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THE EFFECTS OF VARIATION ORDER ON CONSTRUCTION PROJECT PERFORMANCE AT MCG CONSTRUCTION PLC

BY

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DECLARATION

I, Abiy Bekele, the undersigned person declare that the thesis entitled "THE EFFECTS OF VARIATION ORDER ON CONSTRUCTION PROJECT PERFORMANCE AT MCG CONSTRUCTION PLC" is my original and submitted for the award of Master of Art Degree in Project Management from St. Mary University at Addis Ababa and it hasn't been presented for the award of any other degree. Under this study, fellowship of other similar titles of any other university or institution of all sources of material used for the study has been appropriately acknowledged and notice.

Abiy Bekele	_____	_____
Candidate	Signature	Date

CERTIFICATION

This is to certify that Mr. Abiy Bekele has properly completed his research work entitled "THE EFFECTS OF VARIATION ORDER ON CONSTRUCTION PROJECT PERFORMANCE AT MCG CONSTRUCTION PLC" with our guidance through the time. In my recommendation, his task is appropriate to be submitted as a partial fulfillment requirement for the Master of art Degree in Project Management.

Research
Advisor

Temesgen Belayneh (PhD)

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Contents

LIST OF TABLES

LIST OF ACRONYMS/ABBERIVATIONS

RII- Relative importance index

SPSS- Statistical Package for Social Sciences

PLC- Private Limited Company

MCG- the Construction Company name

ABSTRACT

The study aims to investigate the effects of variation order on construction project performance and identify the major effects of variation order related to the owner's, contractors, and consultant's changes. The study also aims to determine the scope at which lack of communication among stakeholders effects variation order and suggest strategies to minimize variation order effect. The author developed questionnaire to assess the perceptions of Engineers, contractors, and consultants on the relative importance of factors causing variation order on Construction Road projects. A total of 20 potential variation effects were selected from previous studies and grouped into two categories, financial related factors, and technical factors. The findings of the analysis of the data gathered through these approaches are provided in the paper.

Key words: variation order, Effects, road construction projects

CHAPTER ONE

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Almost all construction projects vary from the original design, scope and definition. Whether small or large, construction projects will inevitably depart from the original tender design, specification and drawings prepared by the design team. This can be effect of technological advancement statutory changes or enforcement; change in conditions, geological anomalies, non-availability of specified materials or simply be effect of the continued development of the design after the contract has been awarded. In large civil engineering projects variations can be very significant, whereas on small building contracts they may be relatively minor (Fawell, 2015).

Arain and Phen L (2005) distinguished two types of variation order namely beneficial variation order and detrimental variation order. A beneficial variation order is one issued to improve the quality standard, reduce cost, make schedule effectsive and reduce degree of difficulty in the project. A detrimental variation order can be defined as the one that negatively impacts the client value or project performance (Arain and Klow, 2005). Detrimental variations are those that reduce owner value or have a negative impact on a project (Ndihokubwayo and Haupt, 2008) according to (*Ndihokubwayo,2008)* the potential effects of variation orders suggested four main origin agents. These include “client”, “consultant”, “contractor” and others.

The authors Acharya et al. (2006) Suggested consultants should aim at obtaining an understanding of overall scope and goals of the project. They understand deliverables and provide specific suggestion when required. All has to be done relatively quickly without having any negative effects on productivity. It is the role of consultant to advise the client on technical, legal and financial matters.

Although no one can ensure that variation orders can be avoided completely, their occurrence and subsequent waste can be eliminated if their origin and effects are clearly determined (Awad, 2001). Lack of effectsive communication, lack of integration, uncertainty, changing, changing in environment and increasing project complexity are the drivers of variations in the project (Arain

et al., 2004). Awad (2001) analyzed the variation order occurrence in a sewer over flow construction projects. In light of this, the study is to examine the effects of variation on the performance of construction sector.

1.2 STATEMENT OF THE PROBLEM

As stated in the PMI (2000), for a project to be successful, it requires an effectsive and efficient performance that fulfills overall objectives by attaining the three critical success factors, that is meeting the cost, time and quality requirements within the defined scope. Any variations from these objectives in most cases effect projects to be delayed and additional costs to the project implementing agent and project owner (Hammadi, 2006).

In Ethiopia variation order is one of the most frequently occurring issues in construction projects. This variation affects the time limit and budget of the project. It is impossible to eliminate variations totally but we can minimize and develop preparedness trend contractually. In Ethiopian construction industry, almost all projects face project lagging and over budget due to variation order Andualem (2017).

The author (Desai et al. (2015). Hanif, Khurshid, Malik and Nauman (2014) have reflected on the area of variation order. As Andualem (2017) suggested drawings should be complete at stage of tendering; works should be supervised with an experienced and dedicated supervisor and enhancing communication between all parties.

According to Fetene (2008) in Ethiopia aside from the economic inflation and change in foreign exchange rate one of the major effects for cost overrun is variation orders and lack of control on excessive variation orders, which is frequently occurring and becoming a common practice.

In previous studies, Tadesse (2009) studied the effects and effects of variations in the ERA projects, which focused on the existence of variation, its effect and effects but as the researcher himself indicated it was difficult to realize the objective of the study beeffect the questionnaire was not comprehensive to address the objective of the research. It left out some important questions and included some unnecessary questions which don't fit with any of the researcher's objectives.

In another study conducted by Tewodros (2015) the researcher has covered the effect and effects of a variation order. In his study, the researcher had not defined the target population, sample size as well as sampling techniques. Both studies did not rigorously examine the relationship between variation and project performance and only presented the rankings of the factors.

Tadesse (2009) and Tewodros (2015) both the researchers who conducted their study on variation and variation order recommended that further studies on this issue are needed. Similarly, variation order was also recognized to be one of the major problems in the road construction projects which haven't received much attention during preliminary discussion with colleagues and a contract administrator at the Addis Ababa city road authority and Ethiopian road authority,

Therefore, this study attempt to identify the major factors causing variations leading to variation orders and their effects on the overall road construction project performance in MCG Construction specific project name Negele Borena Road Project and rigorously reveal the effects of variation order on project performance with a view of making recommendations that could help towards effectsive variation order management.

1.3 RESEARCH OBJECTIVE

1.3.1 GENERAL OBJECTIVE

The general objective of the study is to analyze the effects of variation order on the overall project performance in the MCG Construction Road Project.

1.3.2 SPECIFIC OBJECTIVES

- To find the effects of variation order related with the Owner's change.
- To identify the effects of variation order related with the contractor's changes.
- To classify the effects of variation order related with the Consultant's changes.
- TO detect the effects of Lack of communication among stakeholders in variation order.

1.4 RESEARCH QUESTIONS

1. What are the Major effects of variation order related with the Owner's change?
2. What are the Major effects of variation order related with the contractor's changes?
3. What are the Major effects of variation order related with the Consultant's changes?
4. At what scope Lack of communications among stakeholders' effects variation order?

1.5 SIGNIFICANCE OF THE STUDY

The result of this study is to have important contribution for construction industries (client, consultant and contractors) to understand variation order and make preparedness action and to stay on the line of the planed schedule and budget. Moreover, the construction industry can adopt the trend of changing any variations that may happen to the project in to a beneficiary outcome. In addition to this the study helps for other researchers who may interest to conduct further studies regarding the issue that this study did not deal with.

1.6 SCOPE OF THE STUDY

Although there are different and wide construction sectors in Ethiopia, this study only focuses on the road construction sector in Ethiopia, specifically on a private construction company called MCG Construction and their Negele Borena Road Project.

1.7 LIMITATION OF THE STUDY

This scop limitation is done due to limitation of budget and schedule of the research. Data used include only Negele Borena Road Project and without assessing other MCG construction road projects.

