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**COLLEGE OF BUSINESS AND ECONOMICS SCHOOL OF
COMMERCE**

DEPARTMENT OF PROJECT MANAGEMENT

**THE INFLUENCE OF CONTRACT ADMINISTRATION IN THE
PERFORMANCE OF GRADE ONE CONTRACTORS BUILDING
PROJECT WITHIN ADDIS ABABA, ETHIOPIA**

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**A RESEARCH PROJECT WORK SUBMITTED TO THE SCHOOL
OF GRADUATE STUDIES OF AAU IN PARTIAL FULFILLMENT
OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF
ART IN PROJECT MANAGEMENT**

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DECLARATIONS

I, Wondewosen Kebede hereby declare that this Project work entitled “The influence of Contract Administration in the Performance of Grade One Contractors Building Project Within Addis Ababa, Ethiopia” submitted by me for the award of the degree of Master in Project Management, is an original work carried out by me and it has not been submitted previously in part or full to this or to any other Institution for any award.

Signature_____

Date_____

CERTIFICATION

The undersigned certify that he has read and hereby recommends for acceptance by Addis Ababa University School of Commerce a project work entitled: “**The influence of Contract Administration in the Performance of Grade One Contractors Building Project within Addis Ababa, Ethiopia**”, in partial fulfillment of the requirements for award of the degree of Master’s in Project Management.

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LIST OF ACRONYMS

BAC - Budget at Completion

BCWP - Budgeted Amount for the Work Actually Accomplished

BCWS - Budgeted Cost for the Work Scheduled

CPI - Cost Performance Index

CV - Cost Variance

D/B - Design and Build

D/B/B - Design Bid Build **EAC** - Estimate at Completion **ETC** - Estimate to complete

EV - Earned Value is the

GC-1 - Grade One General Contractor **GMC** - Guaranteed Maximum CostContract

HBSC - Heineken Brewers Share Company **OLS** - Ordinary LeastSquare

OWMEB - Oromia Water, Mineral and Energy Bureau

P3 - Public-Private Partnership

PV - Planned Value

SOW - Statement of Work

SPI - Schedule Performance Index

SV - Schedule Variance

T&M - Time-and-Material Contract

WBS - Work Break down Structure

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ABSTRACT

Contract administration practice has been explored by many studies. However, the researchers did not consider the consequence of contract administration problems on project performance. This research, therefore, aims to examine the influence of contract administration problems on the performance of the 43 building projects within Addis Ababa being executed by GC-1 contractors. The research used descriptive and explanatory research design besides a combination of qualitative and quantitative research approaches were adopted. Census sampling was employed whereas the primary data was collected using a questionnaire having a four-level Likert scale and the collected data were analyzed using STATA 14 software to come up with regression and correlation results. To confirm that the data satisfies the basic assumptions of linear regression model diagnostics tests such as normality test, autocorrelation, multicollinearity, and heteroscedasticity test were conducted. Besides to this, the study used cost performance index(CPI) and schedule performance index (SPI) to measure the dependent variable project performance and considered delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) as independent variables. The regression result shows that unclear scope of work, the definition of acceptance, change order, delay, and increased cost have a statistically significant and negative influence on cost and schedule performance of grade one contractor's building project in Addis Ababa. The findings revealed that these contract administration problems have a statistically significant influence on the performance of grade one contractor's building project in Addis Ababa. Finally, the study recommended evaluating the performance of the projects starting from the contract agreement signing to every milestone of the construction projects and closely monitoring project contracts during projects implementation also inspection of deliverables to take prompt corrective measures before the contract administration problems escalated to high failure risk and to decide whether the project is suffering too much to consider termination before it is too late.

Key Words: *Grade one contractors, contract administration, project performance*

CHAPTER ONE

INTRODUCTION

1.1. Background

This study discourses the influence of contract administration in the performance of the GC-1 contractor's building project within Addis Ababa, Ethiopia.

The construction sector is one of the most important attributes for the development of one country. Ethiopia directed about 50% of the federal capital budget to the development of physical infrastructure, above and beyond, the involvement of the private sector as a partner has increased capital investment in the field and also promote more advanced technologies and materials. (Ashebir S., Wubishet J., & Murad M. 2017)

As projects become more complex and investment in infrastructure increases, successfully managing projects has become a key issue due to risk supervision. Therefore, many large clients, private as well as public employers, try to cover part of these risks through detailed contracts, which lay down the rights and liabilities of the parties involved. Moreover, as possible clients try to shift their risks to the contractor without additional compensation. Many international companies separate project management and contract management, which are considered to be closely related but separate disciplines. Thus, contract management has become a specialist discipline and has made inter-organizational relationships more complex and detailed. This has resulted in even more formal relationships between contract parties. (John P. & Arjan W. 2014)

Contract administration is the processes and procedures that companies may enforce to supervise the negotiation, implementation, performance, change, and termination of contracts with several parties including clients, marketers, distributors, contractors, and employees. (Alan G. 2013) Contract administration is one of the most essential tasks in construction project management, which helps to ensure fair distributions of obligations and rights among each stakeholder so that appropriate risk among contractual parties are properly allocated. Besides, it has a great influence

on the success of projects therefore, contracts must be managed throughout the life of a project to help ensure the performance of suppliers and contractors are satisfactory, stakeholders are well informed and they meet all contract requirements.

This study aims to analyze the extent to which contract administration issues contribute to the overall operation of projects in the Ethiopian construction industry, by considering building projects being executed by GC-1 Contractors based in Addis Ababa.

1.2. Statement of the Problem

The construction industry in Ethiopia has an essential role in the economy and opens doors to development by providing infrastructures that aid the production of goods and the provision of services in the economy. According to Ashebir S., Wubishet J., & Murad M. (2017), although the sector is significantly increased both in volume and density of work, over 80% of the construction projects are delayed, run over budget and lack of management, resulting from a poor construction performance and failure of most national construction projects, which is one of the major development constraints in developing countries. Hence, it is important to have a robust construction industry in the country, with decent project management and contract administration practices.

Contract administrative problems and issues with the contract are a really common cause for claims that cost the construction industry many of dollars per annum. According to Thomas E. and Philip D. (2002), the connection between the many parties in the building process have become complex, thus, all things considered, some co-ordination and legally binding issues will undoubtedly happen, bringing about cases and debates. For that reason, every effort should be set to minimize the number of claims and disputes, impact they may have on the project. To achieve this, the contracting parties should know the legal principles governing the formation of contracts also more efficient and effective procedures for administering contracts.

The contract administration settings of some national contractors are very deprived and faced with some challenges such as the lack of qualified personnel, incorrect interpretation and application of contract terms and conditions, lack of training, poor record management, poor procurement planning, implementation and lack of contract

management systems which is causing the construction projects to encounter many contractual problems. The researcher recognized that there is a major gap in the awareness of the importance of properly administering a construction project contract and the influence of poor contract administration at the time and cost of projects. Therefore, this study was carried out to further evaluate the existence of the assumed gap and issues attributed to the gap.

