted among many other processes. Changes are caused by various factors and often result into disputes and dissatisfaction among parties involved in construction projects (Alinaitwe et al., 2018). (Oladiran et al., 2018) Identified cost-overruns as the major impact of change orders on construction projects.

In Uganda, the construction sector grew by 8.2% in 2012/13 compared to 3.2% in 2011/12 becoming one of the fastest growing sectors contributing to employment opportunities and other related benefits. The sector contributed 13.7% to the total Gross Domestic Product (GDP) in 2012/13 alone (Muwanga, 2015). In Uganda when the contract is amended more than once, the cumulative value of all contract amendments must not increase the total contract price by more than 25% of the original contract price (Akol, 2021). Uganda's 25% public procurement change order spending limit is inadequate to mitigate the up to 52% cost over-run (Tamale et al., 2020).

Several researchers have investigated the causes of change orders in various areas, as well as suggesting different solutions to reduce them and their impact. For example; In his study on change orders, Oladiran et. al. (2018) concluded that the major cause of change orders in projects is change of plan or scope of works. For omission works change orders, “Poor contractor relationship with the client” is the most significant factor impacting construction project (Khaled, 2018). Zain (2016) developed a dynamic modelling approach to quantify change order impact on labor productivity. Emmanuel et. al. (2020) identified the two most dominant causes of change orders which include: “change of plans or scope of work”, “client’s financial difficulties”. Alinaitwe et al. (2018) developed a variation mitigation model to enhance construction performance of public building projects in Tanzania.

However as much as a lot of research has been conducted, there is an existing knowledge gap in terms of understanding Building Information Modelling (BIM) and its application during the project execution stage as reported by (Alshiefat, 2017). This research will seek to further involve the client’s view on why he makes changes during construction, what could be done in order to improve the understanding of the design drawings. There are limited studies that highlights the roles of the involved parties in the approaches to manage change orders which Alsuliman (2014) concluded that lack of acknowledgement of stakeholder engagement during the process of change order management has led to a high number of unnecessary interactions by stakeholders, unexpected claims, delays, and cost overruns that negatively influence the workflow of change order management.

Therefore, this research is intended to investigate the effects of early stakeholder engagement and use of Building Information Modelling on change order management to minimize the impacts of change orders on a project.

1.2 Problem statement

Current practices in construction provide for change order management so as to easily navigate the process of variation implementation, though claims and disputes still arise due to change orders despite the provisions hence the need to better prepare for these change orders to limit their negative impacts.

1.3 Main objective

To assess the practice of early stakeholder engagement in managing change orders.

1.4 Specific objective

1. To identify the major source of change orders.
2. To identify the current of stakeholder's engagement practice.
3. To determine the significance of stakeholder engagement in the process of change order management.
4. To identify the hinderances to engagement of different stakeholders in the project planning phase.

1.5 Justification

Change is inevitable in the implementation stage of a construction project since there is a factor of progressive elaboration hence the need for identifying better ways for approaching these changes so as to limit their impacts. The construction industry lacks a guide to effective stakeholder engagement in the project planning phase according to the. The terminologies, processes and/or formulas associated may be difficult to grasp by the project team and stakeholders, which would impact the way communication is conveyed between project participants (Duku, 2020). Since in the construction industry most communication about the structure is in terms of drawings, bills and contracts that require basic understanding for easy interpretation, there is a need for deeper utilization of BIM software so as to simplify the building information to make it understandable by all stakeholder mostly the client. This will help minimize the changes that are initiated by the client.

1.6 Significance

The study will help the construction industry acknowledge the need for early stakeholder engagement in change order management. In addition, it will guide on what need to be done so as to find ways in which stakeholders can be optimally engaged in the planning phase.

1.7 Scope of the Study

1.7.1 Academic Scope

The academic scope involved identifying the major causes of change orders, effects on construction projects, determining an optimal way of engage contractor in design stage to minimize the impacts of change orders on the project.

1.7.2 Respondent scope

The respondents in this study included; the architects, civil/structural engineer, project manager, quantity surveyors, mechanical engineers, electrical engineers.

1.7.3 Geographical Scope

The study was carried out within Kampala district metropolitan area.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

In order to understand the problem, there is need to review the existing information so as to identify the critical factors necessary for achieving the research objectives. This section covers already existing information gathered from authentic sources to get a better understanding of the research topic. The information was gathered from different sources including text books, reports, publications and articles. Keane et al. (2010) defined change order as a formal document that is used to modify the agreed contractual agreement and becomes part of the project's documents.

2.2 Change orders

A change order is a written order to the contractor, signed by the owner, and issued after execution of the contract, authorizing a change in the work or an adjustment in contract sum or contract time. Change orders are usually issued to cover variations in the scope of work, material quantities, design errors, and unit rate changes (Khalifa & Mahamid, 2019).

Alshiefat (2017) defined change order as modifications to the contract documents through adding, modifying or deducting something in the original agreement. He added that Change orders might be a change in the work, a change in the quality of the work or in the construction schedule, or other forms of change that affect the nature of the project. Zawawi et al (2010) defined a change order as work that is added to or deleted from the original scope of work of a contract, which alters the original contract amount or completion date.

The impact of variations and change orders on the construction projects are considered to be complex and affected in many intrinsic ways Change in specifications followed by 'Alterations in design and drawing' and 'Time lag in the project implementation' were considered to be the primary causes of change orders affecting the construction projects in Oman. (Al Maamari et al., 2020). Khoso et al. (2019) added that Change orders in construction often have serious impacts on performance of the project. They are difficult to manage without knowing the actual reasons of change; however, they can be reduced. Over the years Government has increasingly realized that

the management of the country's physical infrastructure requires collaboration of the public and private sector. Government is also divesting itself of direct service delivery in order to improve the efficiency and effectiveness of public services. In Uganda, the construction sector grew by 8.2% in 2012/13 compared to 3.2% in 2011/12 becoming one of the fastest growing sectors contributing to employment opportunities and other related benefits. The sector contributed 13.7% to the total Gross Domestic Product (GDP) in 2012/13 alone (Muwanga, 2015). A Preliminary Development Agreement (PDA) may issue a change order to the provider, requiring the provider to make changes to the general scope of the contracts and in particular with respect to; the drawings, designs, or specifications; time of performance or duration of the contract; or the related services to be provided by the provider. The change order must not be one that increases the cost of the contract beyond 0.1% in case of a single change or 1% cumulative change orders, of the original contract price. Where a change in the contract increases the price of the original contract beyond 0.1% in a single change or 1% cumulatively, such a change is effected by amending the contract. A single contract amendment must not increase the total contract price by more than 15% of the original contract price. Where the contract is amended more than once, the cumulative value of all contract amendments must not increase the total contract price by more than 25% of the original contract price (Akol, 2021). Uganda's 25% public procurement change order spending limit is inadequate to mitigate the up to 52% cost over-run as identified by (Tamale et al., 2020).

2.3 Causes of change order

Lukhele et al. (2021) pointed out that construction projects are very complex in nature and subjected to circumstances of high uncertainties and risks due to the interdependences of activities and processes in the project performance. As a result of the dynamic complexities inherited in construction projects, changes in scope of work are inevitable. Oladiran et. Al. (2018) concluded that the major cause of change orders in projects is change of plan or scope of works hence, clients and designers are the major contributors to change orders since they are solely capable of influencing the scope and plan of projects. Emmanuel et. al. (2020) identified the ten dominant causes of change orders which include: "change of plans or scope of work", "client's financial difficulties", "inadequate working drawings", "inadequate project objectives", "errors and omissions in design", "change in design by consultant", "impediment in prompt decision making process", "Change of schedule by client", "differing site conditions", and "design complexity".