1.8 ORGANIZATION OF THE STUDY

This study is organized in to Five chapters. Chapter one presents introduction, statement problem, objectives of the study, significance, scope and limitations of the study. Chapter two describes literature review. Chapter three presents the research design including the methodology

that adopted and techniques that applied in data collection and analysis process. Chapter four looks at data analysis and interpretation of the study and Chapter five contains summery of findings, conclusion and recommendations. Finally, the references used and appendices are listed.

CHAPTER TWO

2 REVIEWS OF RELATED LITERATURE

2.1 THEORETICAL LITERATURE

This chapter reviewed the existing literature on variation order and its impact on construction projects. Variation order (VO) is an alteration to the scope of works in a construction contract in the form of an addition, subtraction or omission from the original scope of the work (Araina and pheng, 2005). While Bin-Ali (2008) viewed variation as the alteration or modification of the design, Quantity of works as agreed upon in the contract drawings, bill of quantities and/or specifications. When a written instruction is, therefore, given by the architect requiring the contractor to alter the works in any of these circumstances, it becomes an order. This implies that both change or variation order is capable of bringing changes to the original plan or the construction process on most construction projects beeffect of the uniqueness of each project and the limited resource available in terms of time and budget for planning (Hanna et al, 2002; Ssegawa et al, 2002).

Studies by Enshassi et al (2010) submitted the amongst 64 effects of variation orders, the lack of material and spare parts beeffect of closure is considered as the most 9 important effect of variation orders in construction projects in gaza strip. Arain and Pheng (2005) and Jawad et al (2009) reported that the errors and omissions in design, change in the specification by owner, design discrepancies, change in specification by consultant and lack of coordination, lack of understanding and correct interpretation of customers requirement are the main factors causing variation in educational building projects.

From the foregoing, Bower (2000) and Ndihokubwayo and Haupt (2008) categorized this variation orders those with direct and indirect cost implications. Direct costs constitute the additional costs incurred to perform the activities of the current variation orders which include resource used such as labor, material and plant to carry out actual variation orders.

Classification of variation orders

Arain and pheng (2005) classify variation in to two categories; beneficial and detrimental variation order.

Beneficial variation order

Arain and pheng (2005) stated that variation order is beneficial when it is issued to improve the quality, standard of workman ship, reduce cost, schedule or degree of difficulty in a project. However, it should be noted that regardless of how beneficial a variation order might be, non-value adding costs are likely to accrue (palaneeswaran et al., 2008).

Detrimental variation orders

A detrimental variation order compromises the client's value for money (Ndihokubwayo and Haupt, 2008). Variation order is detrimental when it negatively affects the client value or project performance (Aeain and Pheng, 2005). In case of financial difficulties clients may require the replacement of expensive materials to sub-standard and cheap material. Detrimental variation order often lead to uncertainty and complicated project interfaces which are common in construction and often contribute to the occurrence of non-value adding activities, such as rework (Palaneeswaran et al. 2008)

2.2 EMPIRICAL REVIEWS

Variations on construction projects makes it almost impossible to achieve the project goals according to Fatoye (2012), these goals are usually not archived on building projects there by putting more strain on client satisfaction.as far as 1994, only a quarter of 8000 completed projects could boast of achieving the desired goals of timely completion, with in client's financial plan and desired quality (Ameh, soyingbe and Odusami, 2010).

The magnitude of variation order varies from one project to another. Though there have been cases where variation costs accounted for as much as 100% of the budgeted fund the industry norm as been determined to be about 10 % (Arain and Pheng, 2005). The study by Charoenngam et al (2003) of variation order in construction projects found that the average cost escalation was

7% of the original project cost with an average time extension of 30 %more than the original project duration.

Construction industry due to its compartmentalization has made variation almost an inevitable element and has become so prevalent that it is hardly possible to complete a project without changes to the plans or the construction process itself. (Kwakye, 1997; Ssegawa et al., 2002). The contract provision seems to support the variation orders in construction project and being misunderstood by the stakeholders both on its application and limit. (Fisk, 1997). A variation is an unwanted situation in a project but with stand-by defence in the contract condition. As it is a common phenomenon in all types of construction projects (Fisk, 1997; O'Brien, 1998; Ibbs et al., 2001), it can Variation orders 103 effect substantial adjustment to the contract duration, total direct and indirect cost, or both (Ibbs et al., 1998). It was asserted that variation orders cannot be avoided completely (Mohamed, 2001) and Ssegawa et al. (2002) further added that the presence of variation clauses in contracts amounts to admitting that no project can be completed without changes. Even if carefully planned, it is likely that there will be changes to the scope of the contract as the work progresses (Harbans, 2003). Hanna et al. (2002) indicated that variations occur given the uniqueness of each project and the limited resources of time and money available for planning. Hanna et al. (2002) in their study "Quantitative definition of projects impacted by Change orders" found out that it is the inevitable changes arising from variation that impacts on a project and that the changes may lead to disruptions and changes in work condition which eventually leads to loss of productivity. Their research also shows that other factors interact with the amount of change (such as timing of change, type of change, project size) or are effectd by change (disruptions such as over-manning, overtime, absenteeism) that determine if a project will be or has been impacted. Their summary further shown that, most projects are impacted by change which is attributed by the designer and those due to misunderstanding of the designs by the contractor.

Table 1 various effects of variation order and their categorization

Category of Variation	Effects of Variation	Identified Author(s)
Design Consultant related changes	Change in design by consultant; Errors and omissions in design; Conflicts between contract documents; Inadequate scope of work for contractor; Technology change; Lack of coordination; Design complexity; Inadequate working drawing details; Inadequate shop drawing details; Consultant's lack of judgment and experience; Lack of consultant's knowledge of available materials and equipment; Consultant's lack of required data; Obstinate nature of consultant; Ambiguous design details;	Al-Hammad and Assaf, 1992; CII, 1994a; Assaf, et al., 1995; Chappell and Willis, 1996; Fisk, 1997; O'Brien, 1998; Mokhtar, et al., 2000; Wang, 2000.
Owner related changes	Change of plans or scope by owner; Change of schedule by owner; Owner's financial problems; Inadequate project objectives; Replacement of materials or procedures; Impediment in prompt decision making process; Obstinate nature of owner; Change in specifications by owner.	Fisk, 1997; O'Brien, 1998; Wang, 2000; Gray and Hughes, 2001; Arain and Pheng (2005); Mokhtar, et al., 2000; Gray and Hughes, 2001.
Contractor related changes	Complex design and technology; Lack of strategic planning; Contractor's lack of required data; Lack of contractor's involvement in design; Lack of modern equipment; Unfamiliarity with local conditions; Lack of a specialized construction manager; Fast track construction; Poor procurement process; Lack of communication;	Al-Hammad and Assaf, 1992; Thomas and Napolitan, 1994; Clough and Sears, 1994; Assaf, et al., 1995;Puddicombe, 1997; Fisk, 1997; O'Brien, 1998; Wang,

	Contractor's lack of judgment and experience; Shortage of skilled manpower; Contractor's financial difficulties; Contractor's desired profitability; Differing site conditions; Defective workmanship; Long lead procurement.	2000; Arain and Pheng, 2005
Other changes	Weather conditions; Safety considerations; Change in government regulations; Change in economic conditions; Socio-cultural factors; Unforeseen problems.	Fisk, 1997; Kumaraswamy, et al., 1998; O'Brien, 1998; Wang, 2000; Arain and Pheng, 2005.

Variation orders occur due to a number of reasons ranging from finance, design, aesthetic, geological, weather conditions to feasibility of construction, statutory changes, product improvement, discrepancies between contract documents (Hanna et al., 2002; Ssegawa et al., 2002; Harbans, 2003; Uyun, 2007). The nature and frequency of variation occurrences vary from one project to another depending on various factors (Kaming, et al., 1997). Effects of variation orders various authors had identified different effects of variation orders in construction project both on the private and public projects. The enormity of the various effects of variations identified over the years by various author shows that variation has come to stay as part of the construction projects and it cut across various stakeholders. Table 1 shows various effects of variation order and their categorization. It has been categorized into consultant related, owner related, contractor related variation order and the other changes that can be referred to as force majeure.