Numerous researchers have studied the contract administration and management practices, as well as construction contract documents, For instance, Mayie B. (2016) have proved that contract management practices monitoring in Wakiso District Intensity, risk Management and evaluation have significant positive link with road building project performance as well as Aluonzi G., Oluka N., Nduhura A. (2016) imply that there is a significant link between contract management and road repair project performance of Arua Municipality, also Mutua M, Waiganjo E, and Oteyo N. (2014) states that in Nairobi County, Kenya contract management exhibited a favorable link with the execution of outsourced projects in medium manufacturing businesses.

Besides various studies have been done in Ethiopia concerning the contract administration and management such as the construction contract administration practices of the new headquarter design-build (DB) project of commercial bank of Ethiopia by Bekele H. (2017), Lakew A. (2018) examined project contract management practice of HBSC Kilinto II Project by addressing contract terms and conditions, contract monitoring, contract documentation, and contract controlling and closing. Dinku M. (2019) investigates the construction contract management practices in concrete pole factory expansion projects of Kabew Construction Private limited company. Moreover, Hirpassa D. (2018) assessed the contract administration practices and the contribution of timely monitoring of contract implementation for the performance/success of projects also the inspection practice and its contribution to getting the intended project deliverables in projects of OWMEB and indicates that projects are not completed in according to their original plan, delayed, terminated and faced with a cost overrun or quality problems, which are originated from poor contract administration.

The above studies are mainly focused on contract management practices and road

construction projects besides browsing through deferent research sites the researcher reveals that there is not enough comprehensive research work on construction contract administration problems and their influence on the performance of the building construction projects.

This research adopted the contract administration problems from the study held by Davison and Wright (2004) to examine the consequences of contract administration problems for contract types, however, the researchers do not relate how these problems are likely to affect project performance. Hence, this research intended to analyze the role of these difficulties with contracts, such as ambiguous scope of employment, delays, change orders, increased costs, and disputes resolution on project time and cost. The research tries to examine this relation by evaluating how contractual issues are influencing the performance of the projects and leading to project failure instead of achieving their intended goals, and how contractors can overcome this contractual problem and improve performance of their construction projects.

1.3. Research Objective

1.3.1. General Objective

The general objective of this research is:

- ✓ To Determine the impact of contract administration in the performance of grade one contractor's building project.

1.3.2. Specific Objective

The specific objectives are:

- ✓ To assess the performance of GC-1 contractor's building project located in Addis Ababa.
- ✓ To identify contract administration problems which have a significant effect on the performance of the GC-1 contractor's building construction project within Addis Ababa.

- ✓ To examine the extent of contract administration problems attributed to the performance of GC-1 contractor's building construction project within Addis Ababa.

1.4. Research Questions

The research questions that will help in achieving the aim are:

- ✓ What is the performance of the GC-1 contractor's building project located in Addis Ababa?
- ✓ Which contract administration problems have a significant outcome on the performance of GC-1 contractor's building construction projects within Addis Ababa?
- ✓ What is the extent of the problem of contract administration attributed to the performance of GC-1 contractor's building construction projects within Addis Ababa?

1.5. Research Hypothesis

According to Kothari C.R., (2004) A hypothesis is a predictive statement or assumption to be proved or disproved also it is considered as the principal instrument in research by relating the independent variable to a dependent variable. Based on the reviewed theories and empirical studies, the following negative hypotheses are developed to achieve the objectives of this study.

H₀₁: Unclear scope of work has no significant effect on the performance of GC-1 contractors building construction projects within Addis Ababa.

H₀₂: Contractual delay has no significant effect on the performance of GC-1 contractors building construction projects within AddisAbaba.

H₀₃: Change order has no significant effect on the performance of GC-1 contractors building construction projects within AddisAbaba.

H₀₄: Dispute resolution has no significant effect on the performance of GC-1 contractors building construction projects within AddisAbaba.

H₀₅: Definition of acceptance has no significant effect on the performance of GC-1 contractors building construction projects within Addis Ababa.

H₀₆: Increased cost has a significant effect on the performance of GC-1 contractors building construction projects within Addis Ababa.

H₀₇: The risk of failure has no significant effect on the performance of GC-1 contractors building construction projects within Addis Ababa.

H₀₈: Subcontractor issues have no significant effect on the performance of GC-1 contractors building construction projects within Addis Ababa.

1.6. Research Significance

Academic significance

The research findings will have excessive use for academia by adding new knowledge in existing literature regarding the importance of contract administration in the construction industry through examining the influence of contract administration problems in the execution of construction projects and how to improve this problem by further exploring its effect on project performance particularly on cost and schedule, it tries to offer insight into the current contract administration difficulties in the Ethiopian construction industry and detail GC-1 national contractor's building construction projects within Addis Ababa.

This research will serve as a stepping stone for further study in this area by providing the information gathered through reading different available literature, publications, and journals which will be a source of documents and reference that guide researchers interested to conduct further research in the contract administration, data assembled from a different contractor will give an insight point and inspire further research into the field for the continuous development of the Ethiopia Construction Industry.

Practical significance

The research findings and recommendations will have paramount importance in providing a better understanding to professionals responsible in formulating and monitoring of construction contract during project implementation on the vital importance of proper administration of contract in the overall performance of the project

so that they have awareness on alleviating risks associated with poor contract administration. The results of this research will also have important implications by presenting a relevant suggestion for the policymakers in formulating appropriate policies for the construction industry on any gap observed regarding contract administration.

Besides all the benefits stated above, this research will provide investors in the construction industry with information on how poor contract administration affect the profitability of their company and indicates how they can improve their practices and expand their performance to be as proficient as international contractors through professional contract management and administration.

1.7. Scope of the study

Geographical scope

Considering all the international construction industry under this study will be difficult and unmanageable from broadens, time, financial and experience constraints. Thus, this study set out to find out the influence of contract administration in the performance of projects in the construction industry globally and then narrowed down into the Ethiopian construction industry by focusing on GC-1 national contractors building construction projects located in Addis Ababa.

Industry or occupational scope

In terms of industry/occupational scope, this study takes into account information referring to the construction industry, specifically studying the impact of contract administration on performance of projects in the Ethiopian construction industry and considering only GC-1 national contractors building construction projects within Addis Ababa.

Time scope

This study concentrates on a cross-sectional survey research design since the study analyzed data at a specific period. As a result, the study considers the existing contractual problems and the performance of the building project at the time of the research, which includes only ongoing grade one contractor's building construction projects in Addis Ababa.

1.8. Limitations of the study

This study is subjected to the following limitations thus future studies should be conducted regarding these limitations such as it examines the influence of contract administration on performance of grade one contractor's projects while excluding lower grade contractor's projects. The study takes in to account the contractors' perspective apart from the consultant, client, and other important stockholders' side, besides the research only focuses on building. Construction projects that are located in Addis Ababa. Moreover, there was a challenge to gain access to important documents of the project information which need to be held confidential.