Al Maamari et al. (2020) identified that 'Change in specifications' followed by 'Alterations in design and drawing' and 'Time lag in the project implementation' were considered to be the primary causes of change orders affecting the construction projects in Oman. Khoso et al. (2019) further elaborated that the most important cause of change order was the owner requirements for change in project scope. The reasons for project CO may be external or internal. External causes might be because of mechanical changes, changes in the client desires and tastes, changes in contender's exercises, changes in government and arrangements, changes in the economy and statistics changes in the general public. Internal causes may come about because of changes in administration arrangement, changes in authoritative destinations and changes in the long-haul survival system of the associations included (Ming et al., 2004). Abuaddous et al. (2020) identified the most important factors causing change orders on road projects in Jordan as inaccurate quantity takeoff, Labors or material not meeting the specifications, Logistic delays, Internal politics and the equipment and tools are not available. In addition, their finding suggest that variation order fluctuated from 23.9% to 5.3% of the total cost of the projects and the most vital causes were consultant related causes from the overall results of the causes. In addition, Keane et al. (2010) grouped the causes of change orders into three (3) categories for the contracting parties: owner-related variations, consultant-related variations and contractor-related variations. On the categorization he further added one additional group to indicate non-party-related causes which is other variations. Under-owner related, change of scope, owner's financial problems, inadequate project objectives, replacement of materials or procedures, impediment to prompt decision-making process, obstinate nature of owner and change in specifications by the owner were placed under this group. Consultant-related variations included; change in design by the consultant, errors and omissions in design, conflicts among contract documents, technology changes, value engineering, lack of coordination, design complexity, inadequate working drawing details, poor knowledge of available materials and equipment, consultants' lack of required data, ambiguous design details, inadequate design and change in specification by the consultant. Under the contractor related variations, lack of involvement in design, unavailability of equipment, unavailability of skills, contractor's financial difficulties, desired profitability, differing site conditions, poor workmanship, unfamiliarity with local conditions, fast-track construction, poor procurement process, lack of communication, long-lead procurement, complex design and technology and lack

of strategic planning. And under other variation category, weather conditions, health and safety, change in economic conditions, sociocultural factors and unforeseen problems were included.

2.4 Effects of change orders on projects

Change orders affect the cost, time and quality of the construction project. In addition, variation orders may get to an extent of disputes among the parties to the construction projects. Moreover, variation orders are also proved to have an effect on the health and safety conditions on a construction project (Lusca et al., 2015). Lusca et al. (2015) also noted that in their study not all the respondents agree that variation orders result in cost overruns because cost reduction was also one of the highest ranked factors which variation orders resulted into according to the response of the respondents. The benefits for the consultant are increased in work with guaranteed payments, and increased income arising from design modifications. The client as the third party also benefits from change orders in that the project is delivered with minimum problems (Alshiefat, 2017). Alsuliman (2014) noted in his study that all the respondents from the consulting firms stated that change orders are unwanted and agreed on the significant negative impact of variation orders and their management in addition they emphasized the negative effects of design changes and blamed change orders as the main cause that leads to design delay.

2.5 Stakeholder engagement

Newton (2017) defines stakeholder engagement as the systematic identification, analysis, planning and implementation of actions designed to influence stakeholders. A stake holder refers to people, groups or organizations that could impact or be impacted by the project (Newton, 2017). Construction project consist various stakeholders that require to be appropriately engaged in the project's activities in an effective way to ensure project success. From the literature stakeholders include; Contractors, consultants, client, government bodies and other personnel. Stakeholder engagement is increasingly becoming a part of construction project practice in order to deliver excellent project outcomes. For example, stakeholder identification is a critical component of the initial scoping phase and should occur before an engagement plan is formulated and consultations begin (Bal et al., 2013). A stakeholder's point of view on a change is a necessity to better understand the reasons for occurrence of change orders Alshiefat (2017) pointed out that some

stake holders consider change orders a problem while others see them as an essential feature of the construction sector. Construction projects are fragmented in nature, and this requires high levels of communication between all the project parties if the project is to be completed in full and in accordance with its objectives (Alshiefat, 2017). Alsuliman (2014) opined that determining an appropriate level of stakeholder engagement in the basic principles of variation order management leads to the greater success of the management of change orders and can improve the communication and relationships among stakeholders. He added that having a strong relationship, establishing good communication and cooperation, understanding of stakeholder engagement, identifying of the stakeholders' responsibilities and regularly meeting to manage design changes can improve stakeholder engagement level. In addition to that the integration of stakeholder engagement and the variation order management process will provide a best practice that can save the design process time. Adu et al. (2020) concluded that stakeholders in the industry should be aware and develop a template for evaluation of variation orders particularly at planning and implementation stages of construction project. Bal et al. (2013) noted that a well-managed stakeholder engagement process helps the project stakeholder to work together to increase comfort and quality of life, while decreasing negative environmental impacts and increasing the economic sustainability of the project.

2.6 Change Order Management

Several authors have come up with approaches to manage change orders so as to minimize their effect on projects. For example, (Alsuliman, 2014) researched on effective stakeholder engagement in variation order management in the Saudi Arabia's public construction industry and noted the basic principles of any variation order management system which included; identify variation, analyze variation, evaluate variation, implementation and documentation. He also identified the shortcomings in the management of change orders which include;

1. Stakeholders' responsibilities are not clear enough with regards to the change order management process.
2. Stakeholder engagement is not clearly understood during the change order management process.

3. Interference by public clients during managing and implementing of the change order affect the process of managing it.
4. Poor co-ordination and lack of effective communication among the stakeholders.

In addition, Alsuliman (2014) pointed out the causes of ineffective stakeholder engagement in Saudi Arabia then.

He suggested the causes behind the ineffective engagement among the design consultants and the public clients during the process of change order management in the Saudi public construction projects, based on the qualitative analysis as;

1. Delay in initiating change orders: due to the public clients making low effort to identify the variation order and giving the design consultants low interest.
2. Insufficient details of the change order: due to the public clients not providing enough information about the change to the design consultant.
3. Lack of accessible information: this is because of the low interest from both parties in this stage, due to insufficient information.
4. Poor communication: the above causes lead to poor communication among the involved stakeholders in this stage.

Alshiefat (2017) in his research with aim of developing an assessment model for the adoption of building information modelling to reduce the cost of change orders in the Jordanian construction industry and in his findings, he pointed out that, “the virtual BIM model provides an opportunity to select suitable methods for constructing the project.” Participant A pointed out that “for a contractor, it helps him to determine the project’s constructability and the construction methods that will be used, as well as improving control of costs and time.” BIM would thus significantly reduce the number of change orders in the Jordanian construction and their cost by providing the knowledge and information required to facilitate construction procedures and choose suitable methods for construction work.

Kolawole et al. (2015) in his findings pointed out that change management in Nigeria is relatively low. Contentment with current methods and high application cost, as well as lack of knowledge were the major drawbacks to change management. Respondent perceived that,

advantages of change order management included: faster response to change order; reduce time spent and reduce human resource required. While completion schedule delay; bureaucracy in public institution and poor coordination and documentation were the three major problems associated with the current practice. He added that Nigerian construction industry does not enjoy the advantages of change management processes which include: reduction in processing cost, reduced timelines, standardization of methods of managing change orders, streamlining steps of managing change order easier, proper documentation, and a decline in error rates.

Shen et al. (2008) based on a synthesis of several change process models reviewed in the literature and the characteristics of computational environments; from this they proposed a generic change process model having five stages in a sequence that include: identify, evaluate and propose, approve, implement and review. We have not arrived at a full solution for construction change management yet. More work will have to be undertaken to develop innovative and practical solutions that are adoptable by the industry they added.

Khaled (2018) and opined that, Professionals from construction industry need to understand the impacts of change orders and ensure taking proactive measures in order to reduce and control these impacts; Improved communication between project team members could reduce the negative impacts of change orders and reduce the disputes; Increased project management efforts for change orders management to control and minimize their impacts and Early involvement of contractor at project design stage could reduce the amount of change orders and help to clarify the project requirements. In addition, he recommended contractors to assign a special team from the project start to evaluate each change order and to keep the owner aware of the overall impact of each change order. And owners to keep in mind that construction project activities are interconnected and changing part of them may impact other activities. The total impact of multi change orders is higher than the summation of the individual impacts of each change order. Change work sequence, work interruption, work delays, payment delays, plans revisions and new requirement impact the overall project performance. Prior issuing a new change order, owner needs to understand how this change order could impact the works which are already completed, how it could impact the ongoing works, and how it could impact the planning of the coming work.

CHAPTER 3

3.0 METHODOLOGY

3.1 Introduction

This chapter presents the entire description of how the research study was conducted. This chapter mainly discusses the research design, methods of data collection and instruments, sample design and data analysis. Below is the description of the chronology of the data collection.

Through comprehensive literature study, a list of causes of change orders on projects will be developed which will be finalized through conducting surveys with construction professionals.

3.2 Research Strategy

Research strategy is a general plan that helps researchers in answering their research questions in a systematic way. In this study, surveys will be used as the research strategy. This is because surveys can produce large quantities of quantitative data that can be subjected to statistical analysis in a short time. Surveys also allow the researcher to widely explore and have an inclusive coverage of a number of subjects in their natural setting.

3.3 Research Design

A research design is an overall plan for connecting the conceptual research problems to the pertinent empirical research. Research design articulates what data is required, the research methods and data analysis methods and how all the above will answer the research question.

3.4 Target Population

The target population of the study was respondents in the construction industry that is the Architect, structural/civil engineers, surveyors, mechanical engineers and electrical engineers within Kampala.