Impact of variation order on project performance

Doloi (2009) argued that in construction projects, some of the challenges for both client and contractors to successfully deliver project stem from growing complexity in design and the participation of a multiple stakeholders. Prev9ious studies (Hsueh et al, 2004; Ibbs1997; Ndihokubwayo and Haupt, 2008) have 9identified that some of the most detrimental effects of variation orders include reduced project quality, ineffectsive infrastructure investment and

overruns. Impact of variation orders on project performance Given a well-structured schedule of works, maximum project performance would be achieved if the work invariably flows smoothly within time limits and anticipated budget constraints. However, it is rare that projects perform precisely in 38 lines with their original schedule due to reasons such as, for example, business condition changes, delivery slips, and corrections to design (Al-Hakim, 2005b).

The occurrence of variation orders has an adverse impact on project performance. Thomas et al. (2002) suggest that variability generally impedes project performance. Ibbs (1997) concluded that variation orders affect project performance as they adversely affect productivity and project costs. According to Arain and Pheng (2005b) variation orders are an unwanted but inevitable reality of any construction project. Further, Hanna et al. (2002) found that projects with many variation orders effect the contractor to achieve lower productivity levels than planned.

Variation orders adversely affect project performance in terms of cost overruns, time overruns, quality degradation, health and safety issues and professional relations.

Cost overruns

Construction projects involve recognized phases of which two are particularly important, namely the pre-construction and construction phases. Given that the construction phase typically consumes more resources than the pre-construction phase, attention to cost planning is focused on the construction phase. Clients desire to know in advance the total cost of their finished construction projects. Clients prefer final construction costs to equate to the originally forecast tender figure. Unfortunately, many construction projects incur cost overruns. However, all variation orders do not increase the costs of construction. Omissions in most cases reduce costs while additions increase costs (Ssegawa et al., 2002). Bower (2000) identified the following direct costs associated with variation orders:

- Time and material charges related to immediately affected tasks;
- Recalculation of network increased time-related charges and overheads;
- Reworks and standing time;
- Timing effects for example winter time;

- Inflation, change to cash flow and loss of earnings;

- Management time, head office and site charges.

Time overruns

Clients require their construction projects to be completed within minimum time limits. It is anticipated that projects finished within the shortest possible time achieve some monetary savings. Contractors are heavily penalized when they exceed the original project delivery date.

Quality degradation

Patrick and Toler indicated that contracts with a significant degree of risk for unknown variables such for example, lump sum, contractors may cut corners on quality and quantity to maximize profits. If variation orders are frequent, they may potentially affect the quality of works. Quality may be compromised as contractors try to compensate for losses, they are not optimistic about recovering.

Health and Safety

Variation order occurrence can lead to revision of health and safety considerations. The OHS (2003)13 clause 5.3 (e) stipulates that where changes are brought about, sufficient health and safety information and appropriate resources are to be made available to the contractor to execute the work safely.

Professional relations

A construction project is not merely brick and mortar brought together. Rather, it creates professional relationships between parties to the contract. Each project successfully completed constitutes an added experience to participants and their reputation builds up. But disputes may arise between parties to the contract due to variation orders. Ssegawa et al. (2002) reported that more than one-third of disputes pertained to how to determine losses that stem from variation orders. The excessive occurrence of variation orders due to design errors or omission may undermine the professionalism of the designer. Workers are demoralized when they have to demolish a portion work that they had already completed.

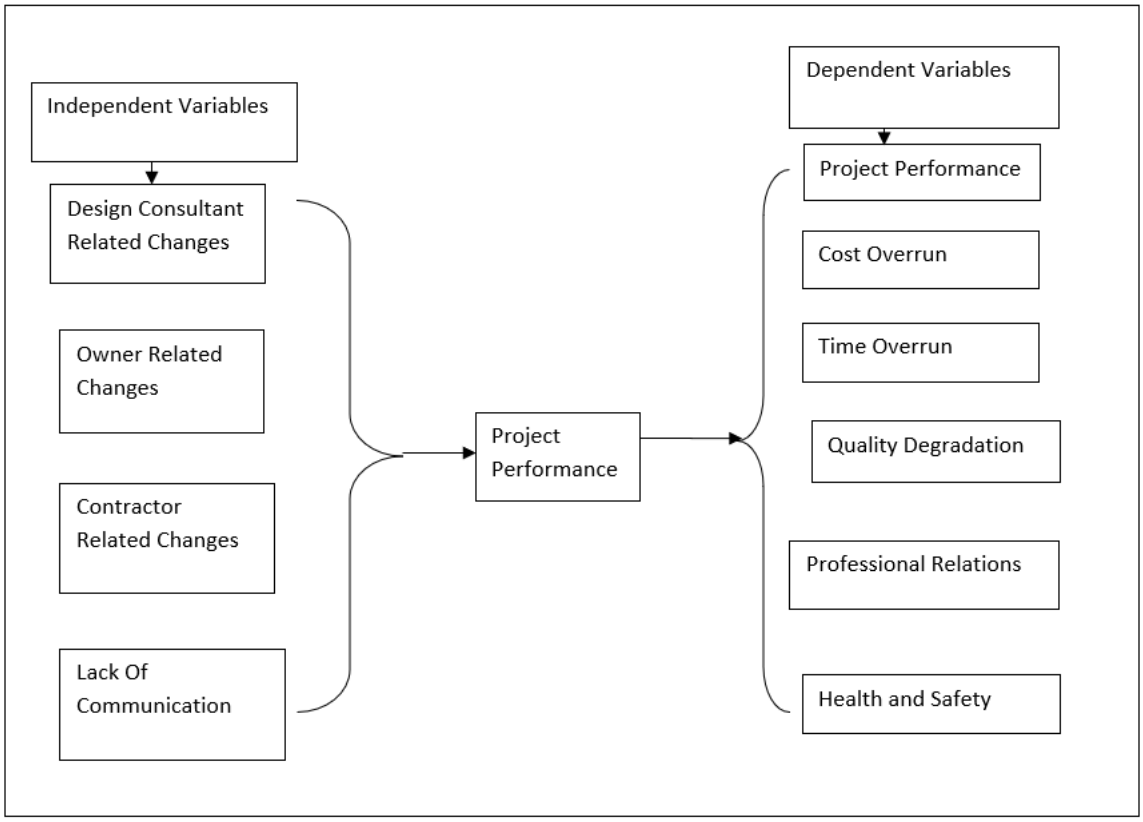
2.3. CONCEPTUAL FRAME WORK

A conceptual frame work is an analytical tool with many variations and contexts. It is used to make conceptual distinctions and organize ideas. Many conceptual frameworks are presented through visual or graphical.

Arain and Pheng (2006) categorized effects of variations in to four origin agents. These are client, consultant, contractor and others related changes. This means the owner, the consultant, the contractor or others can directly initiate variations or the variations are required be affect one of the parties fails to fulfill certain requirements for carrying out the project

The following figure has conceptualized the effects and the effects of variation order on project performance as stated by different scholars Fisk, 1997 O'Brien, (1998); Wang, 2000; Gray and Hughes, 2001; *Arain and Pheng* (2005); Mokhtar, et al., 2000; Gray and Hughes, 2001, Variation orders adversely affects project performance in terms of cost overruns, time overruns, quality degradation, health and safety issues and professional relations.