This study also identified the most leading construction contract administration problems though there are so many contractual difficulties that affect project performance, this study is limited only to problems such as, delay, subcontractor issues, the definition of acceptance, change order, the unclear scope of work, increased cost, dispute resolution, and risk of failure. Among many different indicators to measure a project performance this research focuses on the cost and time which is considered to be a major indicator for measuring project performance.

1.9. Definition of Concepts and Terms

Contract administration: is the processes and procedures that companies may enforce to supervise the negotiation, implementation, performance, change, and termination of contracts with several parties including clients, marketers, distributors, contractors, and employees. (Alan G. 2013)

Project Performance management: is the process of creating, implementing and managing projects that contribute to the performance of an organization and its strategy. (J. Murdoch and W. Hughes, 2000).

1.10. Organization of the Research

This research contains five main chapters and appendices. These are the introduction, literature review, the research methodology, data presentation, analysis, and interpretation, summary finding conclusion, and recommendation.

The first section of this study is an introduction that covers the background of the study, statement of the problem, objectives of the study, scope, significance, and limitation of the study, whereas the second section literature review which includes theories, empirical evidence were presented also articulates the gap which the research is trying to fill and finally the conceptual framework of the study is illustrated to show the relationship between the dependent and independent variables. The research methodology which is the third section explains the research approach and design, population, sampling method, data analysis technique, model specification.

The fourth segment covers the extensive interpretation of the research findings and discussions on the data analysis, then the conclusions of the research together with recommendations are presented in the fifth section. Lastly, in the reference segment, Another person's written work, such as a book, article, essay, report, or any other text kind, that was used in the research is included. Also, the appendices contain additional material that is supportive in providing a more complete comprehension of the research are included.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

A building and construction projects are a complex undertaking in which the related contractual arrangements are certainly and consistently intricate, in which risk management is a key issue in managing projects successfully. Therefore to cover part of these risks many large clients, private as well as public employers, articulates detailed contracts, which lay down the rights and liabilities of the parties involved.

All transactions are a result of a contract agreement it could be whether explicit or implied, a contract is a legally enforceable agreement between one or more parties and it comprises the terms of the agreement presented in legally binding language and terminology. (Realist. 2005)

2.2. Theoretical Literature Review

2.1.1. Definition of Construction Contracts

A building and construction contracts are defined as an agreement oral or written, effected between an owner and a contractor that the contractor will construct a specified structure for the owner, to a specified standard and within a specified time, in exchange for a specified sum of money which the owner will pay to the contractor.

The meaning of construction contract as J. Murdoch and W. Hughes, (2000) is an agreement in writing, under which a contracting party carries out any of the following works: construction operations arranges for others to carry out construction operations for example through sub- contracts and provides labor for the carrying out of construction operations, also professional services relating to construction operations, in particular architectural, design or surveying work and advice on building, engineering, interior or exterior decorating and landscaping.

Uher T. and Davenport P. (2002) mentioned that building contracts involve the supply of goods or services or both. The goods are building materials whereas the services are labor also use of the plant to affect work as well as design and management services. Besides,

Both contractual and legal responsibilities are imposed on both parties is difficult to change.

A building and construction contracts must clearly define the scope of the work, the quality standards of the materials and workmanship, the time frame within which the project should be constructed, the price that is to be paid to the contractors for carrying out the work, the mechanism for varying any or all of these parameters Greg G. (2004). According to Phillips C. (1999), Effective construction contracts require careful and precise preparation of each activity being undertaken because the frequency of project delays, cost overruns, and claims will be directly affected by the quality of the contract.

2.1.2. Essential Elements of a Valid Contract

To be a valid contract, the following elements are essential:

- a) Intention to create a legal relationship
- b) Offer and acceptance
- c) valuable consideration
- d) Legal capacity of the parties to enter a contract
- e) Genuine consent of the parties
- f) The legality of the contract

a) Intention to create a legal relationship

There must be an intention to create a legal relationship. The intention may be expressed or implied.

An express contract is one in which the terms of the agreement, whether verbal or written, are clear, concise, explicit, and definite. Most construction contracts are express. Virtually all written agreements could be classified as being express and an implied contract is one in which the terms of the agreement are not clearly stated, but are established through inference and deduction. The facts and circumstances surrounding a contract must be evaluated before the mutual intent of that contract can be determined. In other words, the contract's terms must be implied from action taken by the contracting parties. (Uher T. and Davenport P. 2002)

b) Offer and acceptance

An agreement or contract comes about when one party accepts a proposal from the other. For an agreement to be legally enforceable, it must be demonstrated that an offer has been induced and that such an offer has been taken, whether expressly or implicitly in the conditions in which it was created. (Uher T. and Davenport P. 2002)

According to Uher T. and Davenport P. (2002), an offer is considered to be made when one person signifies to another person a willingness to enter into a binding contract on certain specified terms. This party (offerer) confers on the second party (offeree) the power to create a binding contract by accepting the stated terms. The offer may be express or implied, as of the acceptance. Uher T. and Davenport P. (2002) reflect that an offer may lapse if not accepted by a certain time or date, it can be revoked at any time before acceptance. When a party makes an offer of settlement, the offer is commonly said to remain open for acceptance until a certain date.

Acceptance creates the contract, provided that it is made in the manner and at the time specified in the offer. The acceptance must be definite, unqualified, and unconditional or it will constitute a counteroffer. Once a party has issued a counteroffer, it is no longer possible to accept the original offer without the express permission of the person who made it. Thus, if a party rejects an offer and replies with a different offer, the original offer cannot be unilaterally accepted if the counteroffer is also rejected. In construction contracts, the offer is the bid submitted to the owner whereas the advertisement of the project to be bid is simply a request, by the owner, for offers or bids. (Hinze J.2011)

c) Valuable consideration

Consideration is a necessary component to constitute a legally binding contract, it is something of value which is given by each contracting party to the other at the time of making the contract, it is also referred to as a price paid for the promise of value received by one of the parties in exchange for another item or action that is of value. A contract can only be binding on the parties if there has been consideration given by each party to the other. Therefore the promise unable to be enforced by a contractual party who has not received something of value in return. (Uher T. and Davenport P. 2002)

d) Legal capacity of the parties to enter a contract

The contracting parties must be competent and capable to enter into a contract and can fulfill their intended role, a party must be of proper age and have sufficient mental awareness. If any party to the contract is not competent to contract, the contract is not valid. (Uher T. and Davenport P.2002)

e) Genuine consent of the parties

For a contract to be valid, there must be free and genuine consent of the contracting parties to the contract and they must have agreed upon the something in the same sense and made the contract of their own free will and not under any fear or pressure. When consent is not induced by compulsion, it is said to be free., undue influence, fraud, misrepresentation, and mistake. (Uher T. and Davenport P. 2002)

f) The legality of the contract

According to Surahyo A. (2018), if the purpose of the contract is unlawful or illegal, it will not be enforced, binding, and is void in courts creating no legal rights therefore cannot be sued upon. A contract must also be made with the free consent of all parties and if a contract is procured by duress or fraud, it will be treated as void. A contract will also be said unenforceable if it is one- sided, where the terms are unreasonably favorable to one party. Generally, for a contract to be enforceable, it should also be free from immoral or criminal purposes and should not contain such clauses that are against publicpolicy.