Table 3. 1: Target population

Professionals	Number	Location
Architects	68	Kampala, central
Structural/civil engineers	19	Kampala, central
Mechanical engineers	7	Kampala, central
Electrical engineers	10	Kampala, central
Surveyors	33	Kampala, central

3.5 Sample Design

Stratified random sampling techniques were used where a reasonable number of each cluster of construction professionals was calculated to provide a 10% margin of error using the Slovin Formula which is $n = N/(1 + Ne^2)$.

Where;

n = number of samples

N =Total population

e = margin of error / error tolerance

from our data;

n =?

N =population size for every professional's cluster

e = 0.10

Table 3. 2; Sample size

Professionals	Population size	Sample size
Architects	68	40
Structural/Civil engineers	19	16
Mechanical engineers	7	7
Electrical engineers	10	9
Quantity Surveyors	33	25
Total population	137	97

3.6 Data Sources

Data that was used in the analysis stage was obtained from primary data which was collected with aid of survey questionnaires which were administered both physically and online through google forms. The secondary data was obtained from the professional organizations for engineers, architects and surveyors. These organizations included Uganda National Association of Building and Civil Engineering Contractors (UNABCEC), Uganda Institution of Professional Engineers (UIPE), Surveyor Registration Board (SRB) and Architects Registration Board (ARB).

Data Collection

The data collected was rated feedback from participants that took part in the survey, the rating scale was dependent on the variables. The data collection approach that was adopted is a questioner, in which the questioners were distributed to the target individuals and collected when complete. Interviews were also carried out for respondents that offered time.

Data Collection Tools

There was use of semi structured survey questionnaires that contained check boxes and appropriate ratings and at the end a there was a provision for the professional's opinion. It included these parts; background, instruction to respondents, body, conclusion and appreciation. The body included preambles to a certain factor and a structured response aimed at obtaining the objectives. The questionnaires were administered via emails of the selected personnel and those that accepted interviews received hard copy personally delivered. Periodic checks and reminders were made to ensure the respondents do not forget about the questionnaires.

Data Analysis

Data was be analyzed using statistical packages and these were Microsoft Excel and IBM SPSS to produce statistical diagrams in the form of graphs in order to establish trends and relationships.

Microsoft word was used for compilation of the report.

CHAPTER FOUR:

4.0 ANALYSIS OF RESULTS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the findings from the field in pursuit of the objectives of the study. A questionnaire was used to assess the perception of respondents on the on the various concepts of change order and change order management. The questionnaire was divided into two (2) parts, the first part requested for the background information of the respondents, the second part focused on the gist of the research in which respondents were required to give their opinions on the different concept that were covered by the survey questionnaire. The chapter gives findings in term of; descriptive statistics, correlation and regression analyses, tests of the hypotheses of the study and a record of qualitative results.

4.2 Data analysis

4.2.1 Quantitative data analysis

Data collected from the field was first of all sorted, edited, coded and entered into in the computer using SPSS software. This package helped the researcher to present data by generating tables, graphics and frequency tables. At univariate level, SPSS helped the researcher generate descriptive statistics such as means and standard deviations. Correlation analysis was carried out to investigate the nature of relationship between supply chain risks and performance and thereafter, a regression analysis was carried out to determine the extent to which supply chain risk influenced performance of Small and Medium Contractors in Sembabule District.

4.2.2 Qualitative data analysis

Qualitative data was obtained through the use of questionnaires categorized into the various variables. The presentation of the above qualitative results was made in verbatim statement to support findings from the quantitative analysis and conclusions were drawn.

4.3 Measurement of variables

There were variables measured at nominal, ordinal and interval ratio levels depending on the items in the instrument. Nominal scale was largely used to measure the conformance of the respondents, the ordinal scale was using a five-point Likert scale of Strongly Agree (5), Agree (4), Not sure (3) and Disagree (2), Strongly Disagree (1), (Ahuja, 2001) maintains that this type of scale is often referred to as a “Likert Scale,” named after one of its originators, Likert.

4.4 Response rate

Self-administered questionnaires were used to solicit responses from majority of respondents while some were sent out through e-mail as google forms and filled in electronically and later sent back to the researcher. 30 questionnaires were administered physically and 67 were online and the table below shows the response rates achieved by the researcher.

Table 4. 1; Response rate

Professionals	Sample size	Responses			
		online	physical	total	% Response
Architects	40	9	0	9	22.5
Structural/ Civil engineers	16	8	12	20	125
Mechanical /Electrical engineers	16	1	1	2	12.5
Quantity Surveyors	25	8	9	17	68
Total population	97	26	28	48	49.5

The table shows that a total of 30 out of 97 questionnaires issued to respondents have been filled, representing (49%) response rate under this category. This is attributed to the fact that the questionnaires were mostly self-administered. Respondents prefer a quick interview to being requested to fill in and return forms at a later time which was to the researchers disadvantage since the questionnaire was bulky.

4.5 Results on the background characteristics of respondents

The study assessed the work organization of the respondents, their profession, their experience in the construction industry as well as the roles they played in the design of the project.

4.5.1 Work organization

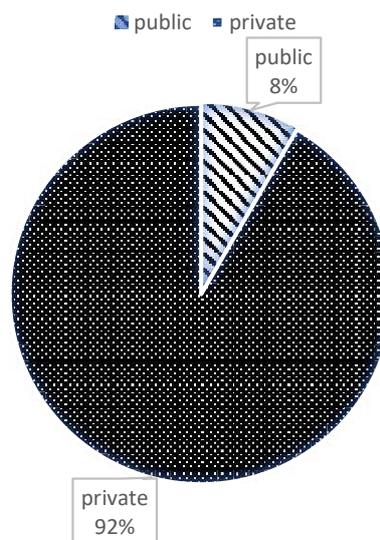


Figure 4. 1; Pie chart showing respondents' organizations with which they work

The chart indicates that (92%) of the respondents worked in the public sector and only (8%) work with the public hence the responses received are more to the private sector perception of change order management.

4.5.2 Profession

The study identified the professions of the respondents whether they are architects, quantity surveyors, civil/structural engineers or mechanical/ electrical engineers.

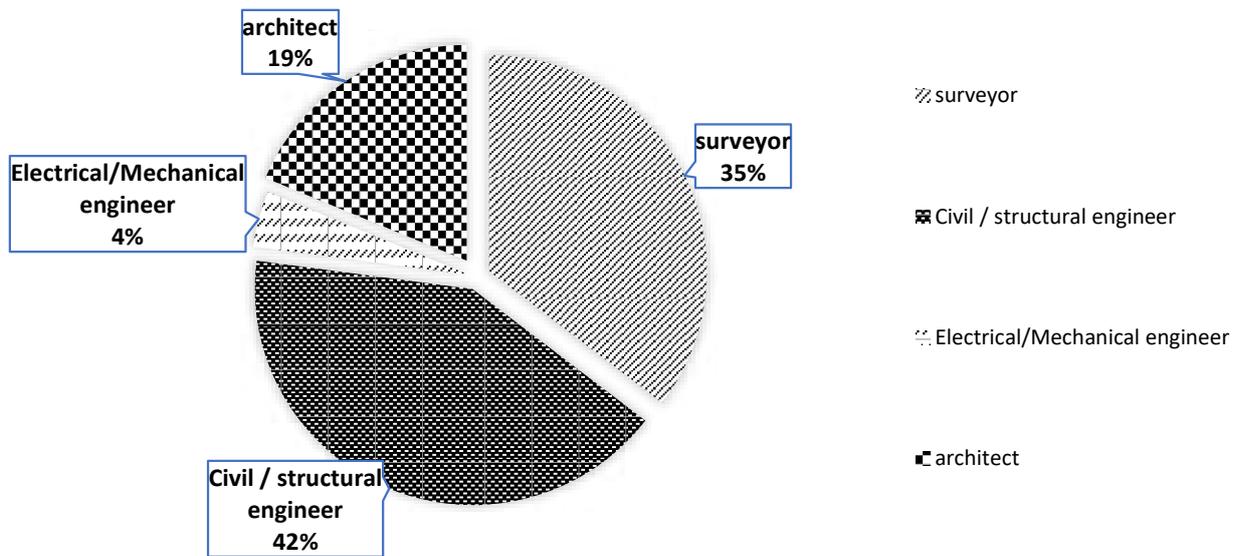


Figure 4. 2; pie chart showing the different professions of the respondents

From the figure above, majority of respondents are structural/civil engineers followed by quantity surveyors. A smaller proportion was for Architects and least respondents being Mechanical/electrical engineers. Hence the findings are more to the civil engineer and surveyor's point of view and least to the architects' and Mechanical/ Electrical engineers.