Figure 1 Conceptual Framework


Independent Variables
Design Consultant Related Changes
Owner Related Changes
Contractor Related Changes
Lack Of Communication
Project Performance
Dependent Variables
Project Performance
Cost Overrun
Time Overrun
Quality Degradation
Professional Relations
Health and Safety

CHAPTER THREE

3 DISCRIPTION OF THE STUDY AREA AND RESEARCH METHODOLOGY

3.1 BACKGROUND OF THE COMPANY

MCG Construction PCL is among Ethiopian emerging construction firms that aim to provide a wide range of civil works and related infrastructure development services such as construction of roads, buildings, Dams, water and water related construction works, real estate developments and drainage systems.

The company was first established in August 2013 G.C as Class 5 General Contractor and has been showing diligence and dedication as a prime contractor in executing construction of various building, road & water supply projects since its establishment. In December 2017, the company advanced itself to Grade 1 General Contractor in order to comply with the ever- growing construction industry of the Country. The main objective of MCG Construction plc is to consistently fulfill the highest client satisfaction using its expertise in the construction industry.

MCG Construction plc employees are team of qualified experts with years of solid working experience in industry recognized companies. A professional approach and attention to the quality of workmanship in all aspects of the project is the key fundamental belief of MCG Construction plc to utilize in-house developed work practices and procedures, the aim is to ensure maximum efficiencies and productivity and most importantly complete client and stake holders' satisfaction.

The manpower of the Company can be grouped in to two major area differentiated as technical experts and supportive staffs. The technical experts have a direct relation with the overall construction activity of the Company. The numbers of permanent employees, working at MCG Construction Plc Company are 579 out of this, only 393 employees are engineers and foreman engaged in the building and road construction work.

Negele Borena Road Project is one of the road projects under the supervision of Ethiopian Roads Authority located on Oromia Regional State & Ethio-Somale Regions. Contract has been signed between Ethiopian roads authority and MCG construction Company on February 15, 2021 G.C with contract amount 1.3 billion ETB. The road has a length of KM 64+500 asphalt road project. Nature of works and special features, all cases of excavation work, hauling, fill, structural excavation & backfill, detour construction, spoil management, Drainage Works, Two Bridges and Structures and ancillary works. The project planned for duration of 4 years nevertheless how only 28% of the work has been completed these days. The project has 72 skilled workers and about 320 unskilled labors including drivers, cleaners and daily labors. Among those skilled labors 2 of them are project coordinators from Ethiopian Road authority. 14 of the workers work under super vision and consulting.

3.2 RESEARCH DESIGN AND APPROACHES OF THE STUDY

A descriptive research design was used to conduct the study. Descriptive research aims to accurately and systematically describe phenomenon. It can answer what, where, when and how questions. In this method the researcher does not control or manipulate any of the variables, but only observes and measures them. More over this method is economically efficient. Descriptive research design is typically concerned with determining the frequency with which an event occurs or the relationship between two variables (Malhotra, 2004). Creswell (2014) added that a descriptive analysis of data is used for all independent and dependent variables in a study.

In order to archive the intended objective both quantitative and qualitative methods are chosen. The quantitative research approach involves the generation of data in quantitative form which can be subjected rigorous quantitative analysis in form land rigid fashion. Qualitative approach to the research is concerned with subjective assessment of attitude, opinion and behavior. The rational of using such approach is to gather data that could not be obtained by a single method for triangulation (creswell, 2003)

3.3 DATA AND DATA SOURCES

The primary source of data obtained from the questionnaires which obtained from project site. The secondary sources of data were obtained from the prior researches, published journals and the company's record.

3.4 POPULATION AND SAMPLING PROCEDURE

According to Mcdaniel (2001) target population is a total group of people from whom the researcher may obtain information to meet the research objectives. In this study target population will be chosen for sampling from project site under the supervision of Ethiopian Roads Authority Respondents will be selected from Negele Borena Road Project. In order to generalize about the targeted population, sample size will be determined. Relatedly both snow ball and purposive sampling technique will be used, With this the researcher tried to obtain information regarding the effects of variation order and the challenges most frequently encountered during the period of construction and what measures had been taken.

3.5 INSTRUMENTATION (METHODS) OF DATA COLLECTION

While collecting data for this research every participant informed about the purpose of the research and their willingness asked before filling the questioner. In this study questions related to variation rated on a 5-point Likert response scale.

Another point is how to determine the sample size, with which the choice of a sample size is expected to have effects on the reliability of a study (Temesgen Hayle , 2015). According to him, it is not the large number of sample size always led to high level of accuracy but rather it is to indicate that sample size is sufficiently representative of the entire population that contributes to the credibility survey estimate.

In this study, sample size was determined by adopting Fowlers (1984) method.as cited by Temesgen (2015), for a given population the level of precision increase steadily up to sample size of 150-200. In this regard we can estimate feasible sample size by applying the formula used by Yamaane (1967). From the total population of our project site i.e. 408 workers a sample size of 135 were feasible to assume the level of precision or sampling error (e) to be 7%. Accordingly, from a total population of 408 (N=408) workers Negele Borena Road Project, with precision level ((e=7%=0.07) the following formula will be applied.

$$n=\frac{N}{1+Ne^2} \qquad n=\frac{408}{1+408*0.07} \qquad n = \underline{135}$$

Accordingly, n=135. therefore, the desired total sample size n will be 135.

3.6 DATA ANALYSIS, MODEL SPECIFICATION OF VARIABLES AND SUPPORT SOFTWARE

To analyze the data collected using the method a Likert scale the mean is the best measure of central tendency. In this regard the paper used means and standard deviation to describe the scale. In addition to this in order to examine data patterns this study used Stata software. Descriptive statics tools (mean, standard deviation and range) are used.

CHAPTER FOUR

4 DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The data obtained from the disseminated questionnaire is presented in this chapter. A total of 20 potential variation effects were selected from the previous studies and grouped in to 2 namely, financial related factors and technical factors.

Both of the factors were ranked in a five-point like rating scale ranging from strongly disagree (1) to strongly agree (5). The data obtained through questionnaire was developed to assess the perceptions of Engineers, contractors and consultants on the relative importance of factors causing variation order on Construction Road projects. The findings of the analysis of the data gathered through these approaches are provided as follow.

4.2 BASIC INFORMATION OF RESPONDENTS

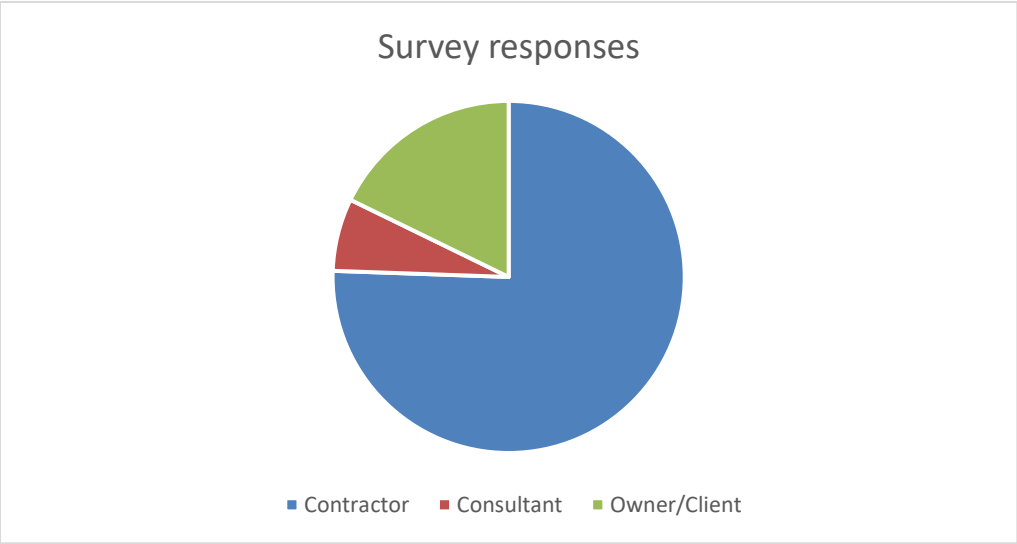
4.2.1 SURVEY RESPONSES

A total of 140 questionnaires (25 client representative, 10 consulting engineers, and 105 contractor employees) were distributed to the respondents. Among the distributed questionnaire 135 were returned. None of them were rejected making 135 responses applicable in the data analysis which makes a percentage of 99.9 return rates. The general characteristics of the respondents are presented below.