2.1.3. Different Types of Construction Contracts

Price-based contracts & cost-based contracts are the most popular types of construction contracts. The price-based contracts are Lump sum and unit price contracts in which the prices are quoted by the contractor at the bidding stage and Cost based are Cost reimbursable contracts,in which the actual costs incurred by the Contractor are reimbursed together with a fee to pay operating costs and profit. (Surahyo A. 2018)

i. Price based contracts Lump-sum (fixed price) contracts

Fixed price or lump sum contracts are the traditional form of the construction contract and involve a single fixed total price for well-defined construction work as compensation for all the labor, materials, equipment, and services required to complete the construction described in the contract. It provides owners with exact barring exceptions and changes to the budget for their construction project and the majority of owners believe it is the most cost-effective means to deliver construction projects. (Phillips C. 1999)

According to Phillips C. (1999), the advantage of this contract is that the owner knows before the work begins what the final cost of the project will be and the finished project will equal the amount stated in the contract. As Uher T. and Davenport P. (2002) even though the main benefit of a lump-sum price is knowledge of the contract price in advance this is of questionable value if derived from inaccurate and incomplete documentation since it might have to be adjusted for the cost of errors and omissions as well as if the project is exposed to a high level of risk, which contractors may find difficult to assess and accurately price in the risk contingency.

Unit Price Contract

The traditional system, known as a unit price contract, is the most often used in the construction and civil engineering industries. Based on the consultant drawings and specifications The quantity surveyor creates a thorough bill of quantities, then the contractors quote their rates against these calculated quantities based on unit rate method. However, the contractors are paid for the work measured in place based on actual quantity multiplied by the quoted rate. Surahyo A. (2018)

Phillips C. (1999) state that unit price contracts are used for those less-complicated projects that are based on readily identifiable units which can be accurately quantified. It necessitates meticulous planning to prevent disputes and well-estimated guide quantities for each unit price item as well as clear instructions for their measurement are the key to successful unit price contracts. If the actual quantity variances more than 10% may result in justifiable claims for additional or deductible expenses, usually clauses are Unit price contracts that handle this issue are supposed to be fair and equal. to both owners and contractors.

According to Surahyo A. (2018), this method is advantageous when the quantities cannot be accurately identified in advance or such works having a high content of ground surface work where the quantities are rather unpredictable and changes in the contract can be made easily as the Contractor will be paid against actual work done on-site. The weakness of this type of contract is the owner takes the risk of changes in the quantities of the originally estimated and The project's final cost is unknown to the owner until completion of the project.

ii. Cost-Based (Cost Reimbursable) Contracts

This contract, also known as a cost-plus contract, reimburses the contractor for the actual cost of performing the work plus an additional amount in the form of fees to cover overhead and profit. The contractor starts the work and ensures all costs are transparent to the owner including payments made for labor, material, machinery and equipment, subcontractors. Any costs incurred as a result of unanticipated circumstances must be paid by the owner. Therefore To avoid any misunderstandings, the scope of work must also be clearly specified. (Surahyo A.2018)

Cost-plus percentage fee

The Contractor will be paid the job's actual direct cost plus a predetermined percentage of the construction cost and have little reason to cut the number of jobs costs. Furthermore, if the project must be completed quickly, overtime payments to workers are usual and will boost the job cost even more. Unless there are compelling grounds to the contrary, like the need for urgency, this method is not advisable to the Owner. This strategy can be utilized to cut down on the amount of time it takes to choose a contractor. (Surahyo A. 2018)

Cost-plus fixed fee

This form of contract entails, The contractor will be paid the actual direct job cost plus a fixed fee, and will have an incentive to finish the job quickly because its fee is set regardless of the project's duration. However, the owner still assumes the risks of direct job cost overrun, while the contractor may risk the loss of profit if the project is delayed beyond the expected completion time. (Surahyo A. 2018)

Cost-plus variable fee

The contractor agrees to a penalty if the real cost exceeds the projected job cost or an incentive if the actual cost is less than the estimated job cost in this form of contract. The Contractor's fee is split into two parts: a fixed amount and a variable amount that is determined by the relationship between the goal and actual costs.

In addition, the project duration is usually set, and the contractor must meet the completion deadline. This contract transfers a lot of the risk of cost overruns to the owner, but it also gives contractors incentives to keep costs as low as feasible but has the disadvantage of requiring the target cost to be fixed based on a rough estimate. (Surahyo A.2018)

Guaranteed Maximum Cost Contract (GMC Contract)

Surahyo A. (2018) stated that The owner and the contractor are both involved in a guaranteed maximum cost contract guaranteed by the contractor as maximum, also known as a ceiling price. This contract is applicable in a project where The scope of work is well specified. and the contractor takes all the risks, both in terms of actual project cost and project time. Thus, a penalty is imposed on a contractor for cost overruns and late completion of the project. Besides,Expenditures below the maximum are normally shared between the owner and the contractor, while costs beyond the maximum are the contractor's responsibility.

Time-and-Material (T&M) Contract

According to Surahyo A. (2018), this type of contractor is commonly known as “Force Account” and the contractor is paid based on actual labor cost at fixed hourly rates, the actual cost of materials and equipment used, and agreed-upon markup to cover the contractor’s overhead and profit. It also contains aspects of both contract categories (cost reimbursable and fixed price). They resemble fixed-price type arrangements in that they are priced on fixed hourly rates, andthey also resemble cost-reimbursable type arrangements because they are open-ended as the total cost of material and equipment is unknown.

Surahyo A. (2018) also noted that time and material are considered mostly during construction when the scope of work cannot be well defined. On the other hand, the type of contracts is not considered beneficial since the contractor is paid for the number of hours that are actually used to perform the job and cost of material installed. Hence, the contractor has little motivation to keep material costs under control or to manage the labor force effectively. Therefore, proper surveillance on the contractor is needed to assure something the contractor is responsible for efficiently and using effective cost control measures as well as daily work records must be prepared by contract administrator reporting the labor and equipment employed, the material used and both parties' signatures daily. This arrangement shall include a ceiling or not-to-exceed price so that the contractor will be bound to charge for labor and material up to a certain maximum and will assume the excessive costs.