4.5.3 Experience the construction industry

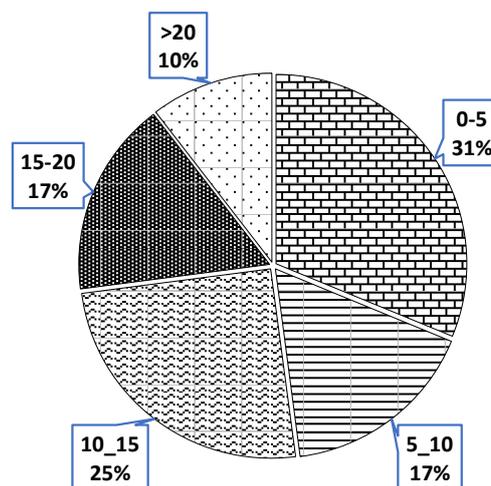


Figure 4. 3: Pie chart showing the percentage of respondents according to their experience

This section solicited responses about the period the respondents had spent in the industry while participating in active construction work. The period spent in the construction field was a reflection of the level of experience gained which in turn impacts on the performance of a particular respondent. This is illustrated in the figure above of the total respondents 69% have over 5 years of experience and 31% have 0-5 years of experience. Hence the confidence that our data will provide reliable findings basing on the years of experience of experienced personnel.

4.5.4 Professionals that have experienced change orders

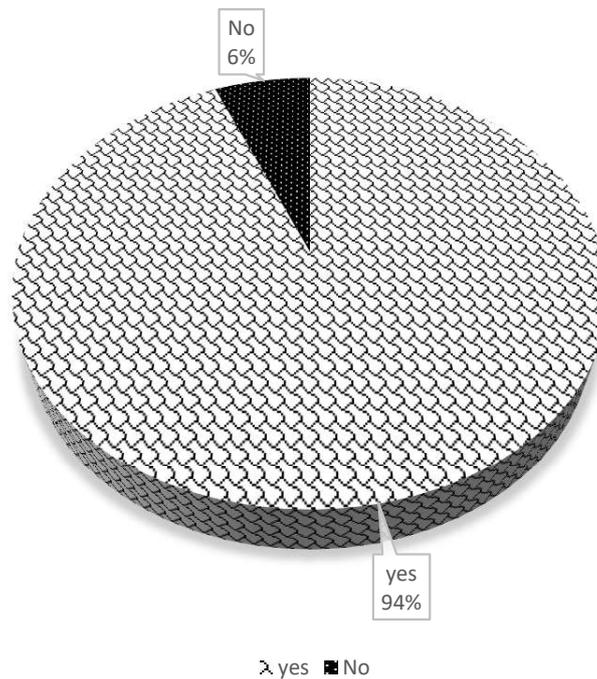


Figure 4. 4: pie chart showing percentage of professionals that have experienced change orders

In accordance with the figures change orders are a common occurrence in construction projects except a few projects about 6% of the projects executed.

4.5.5 Rate the occurrence of change orders on your previous or current project

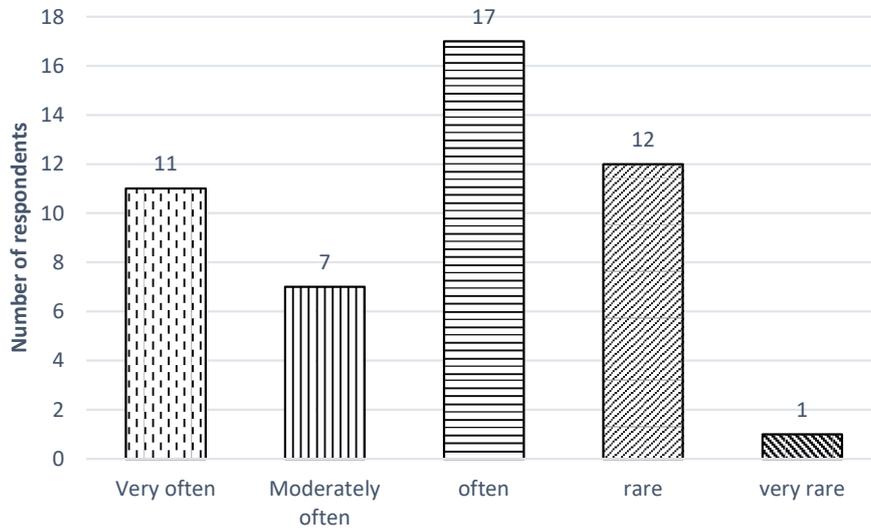


Figure 4. 5: graph showing the occurrence of change orders

The occurrence of change order is rated as an often to very often activity in the construction project as evidenced above in the pie having 73% agree that the occurrence of change orders is often.

4.6 Analysis of Likert scale variables using relative importance index

$$\text{Relative Importance index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A \times N}$$

Where n_5 to n_1 represent the number of respondents for their respective degree of conformance i.e.; n_5 for strongly agree and n_1 for strongly disagree

A is the highest weight and N is total number of respondents

Rate the following stakeholders on their influence on scope change during project planning

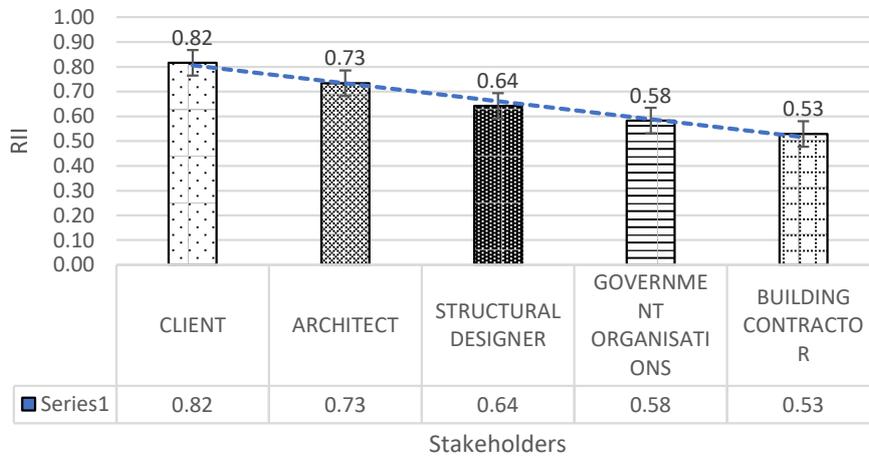


Figure 4. 6: graph showing rating of stakeholders against RII on their influence on scope change

Table 4. 2: ranking for most influential stakeholder in causing change orders

Stakeholders	RII
Client	0.82
Architect	0.73
Structural designer	0.64
Government organizations	0.58
Building contractor	0.53

From the graph and ranking in the table the client is identified as the major influencer of change orders and the contractor as the least influencer, in comparison with Assbeihat et al (2017) whose finding were similar that “owners instructs modification to design” as the most important cause of change orders followed by owner instructs additional works clearly places the client as the major source of change orders. And the least important influencer in change order occurrence building contractor. More to that Alshiefat (2017) findings show that changes initiated by clients are the main causes of change orders in the Jordanian construction industry. The Severity Index (SI) for such changes was significantly high (93.42%), and both the median and mode were 5. . Hence the the major source of change orders is the client with rank 1. Al-Dubaisi (2000) argued that civil/ structural engineers were the most change order generating craft in large-building projects with over 60% respondent in agreement while 23% respondents pointed out that the electrical engineer was the most change order generating craft.