Table 2 Rate of Response

Respondents	Questionnaire distributed	Questionnaire collected
Contractor	105	102
Consultant	10	9
Owner/Client	25	24
Total	140	135

Source: own survey, 2023



4.2.2 DEMOGRAPHIC DISTRIBUTION OF THE RESPONDENTS

The demographic characteristics of the respondents were presented in terms of frequency and percentage distribution. The variables included under this section were sex and age of respondents.

Table 3 Distribution of Respondents by Sex and Age

S. No.	Demographic Variable	Category	Frequency	Percentage (%)
1	Sex	Male	88	65.18
		Female	47	34.81
		Total	135	100
2	Age	18-24 years	2	1.48
		25-34 years	87	64.44
		35-44 years	35	25.92
		45-54 years	7	5.18
		Above 55 years	4	2.9
		Total	135	100

Source: own survey, 2023

The age of the respondents was classified in range and majority of the respondents (1.48%) were found in age group 18-24 years, (64.44%) in age group 25-34 years, (25.92%) in age group 35-44 years, (5.18%) in age group 45-54 years while small number of the respondents (2.9%) were in age group 55 years and above. This shows that lots of the respondents are willing individuals who can permit to give an explanation for the important reasons of variation order on road projects.

Table 4 Distribution of Respondents by Designation, Level of Education and Years of Work Experience

S.No.	**Demographic**	**Category**	**Frequency**	**Percentage**
1	Educational qualification	Diploma	0	0
		Degree	102	75.55
		Masters and above	30	22.22
		Other	3	2.22
		Total	135	100
2	Year of experience	< 2	20	14.81
		2-4	29	21.48
		4-6	14	10.37
		6 and above	72	53.33
		Total	135	100
3	Position in the organization	Site Engineer	24	17.77
		Office Engineer	59	43.70
		Resident Engineer	15	11.11
		Contract Administrator	20	14.81
		Project Manager	17	12.59
		Total	135	100

Source: own survey, 2023

Table 4 above presents the distribution of respondents in terms of respondent designation, level of education and years of experience. Accordingly, from respondent's no one has diploma

whereas (75.55 %) of the participants hold first degree, (22.22 %) of them were master's holder which are 30 in number. Around 2.22 % of the respondents were not specify their educational background. This means that the vast majority of the participants obtained the necessary qualifications to do their jobs. Furthermore, the responders were among the personnel with an engineering education, indicating that they had sufficient understanding of the construction sector and difficulties related to variation order.

The above table also shows the work experience of respondents. Around 20 respondents had less than two-year experience. Which covers 14.81% of the total respondents. 21.48% of them had 2-4 years' experience. While 10.37% of the respondents had a work experience of 4-6 years. Out of the total respondents 72 employees had 6-8 years' experience which covers 53.33% of total respondents. This indicates that the majority of the respondents have the relevant professional experience to execute their job. So the variation is not directly related to work experience of staff.

4.3 THE IMPORTANCE AND RANKING OF EFFECT OF VARIATION ORDER

After collecting data from the relevant respondents and conducting a document review, the data was statistically analyzed using statistical package for social science (SPSS) software. The analyzed data is organized into sub-sections that are related to the study's goal and the questions asked in the questionnaire. The study's initial goal was to identify effects of variation order on MCG road construction projects. These elements were found and categorized into two broad groups (financial and technically related). The Relative Importance Index was used to rank these variation causing factors in each group (RII). The RII method was adopted for this study to determine the relative importance of the various impacts related to variation orders based on responses of the client, consultant and contractors. The relative importance index (RII) ranges from 0-1. The following is a detailed explanation of the importance and order of the elements that effect variation.

4.3.1 FINANCIAL RELATED EFFECTS OF VARIATION ORDER

First of all, among diverse issues that effect variation order in road construction which related to 4 major factors were considered financially related. Thus, table 5 presents the results of

questioner analysis of factors of financially related delays. The elements that influence variation in road construction order were assessed using a relative important index.

Table 5 Importance and ranking of financially related variation effects

FINANCIALLY IMPACTS OF VARIATION ORDER	Average Mean	RII	Rank
Project material cost increase	3.77	0.7541	3
Payment delay	3.44	0.6889	4
Impact on Owners finance	4.36	0.8726	1
Increase the overhead expense	4.00	0.8	2

Source: own survey, 2023

Table 5 reveals the increasing the material cost of projects and the payment delay are the contributing impact for variation order respectively. The third impact is considered to be impact on owner finance. This means as a result of variation order owners finance can be affected or exposed to unplanned cost. The last one considered to be financial impact of variation order is increase the overhead expense.

Impact In owner's finance is found to be the most important effect of variation order in road construction projects with RII of 0.8726. Due to financial challenges, owners are unable to adequately execute and deliver significant projects on time. As El-Sadek (2016) noted whether the main contractor was paid for his amount of work or not, the wages for His labor and his subcontractors need to be paid off. Tadesse (2009) also agrees that contractor's financial difficulties is one of the most important effects of variation order in which it was ranked the fifth Important effect in his research.

Increase the overhead expense is found to be the second important effect of variation order in road construction projects with RII of 0.8. This category includes costs that impact the entire construction company from an administrative and legal stand point. According to Swatis and Bhangale (2014) cost include things like rental space, employee benefits, insurance costs, marketing, legal fees and recurring tax or property payments. Beside this the paper stated

contractors perception regarding overhead cost those includes uncontrolled overhead cost can badly affect the performance, overhead cost were not important in the past and overhead cost can be monitored and controlled.

Increase in project Material cost is found to be the third important effect of variation order in road construction projects with RII of 0.7541. Due to several project deviations it is predicted that the project cost may rise. As a result, every project assigns a contingency sum to account for unexpected project deviations while keeping the overall project cost low. Tewodros (2015) and Oloo (2015) found that increase in project cost is the most crucial effects of a variation order. Although Ndihokubwayo and Haupt (2008b) ranked cost overrun the second most important effects of a variation order.

Delay in payment is found to be the least important effect of variation order in road construction projects with RII of 0.6889. Delay in payments affects contractor financial and his capability to continue working on the project. According to S Bounthip phasert (2020) payments are staged and payment approval is slow, lack of clear payment guidelines and increased project cost be effect of loan interest especially disaster- recovery projects often cost more than the initial estimate.

4.3.2 TECHNICAL RELATED EFFECTS OF VARIATION ORDER

This subtopic develops 16 factors related to technical issues for the effects of variation order in road construction. The relative relevance index is used to rank these factors as follows.

Table 6 Importance and ranking of technical factors related variation effects

TECHNICAL EFFECTS OF VARIATION ORDER	Average Mean	RII	Rank
Quality degradation	3.3407	0.6089	15
Logistic delay	4.2444	0.7244	10
Poor Safety condition	3.1926	0.6385	14
Poor professional relation	3.4889	0.6978	12

Additional payment for contractor	4.3185	0.8637	4
Disputes among professionals	3.4667	0.6933	13
Poor workmanship	2.9704	0.5941	16
Unavailability of equipment	3.5704	0.7141	11
Design change	4.5556	0.9111	1
Change in specification by consultants	4.5333	0.9067	2
Change in specification by owner	4.3259	0.8652	3
Lack of strategic plan	3.6296	0.7259	8
Design complexity	3.7630	0.7526	7
Inadequate working drawing	3.7778	0.7556	6
Change in scope of project	5.3111	0.8267	5
Difficulties faced in land acquisition	3.6296	0.7259	8

Source: own survey, 2023

Design change was found to be the most important effect of variation order in road construction projects in Negele Borena Road Project. As it was ranked the first with RII of 0.9111, According to the findings, design flaws effectd by errors and omissions generate delays, variations, and waste of public money beeffect they necessitate redesign during the implementation stage. Enshassi *et al.* (2010) also found that design change lead to delay and loss of productivity and if not rectified during the design phase would eventually appear in a construction phase and initiate variation order to implement corrective measures.