2.1.4. Project Delivery Systems

Surahyo A. (2018) states that selection of the contract delivery method involves the analysis of many issues such as cost certainty, time certainty, speed, flexibility, risk involvement, etc. and each delivery system has its benefits and drawbacks also represents a particular allocation of risks in exchange for anticipated benefits. Hence, the owner must be prepared to recognize that no method will be free of risk and should gather information about possible risks for each construction method and plan to minimize the risks of the selected construction method. A project delivery mechanism that is insufficient often encourages acrimonious interactions between the parties working on the project, expands the number of claims, and disputes besides obstructs the free exchange of information necessary for the successful completion of the project.

According to Addis M, (2014) in the past decades to maximize project performance the construction business has been searching for effective project delivery methods. Though, There is no single system for delivering projects that is most appropriate for any kind of project. Instead, combinations of different strategies are being used for different circumstances. There is conventional project management strategy referred as Design Bid Build (D/B/B), and alternative project delivery methods such as Design and Build (D/B) and The Partnering (Public-Private Partnership (P3))

Design Bid Build Method (D/B/B)

The D/B/B approach is the most accepted and widely used construction method it is also known as It's sometimes referred to as conventional project delivery. In this method, the project is separated into two well- defined phases a design phase and a construction phase. The construction is separated from design and construction will start once the design is completed, while the drawings become the basis for the bidding documents. Since the finishing products are more certain and well-defined usually a lump sum contract is implemented in the project. (Ibbs W, Kwak Y., Tzeyu Ng, and Odabasi A, 2013)

In D/B/B approach the contractor has no responsibility for the design and the owner/client along with a consulting firm prepares detailed drawings, specifications, and bill of quantities then prepares the bid documents and the project goes out for bid, usually the contract is given to the lowest bidder. Accordingly, there are two different agreements one between the owner and consultant and the other between the owner and the contractor. The contractor agrees with the owner to produce the project per those plans within the stipulated time and for a fixed price or on a unit price basis and during construction, the site supervisory staff of the consultant visits and inspects the work to ensure that it is being built according to the blueprints and specifications. (Surahyo A.2018)

The advantage of this method is owners have a good idea of final cost as the complete design process is almost finished before bidding and the consultants have better control of document preparation and the selection of contractors as well as the end product, because of competition it provides the lowest possible price and equal opportunity to all qualified bidders to obtain the construction. In contrast, this method also has a disadvantage since several parties with different contractual relationships are involved greater coordination and control is required, because the contractor has no input during the planning phase will not be able to propose innovative methods and owner is in contract with multiple parties which can be a serious weakness if a major defect arises. (Surahyo A. (2018)

Design and Build Method (D/B)

According to Surahyo A. (2018) In D/B approach the contractor usually has overall responsibility for both the design and building of the project. The design-build arrangement combines the services of the consultant/designer and the general contractor, the single-source responsibility of the design-builder reduces administration claims and litigation conflicts between the design and construction teams. Usually, there are two general organizational formats, first, the owner may contract with an integrated design-build firm where the firm has architects, engineers, and construction professionals, all in-house and the second design-build organizational format is the design-build joint venture, under this organizational structure, the designer and the general contractor enter into a joint venture agreement for the project's time frame.

As Ohrn L. and Rogers T, This method has the advantage of simplifying the construction can begin before the completion of the design which typically saves valuable time for the owner. Also, because the design-builder is provided integrated services, the owner can take advantage of the contractor's expertise during the planning phase of the project and the architect/engineer's expertise during the construction phase.

The Partnering (Public-Private Partnership (P3))

P3 is a contractual arrangement between two parties mainly a government agency and the private sector for either a specific period or an indefinite/long-term period. It is a procedure for making relationships work better by featuring teamwork, continuous improvement, openness, and acceptance of new ideas, trust, and mutual benefit. (Surahyo A.2018)

This project delivery method extends the owner-contractor relationship beyond just design and construction. In certain circumstances, Additionally, a contractor can give operating services, maintenance services, and financing to assist the owner in meeting their needs. In this case, a contractor with the right knowledge, financing, and expertise can assist and owner in meeting these extended needs. (Ohrn L. and Rogers T)

According to Surahyo A. (2018) in construction, there are numerous variations of P3s, the most common models of P3s are Design-build-maintain (DBM) is the design of the private sector and construct the facility whereas the public entity takes ownership after

construction is complete. The private sector continues to maintain the facility based on a long-term maintenance agreement. Design-build-finance-maintain (DBFM) the private sector beyond designing and construction also takes responsibility for the finances of the facility. In addition to DBFM defined above, Under a long-term arrangement, the private sector provides hard and/or soft facilities management services as well as operations in Design-build-finance-maintain-operate (DBFMO). While in Build-own-operate (BOO) Finances from the private sector, constructs own, and operates a facility or service permanently. Whereas the public does not provide direct funding, it may offer other benefits such as tax exemption and it has ongoing regulatory authority. Under Build-operate-transfer (BOT), the private sector finance, designs, builds the project to the specifications agreed to by the public agency (host government and the Owner) and operate for a certain period then transfer the facility for to the projectowner.

Surahyo A. (2018) mentioned that This strategy offers a benefit of using the benefit of private sector expertise in various fields and funding sources which may not be possible through public methods, there is also a single point of responsibility which transfers majority of risk share to the private sector, also long-term operations and maintenance. These methods also have a weakness since handling a P3 project is very complicated and an owner will need a high rank of expertise and may experience higher total life cycle costs. It is difficult for small consulting firms and construction companies to compete in this market.

2.1.5. Definition of Contract Management and Administration

Contract Administration is a term that is frequently used to describe a contract management, though they differ significantly they are defined as contract administration and how both the contracting parties could satisfy their obligations under a legal agreement, while they share many similarities they refer to different stages of the contract lifecycle. In most literature The term "contract management" refers to the procedures of managing the entire contract lifecycle of contracts, rather than the management of the implementation of contracts, which is an often-used definition for contract administration.

Just similar to any other deal, a building and construction contract needs to be regularly and competently administered throughout its life. John P. & Arjan W. (2014) defines Contract administration as “the process which ensures that all contracting parties meet their obligations, to meet the contract's operational objectives as well as the company's strategic goals of the customers.

Contract administration is the management of the relationship among the client and the contractor over the term of the contract with the purpose of providing goods and services to the agreed standards. It aims to improve the relationship between the contractor and the owner by reducing conflicts or arbitration. Contract administration ought to be corresponding to the the value, risk, and the contract's complexity so that it can increase control and effectiveness as well as reduce cost by providing strategic and competitive advantages, therefore the need for proper contract administration is very essential. (Shaival P., Ashok P. & B M Marvadi)

2.1.6. The Contract Administrator

Greg G. (2004) Defines a contract administrator as an “expert and experienced person or firm appointed by the owner to administer the work of the project on the owner’s behalf.” The contract administrator is not a contracting party, but as the owner’s agents play a major role in the course of the project completion, therefore the owner must ensure the presence of a contract administrator though out the project’s contract life.