Rate the following factors on their influence on the occurrence of change orders

Table 4. 3; Causes of change orders Ranking

Factors	RII	Rank
Change of scope	0.80	1
Change in economy	0.60	9
Schedule	0.60	10
Unforeseen conditions	0.68	6
Inadequate working drawings	0.70	4
Change in execution methods	0.57	12
Conflicting contract documents	0.62	8
Design complexity	0.59	11
Technology change	0.52	14
Limited contractor involvement	0.45	16
Errors and omissions	0.69	5
Change in design	0.77	2
Consultant unawareness of available resources	0.56	13
Change in specifications	0.72	3
Change in govt regulations	0.52	14
Conflicting drawings	0.64	7

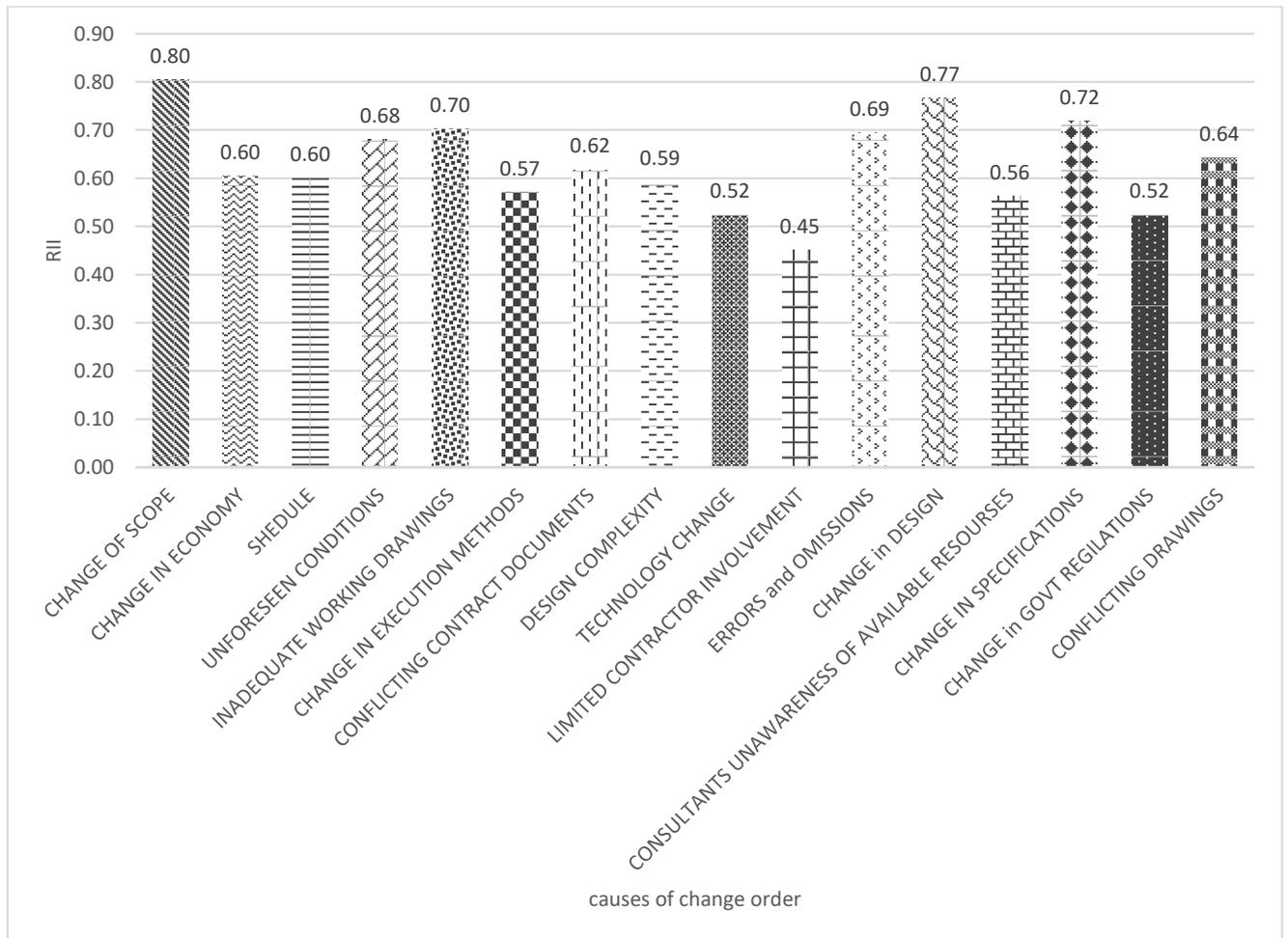


Figure 4. 7; RII against causes of change orders

In ranking the most important factors that lead to change orders from highest are, change of scope, change in design, change in specifications, inadequate working drawings and errors and omissions where the top most. This is similar to Khalifa et al., (2019) findings in which he noted that the top five severe causes of change orders as seen from contractors’ view were: (rank 1) Owner’s additional works, (ranked 2nd) Error and omissions in design, ranked 3rd was Lack of coordination, forth was Defective workmanship and finally in fifth position were Owner financial difficulties. In addition, Assbeihat et al. (2017) determined the main causes of change orders are those which are related to the owner’s internal environment which included “Owner instructs modification to design (1),” and “Owner instructs additional works (2)” are the most important change orders factors. These findings further pinpoint the client as the major source of change orders.

Basing on your experience are all relevant stakeholders engaged in the project planning and design.

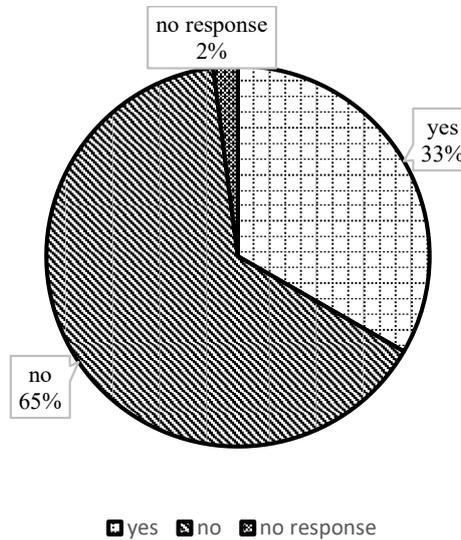


Figure 4. 8: Pie chart showing percentage of professionals' opinion on engagement of stakeholders

The above chart depicts that most respondents believe that not all relevant stakeholders are engaged in design of construction projects.

In your opinion, how likely would the engagement of the following stakeholders during planning and design improve management of change orders

Table 4. 4: likeliness of change order improvement with engagement of the different stakeholders

Stakeholder	RII	Rank
Client	0.92	1
Contractor	0.68	7
Structural Eng.	0.88	3
NGOs	0.47	9
Qs	0.84	4
Architect	0.91	2
Govt BODIES	0.68	7
Electrical Eng.	0.76	6
Mechanical Eng.	0.77	5

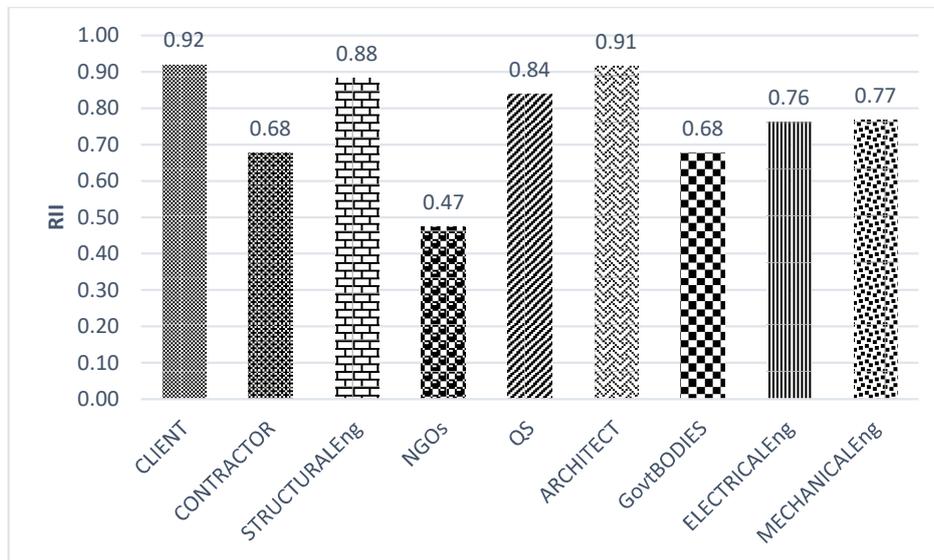


Figure 4. 9; Graph of relative importance of engagement of stakeholders to improve change order management

Findings show that client engagement in design stage would improve the process of change order management as clients are ranked 1st in importance followed by the architect while NGOs ranked least important followed by the contractors and government bodies. Similarity (Alinaitwe, Mahando, & Mlinga, 2018) opined that, client involvement and engagement of project manager to manage the project significantly contribute to performance improvement in construction projects. Hence the need to interpret all project drawings and specifications to the client during planning to ensure full engagement of the client.