Change in specification by consultants was found to be the second most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the second with RII of 0.9067**.** Change in specification by consultants is the most occurring factor of variation order.

Change in specification by owner was found to be the third most important effect of variation order in road construction projects in Negele Borena Road Project. As it was ranked the third with RII of 0. 8652.According to the findings, lead to frequent changes in plans and scope creep, which leads to more work. As Samantha (2002) pointed out having a sufficient plan is an important requirement for construction projects beeffect insufficient plans result in uncertainties and additions in the work which generally lead to an increase in the number of variations in the

work. Oloo (2015) research finding also ranked change in specification the third most important effect included under change of scope.

Additional payment for contractor is found to be the fourth important effect of variation order in road construction projects. As it was ranked the fourth with RII of 0.8637, the finding implies that in the planning stages the scope of the project is not clarify and is vague.

Change in scope of the project is found to be the fifth important effect of variation order in road construction projects. As it was ranked the fifth with RII of 0.8267, the finding implies that in the planning stages the scope of the project is not clarify and is vague. In this regard change in scope that comes after once the project has been started has an impact on project performance. Tadesse (2009) included additional work instructions to be the second most important effect enfolded under the change in defined scope. Oloo (2015) finding also ranked additional work as the third most important effect included under change of scope.

Inadequate working drawing was found to be the sixth most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the six with RII of 0.7556. O. Sunday in his study stated that, to reduce variation cost, there is need to reduce errors in design calculation to the barest minimum. There is also the need to work on specification related issues with account for 44.3% of the types of errors lead to variation cost.

Design complexity was found to be the seventh most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the seven with RII of 0.7526. According to A. Hameed et al, (2014) design complexity is the third ranked effect of variation based on the overall respondent's perception. Construction drawings are different from construction documents. It needs a qualified expert to interpret and make it work on the ground. Complex design requires skill and construction method (Arain *et al*, 2004). Complexity affects the flow of construction activities, whereas simpler and liner construction works are relatively easy to handle (Fkisk, 1997).

Lack of strategic plan was found to be the eighth most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the eight with RII of 0.7259. Strategic plan establishes a direction.so as it is useful to develop the right goals and targets to the work team, lack of strategic plan will result in variation.

Right of way (Difficulties faced in land acquisition) was found to be the eighth most important effect of variation order in road construction projects in Negele Borena Road Project. As it was ranked the eight with RII of 0.7259, the findings show that the contractor commences work despite the fact that the right of way is not settled due to different issues with the owner of the property, and being resolved alongside the works. As a result, it is a primary effect of project delays and interruptions, resulting in more than ten variations in project time and expense. Right of way was also found to be the first most significant effect of variation in Ethiopian federal road construction projects in Tadesse (2009) study. Furthermore, Tewodros (2015) also ranked right of way problem the first among all effects. The finding also agrees with the finding of Oloo (2015) who found that the delay in land acquisition/ compensation to be the first most important effect of variation order in civil engineering construction projects.

Logistic delay was found to be the tenth most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the ten with RII of 0.7244. Beeffect of country policy and insufficient coordination logistics might delay and can be fundamental effect of variation. Hester *et al.* (1991) mentioned that logistic delays are among the significant effects of variations in construction projects.

Unavailability of equipment was found to be the eleventh most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the eleventh with RII of 0.7141. Beeffect of logistic delay and lack of qualified and modern equipment the site had faced shortage and idling of equipment's. Indhu and Yogeswari (2020) stated that the combination of supply chain disruptions, labor challenges, high steel prices, electronic component shortages, High demand and a slow rebound are all contributing to it being extremely tough to get new machines. Also unavailability of materials and resources at the

construction site followed by procurement delay or logistics delay eventually affects the project. Arain and Pheng (2006).

Poor professional relation was found to be the twelve most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked twelve with RII of 0.6978. According to A Fromsa *el a l* (2020) poor workmanship placed last with RII 0.5941 and stated management factors like supervision, training, motivation, and good communication on site to minimize the cost and effects associated with poor workmanship when implementing road projects.

Disputes among professionals -was found to be the thirteen most important effect of variation order in road construction projects in Negele Borena Road Project. As it was ranked the thirteen with RII of 0.6933, the data demonstrate that, even if a project contract contains variation clauses, disputes and claims over variation orders do not appear to be avoided. Rather mitigation measures had been implemented. Oloo (2015) ranked claim and dispute among parties as second most important effects of variation order. In Tadesse (2009) research, it was ranked to be fifth, and in Tewodros (2015) it was found to be the fourth most important effects of a variation order. Ndihokubwayo and Haupt (2008b) and Ismail *et al.* (2012) research findings agree with this finding as claim and dispute among parties were ranked to be the third most important effects of variation.

Poor Safety condition was found to be the fourteen most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the fourteen with RII of 0.6385. Accidents during the construction process can simply result in personal injuries and large costs. Indirect costs of insurance, inspection and regulation are increasing rapidly due to this increased direct cost and result in variation. Shakil *et al.,* (2018) stated that most of the contractors don't know the safety regulations properly and they do not practice safety policy either. The law enforcement agencies also not strict about the safety regulation in construction site.

Quality degradation was found to be the fifteen most important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the fifteen with RII of 0.6089. Quality control during construction consists largely of insuring conformance to this original design and planning decisions. Variation affects the quality of work adversely (Fisk, 1997). CII ((1995) reported that the quality of work is frequently affected by frequent variations beeffect contractors have to compensate for the losses by cutting corners.

Poor workmanship was found to be the least important effect of variation order in road construction projects in Negele Borena Road Project. It was ranked the last with RII of 0.5941. Unqualified man power is one of the effects for delay, rework and variation of project work. Unlike omo-tarcha project, A. Hameed *et al*, (2014) highlighted poor work man ship is as the most significant factor and placed this factor at first rank.

Table 7 Mean and Standard Deviation

DESCRIPTIVE			
	N	**MEAN**	**STANDARD DEVIATION**
TECHNICAL	135	3.3407	0.07398
FINANCIAL	135	3.7704	0.20028

Source: own survey, 2023

The descriptive statistics including the mean and standard deviation along with their ranks are presented in the following tables. The entire frequency and percentage of factors contributing to variation orders and their effects. According to Aynalem Getasew (2020) a mean scores of 0-1.5 means that the respondents strongly disagree with the measurement variable presented in this study, between 1.50 to 2.50 means they are disagreeing, 2.50 to 3.50 means the respondents were neutral or not Sure, for a mean score of 3.50-4.50 respondents have agreed and for a mean over 4.50, respondents have strongly agreed by the statement.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This is the fifth and last section of the chapter, which is separated into three sections. The study's primary findings are summarized in the first section, conclusions are presented in the second section, and recommendations are provided in the third section based on the established findings and conclusions that could be useful and practical for the construction industry.

5.2 SUMMARY

This study focuses on the effects of variation orders on construction project performance at MCG Construction PLC in Ethiopia. The study aims to identify the effects of variation orders and their impact on project performance, as well as recommend strategies to minimize variation order effects. The literature review discusses the definition and categorization of variation orders, as well as their direct and indirect cost implications. The study found that financial and technical factors effect variation orders in road construction, and the impacts include material cost increase, payment delays, quality degradation, logistic delays, poor safety conditions, and disputes among professionals. The study recommends establishing effectsive change management, involving all parties in the project, and using technology tools for efficient change order management. Future research should focus on technical advancements for effectsive variation order management.