The person in charge of the contract has a dual role, in the first role as the owner representative looks after all aspects of the project on the behalf of the owner and issues instructions to the contractor as to the scope, quality, time and cost of the work as well as all relevant matters under the contract. Besides in the second role, the administrator exercises an independent function in the matter that requires professional judgment as an impartial assessor, value and certifier of the contractor’s work, by periodically assesses the quality and quantity of the work the administrator issues certification for payment by valuing the contractor's efforts and ensures that the project objects are met while at the same time dealing fairly between the owner and contractor which requires the exercise of professional independence and integrity. Therefore, to exercise this role the owner is required to ensure that the administrator acts fairly, impartially also reasonably and in a good faith as well as should not influence the administrator to exercise this role in the

favor of the owner. (Greg G. 2004).

Phillips C. (1999) states that site Managers are in charge of administration of the contracts and they are required to have administrative, technical, investigative, and communication skills, as well as they, must have basic knowledge of construction law, a detailed understanding of the contract documents to recognize all the obligations of owners and contractors, the intent and use of exculpatory clauses, as well as the ability to negotiate claims and resolve disputes.

2.1.7. General Contract Administration Processes

According to Contract Management Handbook (2017), contract administration comprises seven general processes. These processes are elaborated as follows.

I. Planning

Contract Management Handbook (2017) specified that planning for contract administration should be simultaneous with the drafting of the work statement for the solicitation. Work statement (SOW) is a roadmap for contract administration thus the contract administration begins with the development of a clear and concise SOW. Procedures for contract administration should be described in the solicitation. At the same time, the institution should appoint, coordinate, and schedule resources for the contract administration team that will assist the contract manager with the performance of contract administration procedures.

To properly plan for contract administration, Contract Management Handbook (2017) point out that all of the components of the solicitation and the contract stated such as proposed contract outcomes and related performance measures, scheduling for deliverables, links between the payment schedule and significant deliverables, total contract cost including any indirect cost allocation for the goods/services to be provided under the SOW, identification and management of potential contract risks, when, where, and how the contract is to be performed, including delivery of goods/services, institution's right to inspect and accept or reject the goods/services, as well as any conditions related to acceptance or rejection, Effective date, completion date, contract term extension options, and other dates applicable to contract performance, contractor's contact information for correspondence, payment and notice (including address, email, telephone and fax and other contact information) must thoroughly be understood.

Contract Management Handbook (2017) indicated that Communication is a critical factor in successful contract administration. Contract administrators are in need to understand the provisions of the contract and communicate contractual obligations to all parties involved, besides closely monitor contract performance over the entire term of the contract. The contract manager's role includes ensuring that the contract requirements are satisfied, that the goods/services are delivered promptly, and that the financial interests of the institution are protected

II. Monitoring Performance

Monitoring performance is an important part of good contract management that helps the Institution confirm that contractor/supplier is fulfilling all of its responsibilities and obligations following the contract's provisions, as well as identifying and resolving any emerging problems or challenges. Contract Monitoring could be seen as a preventative measure, a preventive function, a possibility to decide the contractor's need for technical assistance; and a valuable source for information concerning the effectiveness and quality of goods/services being provided. Performance monitoring tools should be mentioned in the solicitation and included in the contract. (Contract Management Handbook 2017)

Contract Management Handbook (2017) also point out that monitoring performance includes reviewing the SOW and other contract terms, contractor compliance requirements and designing the monitoring program to focus on most important contract requirements, this means monitoring contractor's progress on the SOW and deliverables as well as considering the impact of the contract payment methodology on the monitoring program. Furthermore, the Monitoring programs should be created with this in mind to include appropriate follow up on contract monitoring findings and monitoring reviews, audits, and investigations should be routinely used to ensure the contractor takes corrective action, and to bring contractor back into compliance with contract requirements. Contract monitoring findings should also be used to improve the contract requirements for future procurements. Unnecessary constraints or inadequate specifications should be noted for incorporation into future solicitations.

III. Change Management Process

According to Contract Management Handbook (2017), it may be necessary to amend the contract throughout the contract. There are two types of amendments. A bilateral and

unilateral a bilateral amendment requires all parties to amend the contract while a unilateral amendment requires only the agreement of one party to be amended. Conditions of Sale in the original contract may specify when a bilateral (agreement of all parties) or a unilateral (agreement of one party) amendment is required. The Institution should implement a successful change management strategy Failure to monitor and regulate contract modifications can lead to SOW revisions, the schedule has been extended, an increase in contract cost, circumvention of management controls, or decrease of contractor accountability.

Contract Management Handbook (2017) indicates that effective a successful change management procedure is having procedures to avoid an informal undocumented change process and documentation of all changes no matter how small and approval/disapproval of the proposed change and notification of the contract modification while evaluating the impact of each change to contracting objectives, deliverables, schedule, cost, overhead, work-in-progress, completed work, standards, and acceptance criteria in addition to planning for requests and approvals of draws against any contingency allowance, Single point of contact for recommendation and authorization of all changes, formal, written approval of all changes before contract amendment.

As mentioned in Contract Management Handbook (2017) there are deferent categories of contract changes, for instance, administrative changes to a contract are changes that are within the contract's parameters and do not affect or alter the right of the parties these kinds of changes include alteration to billing instruction or contract information, a change in the institution's representative or the contractor's representative, Changes permitted under the contract's specific language, as well as repairs of typographical errors that do not impact the contract's substance. Whereas substantive changes are contractual changes that affect the rights of both parties for example changes in the price, quality and specification of goods or services, delivery schedule, and changes of any terms and conditions also of key personnel assigned to a project the contract are considered as substantive changes. On the contrary, constructive changes to the contract may take place when the contractor is directed to perform in a manner that differs from the terms of the contract. Some of the constructive changes are acceleration of the delivery schedule, when the contractor is directed to perform the works under the contract in a way that

differs from the contract requirement, changing the sequencing of the work and delay in accepting or rejecting deliverables and delay in reviewing invoices and approval of payment.

IV. Payment Approval

Invoices submitted by contractor/supplier must comply with the contract rate schedule and with the contractor's progress on the work. should be examined in light of the contractor's progress and the development of the contractor should be measurable because the cost incurred or invoices submitted, in and of themselves, are insufficient indicators of contractor's progress. Before payment, Invoices must be reviewed and authorized by program officials who are familiar with the project. If the contract management is convinced that the invoice exceeds the contractor's progress, the contract manager should request and receive the contractor's explanation before approval of the invoice for payment. Payment should be withheld pending the institution's approval of the contractor's progress and payments must be issued based on the applicable laws, including Taxes. (Contract Management Handbook 2017)

V. Dispute Resolution

Contract Management Handbook (2017) noted that appropriate dispute resolution is an essential contract management skill. It is vital to identify issues early also effective communication with contractors, and providing the contractor with written notice of issues raised. The dispute resolution process aims to resolve contract issues through direct negotiation of the institution and contractor representatives before the issues need third party resolution. To avoid an escalation of the situation of contract issues institution personnel must respond promptly to all contractor inquiries and in dispute resolution, the following step should be in use.