To what extent are the following stakeholders involved during the design and planning stage

Table 4. 5: Frequency of stakeholder engagement

Stakeholder	RII	Rank
Client	0.91	2
Architect	0.95	1
Structural Eng.	0.90	3
Building contractor	0.49	8
Govt BODIES	0.58	7

Suppliers	0.40	9
Qs	0.83	4
Electrical Eng.	0.81	5
Mechanical Eng.	0.81	5

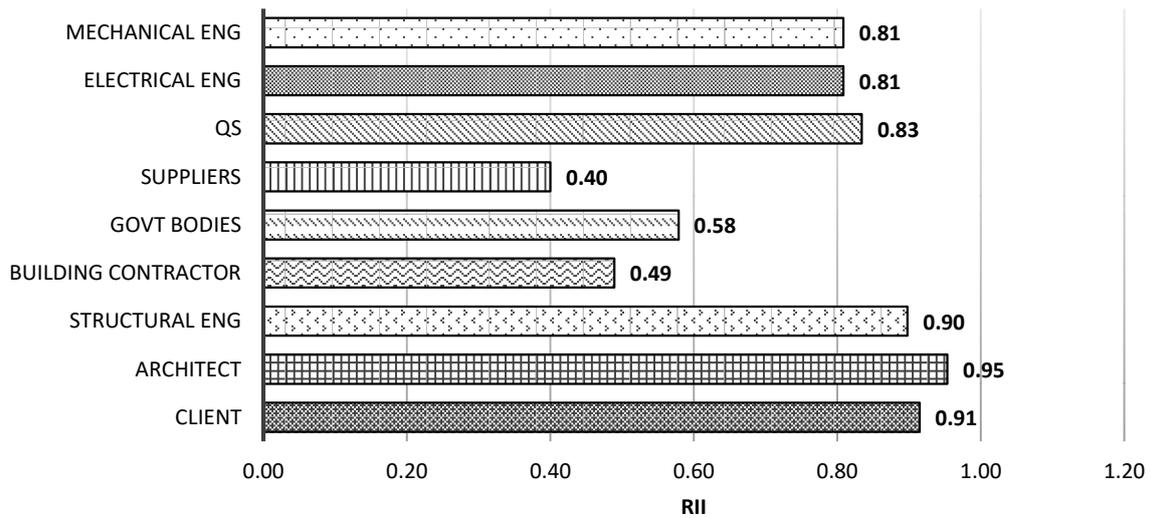


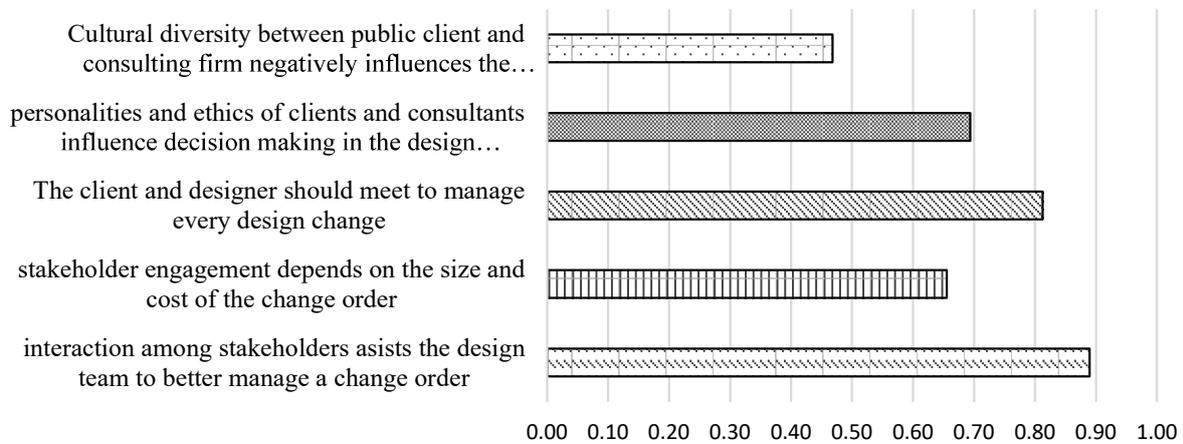
Figure 4. 10: figure showing the current engagement practice

The above findings suggest that the architect is the most engaged stakeholder in design followed by the architect the client then structural engineer and quantity surveyors. The suppliers were the least engaged stakeholder followed by the building contractor and government bodies. This can be justified by (Alsuliman, 2014) who noted that, in the pre-design stage of a construction project, clients usually appoint consultants as internal stakeholders for further investigation of the project. In this stage the project manager, the architect, the quantity surveyor and the engineers have to work together on a feasibility study, as a group of internal stakeholders, in order to guarantee the project will be constructed and operated as planned and designed. Hence the architect having the highest RII. He added that there may be some further conflicts amongst consultants at both the pre-design stage and design stage, as each consultant in this stage concentrates on his/her specific area. Hence, the client needs to make decisions about several important aspects in the project such as the scope of the project work and the investments in the development, design considerations, financial conditions, project costs and duration. This justifies why the client is ranked second.

To what extent do you agree with the following statements in accordance with the change order management process

Table 4. 6: Relative importance ranking of change order management process practices

Statements	RII	Rank
Interaction among stakeholders assists the design team to better manage a change order	0.89	1
Stakeholder engagement depends on the size and cost of the change order	0.66	4
The client and designer should meet to manage every design change	0.81	2
Personalities and ethics of clients and consultants influence decision making in the design changing process.	0.69	3
Cultural diversity between public client and consulting firm negatively influences the performance of change order management	0.47	5



	interaction among stakeholders assists the design team to better manage a change order	stakeholder engagement depends on the size and cost of the change order	The client and designer should meet to manage every design change	personalities and ethics of clients and consultants influence decision making in the design changing process.	Cultural diversity between public client and consulting firm negatively influences the performance of change order management
Series1	0.89	0.66	0.81	0.69	0.47

RII

Figure 4. 11; graph of factors that influence change order management

According to the above findings increased interaction among stakeholders could significantly reduce occurrence of change orders with a relative importance index of 0.89. followed by clients and designers should meet to manage every design change with RII (0.81). This is similar to the findings of Oladiran et al., (2018) in which proper planning among parties involved was ranked first (1st) out of twelve (12) with STD of 1.16 and mean of 4.20 as a measure to control change orders.

In trying to engage stakeholder, have you experienced any difficulties?

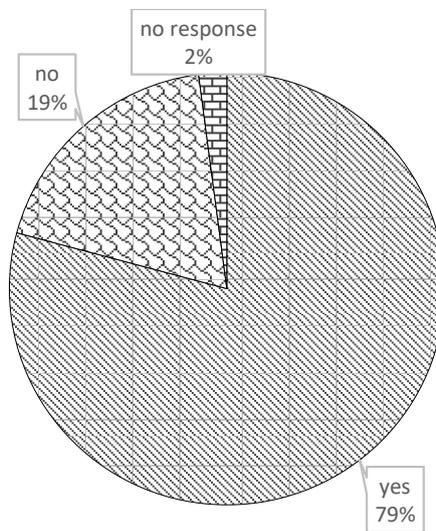


Figure 4. 12; pie chart showing percentage of professionals that have had difficulties in engaging stake holders

Most respondents agree to have experienced difficulties in engagement of stakeholders and consist 79% while 19 % have not experienced any difficulties and 2% did not respond to this part.

To what extent do you agree with the following statements as hinderances to effective stakeholder engagement to manage change orders at planning and design stage.

Table 4. 7: Ranking of Hinderances to stakeholder engagement

Statements	RII	Rank
Costs	0.56	4
Government policies	0.51	6
Inadequate stakeholder engagement guidelines	0.60	2
Complexity of the construction projects and unpredictability	0.54	5
Shortage of professionals	0.46	7
Procurement methods	0.56	3
Limited project planning and design time	0.73	1

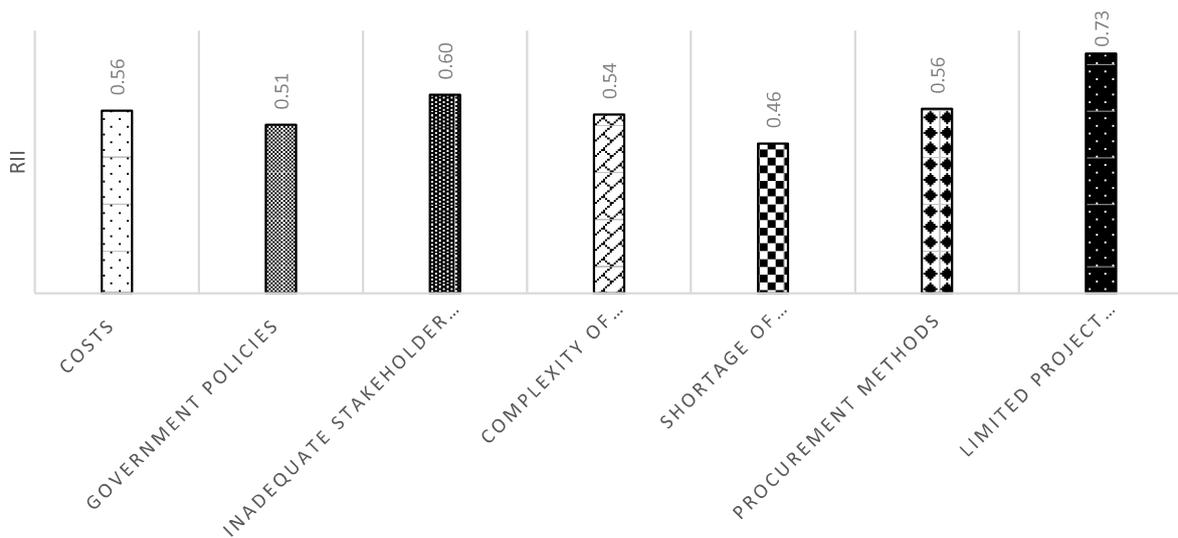


Figure 4. 13; Graph showing relative importance of hinderances to engagement of stakeholders

The above table and data give limited project planning and design time as the most important hinderance to engagement of stakeholders during design, followed by inadequate stakeholder engagement guidelines then, costs involved in engagement and procurement methods as the three (3) most important hinderances to stakeholder engagement at design. While shortage of professionals to implement the stakeholder engagement process was the least important followed by government policies.