The document discusses a study conducted on variation orders in road construction projects, with the aim of identifying the major effects and effects of variation orders and providing recommendations to minimize their effects on project performance.

The purpose of the study was to investigate thus questionnaires (survey instruments) for assessing the research variables were produced and structured based on the study's purpose,

research questions. Out of 140 distributed questionnaires, 135 (96%) valid questionnaires were collected and used for the analysis. The participants of this study were employees from contractors, consultants and the client. Project Manager, site engineer, office engineer, contract administrator and resident engineer , foreman's , daily labors from their respective organizations with experience ranging from 0 to more than 15 years were the professionals who participated in filling the questionnaires. The data was examined and analyzed with the use of a statistical package for social science software (SPSS). The respondents' opinions on the prevalence, effect, and influence of variation were analyzed using descriptive data such as frequency, percentage mean, and standard deviation, which were ranked using the relative importance index (RII). According to the descriptive statistical analysis, the majority of respondents agree that the problem exists and that it occurs frequently in Negele Borena Road Project. Similarly, the findings of the desk study revealed that variation is one of the major issues in road construction projects where the amount of variation exceeds the amount of contingency.

5.3 CONCLUSIONS

The paper concludes that variation orders have a significant effects on construction projects, leading to cost and time overruns. The study recommends strategies to minimize the effects of variation orders, such as improving communication among stakeholders, conducting thorough site investigations, and involving all parties in the decision-making process. The paper also categorizes variation orders into those with direct and indirect cost implications.

The study found that variation orders are a major problem in road construction projects, with technical and financial effects being the most common.

The document provides recommendations for minimizing variation orders, including the use of proper equipment and technology, clear change order procedures, and the appointment of an independent professional to manage the project. The study suggests that future research should focus on technical advancements for effectsive variation order management.

The first objective of the research was to identify the major effects of variation order at Negele Borena Road Project. According to the result obtained from the questionnaire survey, 96 % of the respondents give their answers for technical and financial effects of variation order and

returned the questionnaire accordingly. The result of the desk study also strengthens this finding indicating that the magnitude of variations. The variation in total amount is about more than a year of granted extension of time. Therefore, based on the data obtained from both the questionnaire survey and the desk study, the study concluded that variation/variation order is one of the major problems in road construction projects.

The second objective of this research is to identify major effects of variation. To achieve this, 21 potential effects were identified from literature and respondent were requested to rate these factors based on their experience and the most important effects were ranked using the relative important index (RII).

- Based on the survey result the research concluded that the top four financial major issues related to variation order at Negele Borena Road Project. This includes increase in project material cost, impact on owner finance, delay in payment and increase the overhead expense.

- As a result of the survey, the research concluded that the top five major technical issues related Variation order on road construction project performance. Those are design change, change in specification by consultant, change in specification by owner, additional payment for the contractor, and change in scope. To strengthen these results and understand the relationship as well as the effects of variation orders on project performance the study carried out relative important index. The study recommends strategies to minimize variation order effect.

5.4 RECOMMENDATION

The practical implications of this study are that it provides insights into the effects of variation orders on construction projects, particularly in the road construction sector in Ethiopia. The study recommends strategies to minimize the effects of variation orders, such as improving communication among stakeholders, conducting thorough site investigations, and involving all parties in the decision-making process. The study also categorizes variation orders into those with direct and indirect cost implications. The findings of this study can be useful for construction companies, project managers, and stakeholders in the road construction sector in Ethiopia to minimize the impact of variation orders on their projects.

According to Arain and Pheng (2005), a variation order is considered beneficial when it is issued to improve the quality, standard of workmanship, reduce cost, schedule, or degree of difficulty in a project.

The researcher recommends the following list of action items based on the findings of the study to minimize variation orders in construction projects and minimize their effects on road construction project performance in Negele Borena Road Project:

1. All parties involved should work together at the construction stage to handle variation orders.
2. Comprehensive documentation of variation orders is essential.
3. Consistent cooperation and direct communication are necessary.
4. Clear change order procedures should be established.
5. Prompt approval procedures should be implemented.
6. An independent professional should be appointed to manage the project.
7. Work breakdown structure (WBS) should be used.
8. Proper equipment and technology as defined in the specification should be used.
9. Profitability and fast track construction should not be prioritized over the quality of works to avoid rework.
10. Technology tools should be used for efficient change order management via a centralized database.

These recommendations are a set of remedies to minimize variation orders in construction projects and minimize their effects on road construction project performance in Negele Borena Road Project.

5.5 AREAS OF FURTHER RESEARCH

The study suggests that future research should focus on technical advancements for effective variation order management. The study's findings can be used to suggest a research direction for the future. The researcher recommends that future research should focus on developing new technologies and tools to manage variation orders more efficiently. Additionally, future research could investigate the impact of variation orders on other types of construction projects and explore the effectiveness of different strategies for minimizing variation orders. Further research could also examine the role of project management practices in minimizing

variation orders and their impact on project performance. Finally, future research could investigate the impact of variation orders on the quality of construction works and explore ways to improve the quality of construction works in the presence of variation orders.

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Annex

Appendix I –Questionnaire

ST. MARY'S UNIVERSTY

MASTERS OF ART IN PROJECT MANAGMENT (MAPM)

Dear respondents:

Thank you very much for your time and patience in completing this questionnaire. This questionnaire is part of Master's Thesis "The effects of variation order on construction project performance". I request for 5-10 minutes of your time to fill out this questionnaire. The feedback of the questionnaire will help me in analyzing the impact of variation order on construction project performance. Please mark the right option and assist me by giving correct and complete information. There is no need to write your name or any other personal identity. For all questions below, you may tick (√) and choose where applicable or give a brief explanation where necessary. If you need any clarification or information, contact me by **Mob. No. +251 95 342 8720 or by E-mail: abiybuna@gmail.com**

Thank you for your cooperation!

Part I – DEMOGRAPHICAL INFORMATION

Please put (√) mark to all your responses in the box provided beside each statement.

1. Gender

   ☐ Male ☐ Female

2. Age Group

   ☐ 18-24

   ☐ 25-34

   ☐ 35-44

   ☐ 45-54

   ☐ 55 and above

3. Educational Qualifications

   ☐ Diploma ☐ Degree ☐ Master's and above ☐ or other (specify)

4. Type of your organization

   ☐ Contractor ☐ Consultant ☐ Owner/Client

5. Your position in the organization

☐ Site Engineer ☐ Contract administrator

☐ Office Engineer ☐ Project Manager

☐ Resident Engineer If other please specify _____

6. Year of experience (year)

   ☐ Less than 2 ☐ 2-4 ☐ 4-6 ☐ 6 and above

Part II variation incidence

No	Description	Rating				
		1	2	3	4	5
1	Variation/change is a problem in Ethiopian construction industry in general and that of road construction projects in particular?					
2	Variation orders frequently occur in MCG construction road projects					

Part III Effects of variation order on project performance

Below are lists of questionnaires relating to the effects of variation order on project performance are listed. Whether you agree or disagree with each statement by ticking (√) on the spaces that specify your choice from the options that range from "Strongly Agree" to "Strongly Disagree".

Key 1=Strongly disagree 2=disagree 3= Neutral 4= Agree 5= Strongly agree

	Rating				
Description	**1**	**2**	**3**	**4**	**5**
major effects of variations Order					
Financial					
1. Variation order occur when cost of project material increase.					
2. Variation order occur when payment delay.					
3. Variation order has an impact on Owners finance.					
4. Variation order Increase the overhead expense.					
Technical					
5. Quality degradation happens as a result of variation order.					
6. Logistic delay can effect variation order.					
7. Poor safety condition may result in variation order.					
8. Poor professional relation may result in variation order.					