Identify the Issue by providing the contractor with information or clarification what appears to be an issue can be resolved before the issue becomes a problem, and then researching the facts when investigating contract issues, factual information should be obtained to the greatest extent possible from as many relevant sources, including the project manager and contractor. The third step is to assess all of the factual information, the contract requirements shall be reviewed, and the client should determine an appropriate course of action after discussing with all decision-makers.

VI. Termination

Contract termination reflects a failure by all contracting parties thus should be the last resort. When the contract terms permit termination, the parties are no longer obligated to continue the performance of their duties and Contractual responsibilities. Depending on the specific contract terms, parties may terminate without cause (Termination for Convenience), with cause (Termination for Default) or for force majeure. Termination for convenience also known as no- fault termination the contract might be terminated at any time in its sole discretion in this case the contractor should be provided with notice in accordance with the contract terms and be paid for fees and the allowable cost incurred up to the termination date. On the other hand, firing due to misconduct is when the contract is terminated and the contractor failed to perform its responsibilities and obligation under the contract also did not mitigate the failure within the period specified in the contract, the failure to perform is also referred as a breach or a default. (Contract Management Handbook 2017)

VII. Contract Closeout

A contract is considered completed when all goods/services have been received and accepted, all reports have been delivered and accepted, any administrative procedures have been completed, all institution-furnished material and equipment have been returned, and The last payment was made to the contractor. The contract close-out procedure is usually straightforward but detailed administrative procedure and it includes verification that all contract parties have met their contractual commitments and duties then there are no remaining unperformed duties or obligations as well as assessing the success of the contract and lessons learned for use in future contracting. (Contract Management Handbook 2017)

2.1.8. Problems Relating to Administering Contract

According to Contract Management Handbook (2017), Contract administration's purpose is to ensure that the contract is completed satisfactorily by the contractor and the responsibilities of the contract The parties have been released in a proper manner. Effective contract administration helps to minimize or eliminate problems, disputes, and claims.

World Bank, (1984) cited by M Sysavath and S O Ogunlana states in many developing countries construction work suffers from administrative inefficiencies because of a lack of a sound framework of institutional and legal arrangements, M Sysavath and S O Ogunlana also mentions that some of the pitfalls in managing projects effectively and maximizing project performance are problems associated with misunderstanding of contract documents, especially general and special conditions have a great impact on project performance.

Mirza M., Pourzolfaghar Z., Shahnazari M. (2013) note that The majority of initiatives fail due to a lack of defined project and product scope definitions, as well as poor project and product control. Projects must be limited by providing detailed descriptions of what work must be done, where it starts, where it stops, and the major components required. The importance of a project scope with well defined goals and objectives has been proven as a factor in project success. As Collins &Baccarini cited by Mirza M., Pourzolfaghar Z., Shahnazari M. (2013), considered a rigorous scope to be an issue that is essential for meeting the owner's needs and achieving success. Mirza M., Pourzolfaghar Z., Shahnazari M. (2013), also added that poor scope definition has been linked to project failure and inadequate scope definition negatively correlates to project performance, it has also been known as a significant problem and final project costs tend to be higher, increasing project time, as well as lower the productivity.

Davison and Wright (2009) proposed that each contractual risk is made up of a set of contract issues that can jeopardize the project's success by having a negative impact such as, delivery of an incorrect product, with improper quantity, project expense increases, delivery delays, and poor quality or unsuccessful result and contract termination, they may also occur each time the good or service is procured. The potential issues with contractual risk and contract administration are listed in Table 2.1

Table - 2.1: Contractual risk and Contract Administration Problems

Types of Contract Administration Problems	Example
Proposal risk: Unclear scope of work	Ambiguous Specifications cause disagreements over needed performance and acceptance.
Surety and Liability risk: Increased cost	Inadequate bonds and insurance to cover vendor failure
Product risk: Wrong product	Contract clearly identifies correct product, but vendor delivers the incorrect.
Schedule risk: Delay	Completion Due to an agency or vendor, the due date has been postponed (for any amount of time) (with or without cause)
Contractual risk: Change order	After a contract has been awarded, the scope of work may be changed (more work, money, or time). For any reason, either side can seek it.
Contractual risk: Dispute resolution and personality conflict	Personality Conflicts between the project manager or personnel of the agency and the project manager or employees of the vendor. Disagreement that cannot be easily settled between the parties
Performance risk: Definition of acceptance	Completion of project is delayed due to non-acceptance of final product. Example: difference in either party's definition of what was expected to be handed off delivered or provided
Performance risk: Poor performance	Contract clearly indicates the required level of performance (this is not in question) and quality issues with the vendor's job performance occur
Performance risk: Sub Contractors	To do any or all of the task, the vendor hires subcontractors who are not on his payroll. Prior authorisation was granted for the use of subcontractors.
Performance risk: Other sources	There are only a few vendors who can do the job.
Performance risk: Risk of failure	The project has a significant chance of failing. i.e. new equipment, new technology, new vendor, the project has never been completed before. Tight timeline or budget
Price Risk: Cost	Project has a high price tag

Source: Davison and Wright (2009)

Tutesigensi and Moodley (1999) cited by M Sysavath and S O Ogunlana found that construction contracts affect levels of profit in the construction industry. The positive contribution of conditions of the contract to the profit can be affected when there is a lack of understanding, trust, and belief in the conditions of contract by at least one of the participants. Many standard contract conditions are „imported’. They originate from a range of sources, each aimed for a specific social, cultural, or political, legal, and economic backgrounds. There has been an argument against the use of legal’ language and calls for the use of plain English in drafting conditions of contract the basis of the argument is that the use of, legal’ language results in increased cost, distortion and oversight in the process of the so often necessary translation and retranslation.

2.1.9. Theoretical Perspectives

2.1.9.1. Contract Compliance Theory

Compliant to contract agreements between buyers and sellers is a contract compliance theory. Aberdeen Group (2006) noted that compliance may be internal or external. Internal compliance can be interpreted as either conforming to the rules in the agreement by purchasing organizations such as payment terms and minimum order requirements or in purchasing from the agreement only, that is, purchasing by using framework agreements for the entire company.

2.1.9.2. Contract Management Theory

According to Knoester, (2005) cited by Hirpassa D. (2018), contract management theory can be interpreted as category management, contract administration, and contracting processes. Category management is about managing the contracting processes initiation, contract management is the management of the engagement administration of all term agreements by which means a contract is closed. The contract management process ensures that the right information is in the right place at the right time, to support the whole of the contracting process. In project disciplines, this can be achieved by distributing contract information to all primary project stakeholders to determine an optimal supply base. The contracting process is the third interpretation of contract management and is where contract realization is managed. This process is connected to both the category management process and the contract administration process.