Alsuliman (2014) identified that Stakeholders' responsibilities are not clear enough with regards to the change process. Plus, lack of formalized method is applied to manage variation orders in either public sector or consulting firms at the design stage of Saudi public construction projects. This is similar to the, Inadequate stakeholder engagement guidelines which scored rank two (2) with RII of 0.60.

Respondents' opinions

In addition, respondents opined as follows on the stakeholder engagement practices in change order management

- i. The type of building procurement - e.g., Design and Build, DBB, PPP, EPC also greatly influences stakeholder involvements
- ii. All Project Stakeholders should be engaged at all design stages from Inception to Project Completion
- iii. Different funder policies on stakeholder engagement drive the extent of implementing the same. The capacity of the consultant / project manager to respond to change orders timely can influence the project timelines directly and /or indirectly.
- iv. First the type of project under the procurement and its funding style is important. Stakeholder engagement management plan, change order management plan and risk management plan are really important in the planning and design stages to enable reduce change orders on a project. Proper staffing of experts to be involved in the planning and design is really important. Project complexity Versus the time granted for project planning and detailed design phase should be critically analyzed first by the Client otherwise designer and planners may not comprehend the entire expected scope as expected by the conditions of the contract hence submitting incomplete works due to shortage of time. conclusively, Client should critically invest time in scrutinizing the specifications of a project before handing it over to the Consultant.
- v. Corporation and team working amongst the stakeholders should be looked at as the way of harmonizing challenges in the planning phase as a way of reducing their impacts.

- vi. I believe involving stakeholders in the planning and design stage is very important because the stakeholders in the end receive what they expect and reduces on the period and cost of the project in terms of variations.
- vii. All relevant stakeholders ought to do a thorough review of the drawings and address the necessary changes in the planning stage. This minimizes the change orders which implicate the project duration and cost.
- viii. thorough stakeholder engagement before project commencement is necessary for proper planning. Where the step is missed, eventual designs may not match the needs of the end user hence resulting into a lot of change orders.
- ix. In general, it would be better to involve key stake holders in the planning phase this will minimize change orders in most projects.
- x. Guidelines for the engagement of stakeholders should be compiled to guide designers and planners on how the engagement should be carried out.
- xi. The contractor should be put up to speed on all the designs and works that are upcoming so that all intended works can progress smoothly since they will always have an idea of what is to be done and how to do it hence better management of change orders.
- xii. Advise clients to follow right routes when engaging stakeholders and not skip any.

CHAPTER 5

5.1 Conclusion

This study aimed at determining the possibility of early stakeholder engagement to optimize the management of change orders so as to reduce their negative impacts that include claims and disputes which would arise from the inefficient management of change orders. The study was conducted through administering questionnaires to selected professionals online via their emails and physically by the researcher to their offices if they preferred and after collect them when they were done filling them. A few that had time were able to create engage in a one-on-one interaction with the researcher.

1. To identify the major source of change orders

According to the findings, the major source of change orders is the client that this is done through change of scope and instructing a change in design.

2. To identify the current of stakeholder's engagement practice.

Current engagement practice suggest that the architect is the most engaged stakeholder with RII (0.95), client with RII (0.91) takes up the second position followed by the structural engineer with RII (0.90) next is the quantity surveyor with RII (0.83). The Mechanical / electrical engineer both having RII of 0.81 take on the fifth position. Suppliers are least engaged with RII of 0.40 followed by building contractors with 0.49 RII and then government bodies with 0.58 RII. In addition, 65% were of the view that not all relevant stakeholders are engaged in the design and planning while 33% agreed that all relevant stakeholders are engaged in the design and planning of a project.

3. To determine the significance of stakeholder engagement in the process of change order management.

Client takes precedence under this criterion with 0.92 RII followed by the architect with 0.91, structural engineer with 0.88, Quantity surveyor with 0.84, Mechanical engineer with 0.77, electrical engineer with 0.76, contractor and government bodies tie with 0.68, and non-government organizations came last with 0.47 RII.

4. To identify the hinderances to engagement of different stakeholders in the project planning phase.

The most important hinderance was identified to be limited project planning time with 0.73 RII.

Next was inadequate stakeholder engagement guidelines with 0.60 RII.

Followed by Procurement methods at 0.56 tying with costs involved.

Next was Complexity of the construction projects and unpredictability with 0.54 RII.

Then Government policies with 0.51 and lastly shortage of professionals at 0.46.

5.2 Recommendations

5.2.1 To the consultants;

Consultants should ensure cooperation amongst each other and provide reliable advice to the client on stakeholder engagement and they should follow ethical practices.

5.2.2 To researchers;

Future research should be conducted on stakeholder engagement including the client as a respondent.

Since most of the respondents were from private sector, further research needs to be carried out to identify the opinions of the public sector.

Appendix

Questionnaire

Dear Sir/Madam,

I am a student in the School of the Built Environment at Makerere University, conducting research under the supervision of Mr. Ainomugisha Safiki. I am researching early stakeholder engagement in change order management in construction projects during planning.

Previous studies in this research revealed that, the current practice of change order management on construction projects follows the basic principles of any change order management system, which can be described as identifying, evaluating the change order, estimation, approval, implementation and documentation. However, construction industry shows some deficiencies in change order management due to late stakeholder engagement. Hence, this survey aims to integrate stakeholder engagement with the current process of change order management to investigate the possibility of early stakeholder engagement in order to improve the change order management process at the planning stage.

Please, I respectfully ask you to complete the questionnaire and be assured that the data collected will be kept confidential and no firm, organization or individual will be identified in the thesis or in any report or publication based on this research. A copy of the summary report will be made available if required. I would also like to assure you that this study has been reviewed and received clearances from the College of Engineering Design Art and Technology at Makerere University.

Thanks in advance for your co-operation.

Yours sincerely

Marvin Alinde

0774777514/0702340128

* Required

1. Email *

2. Name (Optional)

3. What is your work organization?

Check all that apply.

Public sector

Private sector

4. Feel free to indicate the name of organization with which you are working.
(optional)

5. With which professional organization are you registered?

Mark only one oval.

- UIPE
 USA
 ERG
 ISU
 UNABCEC
 UACE
 SRB
 ARB
 CMAU
 Other: _____

6. Please indicate your profession *

7. What is your job in the design process of your project?

Check all that apply.

- Project manager
 Design manager
 Architect
 Civil engineer
 Site engineer
 Quantity surveyor
 Electrical engineer
 Mechanical engineer
 Other: _____

8. Have you been involved in designing construction projects?

Check all that apply.

- Yes
- No

9. Please specify your years of experience:

Check all that apply.

- 0-5
- 6-10
- 10-15
- 16-20
- more than 20 years

10. Basing on any project that you have been on, answer the following appropriately.

Have you experienced change orders on your projects?

Check all that apply.

- Yes
- No

11. Rate the occurrence of change orders on your previous or current project.

Check all that apply.

- Very often
- Moderately often
- Often
- Rare
- Very rare

12. Rate the following stakeholders on their influence on scope change during project planning. (1= not at all, 2= to a lesser extent, 3= moderate, 4= usually and 5= to a great extent)

Mark only one oval per row.

	1	2	3	4	5
client	<input type="radio"/>				
Architectural design consultant	<input type="radio"/>				
Structural design consultant	<input type="radio"/>				
Government organizations	<input type="radio"/>				
Building Contractor	<input type="radio"/>				

13. Rate the following factors on their influence on the occurrence of change orders.
(1= not at all, 2= to a lesser extent, 3= moderate, 4= usually and 5= to a great extent)

Mark only one oval per row.