9. Additional payment for contractor may be required as a result of variation order.					
10 Disputes among professionals may result in variation order.					
11. Poor workmanship may result in variation order.					
12. Unavailability of equipment may result in variation order.					
13. Design change may result in variation order.					
14. Change in specification by consultants may result in variation order.					
15. Change in specification by the owner (client) may result in variation order.					
16. Lack of strategic planning My result in variation order.					
17. Design complexity may result in variation order.					
18. Inadequate working drawing details result in variation order.					
20. Change in scope of the project may result in variation order.					
21. Difficulties faced in land acquisition					

NO		Rating				
Constraints of independent Variables		1	2	3	4	5
1	Contractor related factors					
2	Consultant related factors					
3	Owner /Client Related factor					
4	Lack Of Communication					
Constraints of Dependent Variables						
1	Cost overruns occurs					
2	Time overruns occurs					
3	Quality degradation occurs					
4	Health and Safety issues occurs					

5	Professional relations occurs					

Dearest participant, if there are supplementary issues that have an influence on construction project delay, you may write on the space provided below

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…….

Thank you for your time!!!

Appendix II –Data

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	11	8.1	8.1
	disagree	42	30.9	31.1
	Neutral	18	13.2	13.3
	Agree	57	41.9	42.2
	Strongly Agree	6	4.4	4.4
	44.00	1	.7	.7
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	18	13.2	13.3
	Neutral	22	16.2	16.3
	Agree	58	42.6	43.0
	Strongly Agree	30	22.1	22.2
	42.00	2	1.5	1.5
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	14	10.3	10.4
	disagree	25	18.4	18.5
	Neutral	35	25.7	25.9
	Agree	43	31.6	31.9
	Strongly Agree	18	13.2	13.3
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	4	2.9	3.0
	disagree	31	22.8	23.0

	Neutral	29	21.3	21.5
	Agree	37	27.2	27.4
	Strongly Agree	34	25.0	25.2
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	3	2.2	2.2
	Neutral	10	7.4	7.4
	Agree	43	31.6	31.9
	Strongly Agree	74	54.4	54.8
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	27	19.9	20.0
	Neutral	26	19.1	19.3
	Agree	54	39.7	40.0
	Strongly Agree	23	16.9	17.0
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	45	33.1	33.3
	Neutral	46	33.8	34.1
	Agree	27	19.9	20.0
	Strongly Agree	12	8.8	8.9
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	disagree	35	25.7	25.9
	Neutral	22	16.2	16.3
	Agree	44	32.4	32.6
	Strongly Agree	34	25.0	25.2
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	disagree	6	4.4	4.4
	Neutral	8	5.9	5.9
	Agree	26	19.1	19.3
	Strongly Agree	95	69.9	70.4
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	disagree	5	3.7	3.7
	Neutral	9	6.6	6.7
	Agree	30	22.1	22.2
	Strongly Agree	91	66.9	67.4
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	disagree	5	3.7	3.7
	Neutral	26	19.1	19.3
	Agree	24	17.6	17.8
	Strongly Agree	80	58.8	59.3
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	8	5.9	5.9
	disagree	13	9.6	9.6
	Neutral	31	22.8	23.0
	Agree	52	38.2	38.5
	Strongly Agree	31	22.8	23.0
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	4	2.9	3.0
	disagree	13	9.6	9.6
	Neutral	31	22.8	23.0
	Agree	50	36.8	37.0
	Strongly Agree	37	27.2	27.4
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	8	5.9	5.9
	disagree	11	8.1	8.1
	Neutral	11	8.1	8.1
	Agree	78	57.4	57.8
	Strongly Agree	27	19.9	20.0
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	3	2.2	2.2
	Neutral	11	8.1	8.1
	Agree	57	41.9	42.2
	Strongly Agree	56	41.2	41.5

	55.00	3	2.2	2.2
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	disagree	17	12.5	12.6
	Neutral	30	22.1	22.2
	Agree	54	39.7	40.0
	Strongly Agree	29	21.3	21.5
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	10	7.4	7.4
	disagree	5	3.7	3.7
	Neutral	33	24.3	24.4
	Agree	45	33.1	33.3
	Strongly Agree	42	30.9	31.1
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	10	7.4	7.4
	disagree	28	20.6	20.7
	Neutral	12	8.8	8.9
	Agree	62	45.6	45.9
	Strongly Agree	23	16.9	17.0
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	Strongly disagree	5	3.7	3.7
	Neutral	11	8.1	8.1
	Agree	44	32.4	32.6
	Strongly Agree	75	55.1	55.6
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

		Frequency	Percent	Valid Percent
Valid	disagree	4	2.9	3.0
	Neutral	31	22.8	23.0
	Agree	61	44.9	45.2
	Strongly Agree	39	28.7	28.9
	Total	135	99.3	100.0
Missing	System	1	.7	
Total		136	100.0	

	Strongly disagree	disagree	Neutral	Agree	Strongly Agree	Total
Project material cost increase	10	5	33	45	42	135
Payment delay	10	28	12	62	23	135
Impact on Owners finance	5	0	11	44	75	135
Increase the overhead expense	0	4	31	61	39	135

	Strongly disagree	disagree	Neutral	Agree	Strongly Agree	Total	Total Number	A*N	RII	Rank
Project material cost increase	10	10	99	180	210	509	135	675	0.7541	3
Payment delay	10	56	36	248	115	465	135	675	0.6889	4
Impact on Owners finance	5	0	33	176	375	589	135	675	0.8726	1
Increase the overhead expense	0	8	93	244	195	540	135	675	0.8	2

	Strongly disagree	disagree	Neutral	Agree	Strongly Agree	Total
Quality degradation	11	42	18	58	6	135
Logistic delay	5	18	22	58	30	133
Poor safety condition	14	25	35	43	18	135
Poor professional relation	4	31	29	37	34	135
Additional payment for contractor	5	3	10	43	74	135
Disputes among professionals	5	27	26	54	23	135
Poor workmanship	5	45	46	27	12	135
Unavailability of equipment	0	35	22	44	34	135
Design change	0	6	8	26	95	135
Change in specification by consultants	0	5	9	30	91	135
Change in specification by owner	0	5	26	24	80	135
Lack of strategic planning	8	13	31	52	31	135
Design complexity	4	13	31	50	37	135
Inadequate working drawing	8	11	11	78	27	135
Change in scope	6	4	12	57	56	135
Difficulties faced in land acquisition	5	17	30	54	29	135

	Strongly disagree	disagree	Neutral	Agree	Strongly Agree	Total	Total Number	A*N	RII	Rank
Quality degradation	11	84	54	232	30	411	135	675	0.6089	15
Logistic delay	5	36	66	232	150	489	135	675	0.7244	10
Poor safety condition	14	50	105	172	90	431	135	675	0.6385	14
Poor professional relation	4	62	87	148	170	471	135	675	0.6978	12
Additional payment for contractor	5	6	30	172	370	583	135	675	0.8637	4
Disputes among professionals	5	54	78	216	115	468	135	675	0.6933	13
Poor workmanship	5	90	138	108	60	401	135	675	0.5941	16
Unavailability of equipment	0	70	66	176	170	482	135	675	0.7141	11
Design change	0	12	24	104	475	615	135	675	0.9111	1
Change in specification by consultants	0	10	27	120	455	612	135	675	0.9067	2
Change in specification by owner	0	10	78	96	400	584	135	675	0.8652	3
Lack of strategic planning	8	26	93	208	155	490	135	675	0.7259	8
Design complexity	4	26	93	200	185	508	135	675	0.7526	7

Inadequate working drawing	8	22	33	312	135	510	135	675	0.7556	6
Change in scope	6	8	36	228	280	558	135	675	0.8267	5
Difficulties faced in land acquisition	5	34	90	216	145	490	135	675	0.7259	8