	1	2	3	4	5
Change of scope	<input type="radio"/>				
Change in economic conditions / inflation	<input type="radio"/>				
Change of schedule	<input type="radio"/>				
Unforeseen conditions	<input type="radio"/>				
Inadequate working drawings.	<input type="radio"/>				
Change in methods of execution	<input type="radio"/>				
Conflicts between contract documents	<input type="radio"/>				
Design complexity	<input type="radio"/>				
Technology change	<input type="radio"/>				
Contractor not involved in design stage	<input type="radio"/>				
Errors and omissions in design	<input type="radio"/>				
Change in design	<input type="radio"/>				
Consultant's unaware of available resources	<input type="radio"/>				
Change in specifications	<input type="radio"/>				
Change in government regulations	<input type="radio"/>				
Conflicting contract documents (Drawings)	<input type="radio"/>				

14. Basing on your experience are all relevant stakeholders engaged in the project planning and design.

Mark only one oval.

- Yes
 No

15. In your opinion, how likely would the engagement of following stakeholders during planning and design improve management of change orders.

Mark only one oval per row.

	Not at all	Less likely	moderately	likely	Very likely
Client	<input type="radio"/>				
Contractor	<input type="radio"/>				
Structural engineer	<input type="radio"/>				
NGOs	<input type="radio"/>				
Quantity surveyor	<input type="radio"/>				
Architect	<input type="radio"/>				
Government bodies	<input type="radio"/>				
Electrical engineers	<input type="radio"/>				
Mechanical Engineers	<input type="radio"/>				

16. To what extent are the following stakeholders involved during the design and planning stage? Tick appropriately.

Mark only one oval per row.

	Not at all	Rare	Neutral	Often	Very Often
Client	<input type="radio"/>				
Architectural design consultant	<input type="radio"/>				
Structural design consultants	<input type="radio"/>				
Building Contractor	<input type="radio"/>				
Government bodies	<input type="radio"/>				
Suppliers	<input type="radio"/>				
Quantity surveyors	<input type="radio"/>				
Electrical engineers	<input type="radio"/>				
Mechanical engineers	<input type="radio"/>				

17. To what extent do you agree with the following statements during the process of change order management at the design stage? (1= strongly disagree, 2 = disagree, 3= somewhat agree, 4=agree, 5=strongly agree)

Mark only one oval per row.

	1	2	3	4	5
Interaction among stakeholders assists the design team to better manage a change order.	<input type="radio"/>				
Stakeholder engagement depends on the size and cost of the change order	<input type="radio"/>				
The client and designer should meet to manage every design change.	<input type="radio"/>				
Personalities and ethics of clients and consultants influence decision making in the design changing process.	<input type="radio"/>				
Cultural diversity between public client and consulting firm negatively influences the performance of change order management	<input type="radio"/>				

18. In trying to engage stakeholder, have you experienced any difficulties?

Mark only one oval.

- Yes
 No

19. To what extent do you agree with the following as hinderances to effective stakeholder engagement at the design stage? (1= strongly disagree, 2 = disagree, 3= somewhat agree, 4=agree, 5=strongly agree)

Mark only one oval per row.

	1	2	3	4	5
Costs involved in engaging stakeholders during planning make stakeholder engagement difficult.	<input type="radio"/>				
Government policies make the stakeholder engagement process challenging	<input type="radio"/>				
Inadequate stakeholder engagement guidelines set for adequate stakeholder engagement	<input type="radio"/>				
Complexity of the construction projects and unpredictability of what makes project initiators reluctant to engage some stakeholders.	<input type="radio"/>				
Shortage of professionals to implement the process of stakeholder engagement.	<input type="radio"/>				
Procurement methods limit engagement during planning and design stage.	<input type="radio"/>				
Limited project planning and design time make the engagement of stakeholders difficult.	<input type="radio"/>				

20. Please feel free to add any comments that you think are related to stakeholder engagement in the planning phase to better manage change orders to minimize their impacts during project implementation.

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Google Forms

Frequency tables and statistics

No. 12

Statistics

		CLIENT	ARCHITECT	STRUCTURALDESIGNER	GOVERNMENT ORGANISATIONS	BUILDINGCONTRACTOR
N	Valid	48	48	48	48	48
	Missing	0	0	0	0	0

Frequency Tables

CLIENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	to a lesser extent	5	10.4	10.4	10.4
	moderate	10	20.8	20.8	31.3
	usually	9	18.8	18.8	50.0
	to a great extent	24	50.0	50.0	100.0

Total	48	100.0	100.0	
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ARCHITECT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	1	2.1	2.1	2.1
	to a lesser extent	6	12.5	12.5	14.6
	moderate	13	27.1	27.1	41.7
	usually	16	33.3	33.3	75.0
	to a great extent	12	25.0	25.0	100.0
	Total	48	100.0	100.0	

STRUCTURALDESIGNER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	1	2.1	2.1	2.1
	to a lesser extent	15	31.3	31.3	33.3
	moderate	11	22.9	22.9	56.3
	usually	15	31.3	31.3	87.5
	to a great extent	6	12.5	12.5	100.0
	Total	48	100.0	100.0	

GOVERNMENTORGANISATIONS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	2	4.2	4.2	4.2
	to a lesser extent	18	37.5	37.5	41.7
	moderate	15	31.3	31.3	72.9
	usually	8	16.7	16.7	89.6
	to a great extent	5	10.4	10.4	100.0
	Total	48	100.0	100.0	

BUILDINGCONTRACTOR

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	6	12.5	12.5	12.5
	to a lesser extent	15	31.3	31.3	43.8
	moderate	19	39.6	39.6	83.3
	usually	6	12.5	12.5	95.8
	to a great extent	2	4.2	4.2	100.0
	Total	48	100.0	100.0	

No. 13

Frequency Table

CHANGE OF SCOPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	2	4.3	4.3	4.3
	to a lesser extent	5	10.6	10.6	14.9
	moderate	6	12.8	12.8	27.7
	usually	11	23.4	23.4	51.1
	to a great extent	23	48.9	48.9	100.0
	Total	47	100.0	100.0	

CHANGE IN ECONOMY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	1	2.1	2.1	2.1
	to a lesser extent	18	38.3	38.3	40.4
	moderate	12	25.5	25.5	66.0
	usually	11	23.4	23.4	89.4
	to a great extent	5	10.6	10.6	100.0
	Total	47	100.0	100.0	

SCHEDULE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	3	6.4	6.4	6.4
	to a lesser extent	11	23.4	23.4	29.8
	moderate	19	40.4	40.4	70.2
	usually	11	23.4	23.4	93.6
	to a great extent	3	6.4	6.4	100.0
	Total	47	100.0	100.0	

UNFORESEEN CONDITIONS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	2	4.3	4.3	4.3
	to a lesser extent	6	12.8	12.8	17.0
	moderate	19	40.4	40.4	57.4
	usually	11	23.4	23.4	80.9
	to a great extent	9	19.1	19.1	100.0
	Total	47	100.0	100.0	

INADEQUATE WORKING DRAWINGS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	1	2.1	2.1	2.1
	to a lesser extent	10	21.3	21.3	23.4
	moderate	12	25.5	25.5	48.9
	usually	12	25.5	25.5	74.5
	to a great extent	12	25.5	25.5	100.0
	Total	47	100.0	100.0	

CHANGE IN EXECUTION METHODS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	2	4.3	4.3	4.3
	to a lesser extent	14	29.8	29.8	34.0
	moderate	20	42.6	42.6	76.6
	usually	11	23.4	23.4	100.0
	Total	47	100.0	100.0	

CONFLICTING CONTRACT DOCUMENTS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	5	10.6	10.6	10.6
	to a lesser extent	10	21.3	21.3	31.9
	moderate	17	36.2	36.2	68.1
	usually	6	12.8	12.8	80.9
	to a great extent	9	19.1	19.1	100.0
	Total	47	100.0	100.0	

DESIGN COMPLEXITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	to a lesser extent	19	40.4	40.4	40.4
	moderate	15	31.9	31.9	72.3
	usually	9	19.1	19.1	91.5
	to a great extent	4	8.5	8.5	100.0
	Total	47	100.0	100.0	

TECHNOLOGY CHANGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	4	8.5	8.5	8.5
	to a lesser extent	21	44.7	44.7	53.2
	moderate	14	29.8	29.8	83.0
	usually	5	10.6	10.6	93.6
	to a great extent	3	6.4	6.4	100.0
	Total	47	100.0	100.0	

LIMITED CONTRACTOR INVOLVEMENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	13	27.7	27.7	27.7
	to a lesser extent	21	44.7	44.7	72.3
	moderate	4	8.5	8.5	80.9
	usually	6	12.8	12.8	93.6
	to a great extent	3	6.4	6.4	100.0
	Total	47	100.0	100.0	

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