Contracting processes are initiated by category management and are from there supported by the contract administration process. This administration process is necessary during the whole contracting process to assure quality, efficiency, and effectiveness (Angelov,2005)

2.1.9.3.The Will Theory

According to Hutchison et al., (2009) cited by Hirpassa D. (2018) the basis of the contract is the meeting of the minds of the parties that is the will of the parties. If one party is in fault as regards one of the important elements of the agreement there is no real agreement. The result is neither party is bound nor each party may reclaim whatever it has performed. This theory maintains that commitments in project contracts are enforceable because the promisor has "willed" or chosen to be bound by his or her commitment(s). Because the will is something naturally worthy of respect; the use of force against a defaulting promisor in project contracts is ethically justified.

2.1.9.4.The Agency Theory

The agency theory refers to two actors the principal and agent, According to Chiappori and Salanie´ (2003), the underlying principle of the theory is there should be a clear understanding of the needs of the principal and ability of the agent to meet these needs competently. When a project contract is clearly specified and planned, the principal and agents will find it simple to meet each other's needs in an efficient manner, resulting in projects being completed on time at a predetermined service level.

2.3. Empirical Literature

Mayie B. (2016) researched contract management practices on performance of the road construction projects in Wakiso district to examine the role of monitoring intensity in enhancing the performance of the road construction projects, to analyze the relationship between risk management and performance of the road construction projects and to assess the role of evaluation in enhancing the performance of the road construction projects and to assess the role of evaluation in enhancing the performance of the road construction projects. The studies revealed that there was a strong and beneficial relationship between monitoring intensity, risk management, evaluation, in the study context, and the performance of road construction projects

As Aluonzi G., Oluka N., Nduhura A. (2016) attempted to investigate the link between contract management and road maintenance project performance in the Arua Municipality. Cross-sectional survey design Using a questionnaire survey and interviews, data was collected from a sample of 102 respondents. The study discovered a link between contract administration, relationship management, contract closure, and maintenance project performance. The researcher concludes that improved payment mechanisms, Project performance is improved via limited contract modifications, improved communication channels, and dispute management.

In the research on Amoako K., Amoako K., Contract management in the construction industry: a case study of local contractors in Ghana, Amoako K, investigate the practice of contract management among local contractors belonging to Contractors in the construction and civil engineering industries have formed a group called the Building and Civil Engineering Contractors Association of Ghana, The results showed that a few construction companies use designated contract managers for the management of their contracts and some contract management challenges were identified as, lack of detailed contract-specific information, improper documentation of the effects of delays, variations and events/changes during contract/project implementation, lack of contract management systems such as procurement planning and poor record keeping and/or filing systems. In addition, the study showed that though compliance with contract management within the construction industry of Ghana was low, most of the construction companies appeared to be familiar with Best practices in contract management.

In their research on the impact of contract management on the execution of outsourced projects in Nairobi County, Kenya's medium manufacturing firms. Mutua M, Waiganjo E, and Oteyo N. (2014) The target audience was all medium-sized manufacturing companies with offices in Nairobi. According to the findings, the overall performance of projects was only moderately satisfactory, with success being Contract management has an impact. Essentially Contract management was found to have a positive relationship with project success.

The contract management and other factors were responsible for 66% of the variance in project performance. Contract management was discovered to have the greatest impact on outsourced project performance. A clear description of project objectives in contracts is

vital for successful project delivery, according to 95% of all firms questioned, while project acceptance criteria and dispute resolution are also important, while project acceptance criteria and dispute resolution mechanisms were rated as important contractual devices. One way to improve the performance of outsourced projects is to provide management training, particularly in contract management. To improve project performance in medium manufacturing businesses, the study advises introducing contract management training and certification for project managers and project team members. The increasing recognition of improving contractual processes has enforced Elsey (2007) to address the importance of contract management by addressing the critical success factors for successful contract management namely; on-time delivery, value for money, cooperation

and responsiveness, fulfillment of one's obligations, no controversies as well as proper change management. These factors are indeed critical in order to handle projects effectively where projects are bound by scope, quality, cost, time and resources irrespective of project type and environment (Wysocki, 2009).

To emphasize contract's function, the Republic of South Africa's National Treasury (2010) conducted a research for enhancing service delivery and suggested that when a contract is effectively managed it has the capacity to increase revenue opportunities, decrease costs and enhance service delivery.

The role of contract administration on project performance is also seen in where TQM and JIT philosophies are adopted to ensure on time delivery for good quality deliverables and meeting deadlines. This is in agreement with Guiffreda and Nagi (2004) who conducted their study in Cost Characterization of Supply Chain Performance in New York and found that contract management is essential for JIT effective project environments. In emphasizing on robust contract management, Garcia (2012) conducted a research at the European Journal of Legal Studies where he strongly insisted on the need to secure enforcement of penalty clauses in international commercial contracts. This would help all actors in the supply chain have quality goods and services as well as ensure on time delivery of goods.

In attempt to make contracts alive and healthy, Jukka (2003) described three processes for implementation of contract management, namely; to establish the basic contract

management operation such as competent contract personnel, defining proactive alarms for contracts and templates, The next step is to create a contract. alive that is being part of the business such as deeper involvement of stakeholders, and finally, the third is the strategic step of contract management. Although this can take time to implement but once implemented can be a cornerstone to project management.

Research by Girmay Kahsay (2003) on the claims in international projects in Ethiopia, states that all of the ten foreign projects surveyed have had claims due to late site handover, rights of way issues, design flaws, or late submission of drawings by supervising consultants, indicating insufficient contract administration standards. The researcher suggests that the construction industry of Ethiopia needs to focus on the development of adequate project management skills and enhance the contract administration capacity of its practicing professionals, with particular emphasis on international projects.

A case study was conducted by Bekele H. (2017) on the construction contract administration practices of the new headquarter design-build (DB) project of commercial bank of Ethiopia. the researcher tried to address the major research gap of which the effectiveness of design-build contract administration on the project's time, cost, quality management, and whether this design-build project contract administration has become effective to meet its objectives of technology transfer and training through the contract administration. The qualitative research has come up with a finding that following the legal bindings, keeping confidentiality, and having well-experienced professionals on the project is leading the undergoing project to be successful so far regarding the well-administered contract.

The study conducted by Hirpassa D. (2018) examined contract administration's role on the project performance at Oromia Regional State, specifically at Bureau of Oromia Water, Minerals, and Energy and the objectives of the research were to assess the contract administration planning practices and its role on managing the contracts, to assess the contribution of timely monitoring of contract implementation for the performance/success of projects and to assess the inspection practice and its contribution to getting the intended project deliverables. According to the study's findings, most of the water construction projects of OWMEB aren't finished according to the initial plan and

they usually put up with delay, termination, Quality or cost overrun problems, which were originated due to shoddy contract management especially lack contract administration plan, poor monitoring of the contract implementation, and lack and/or poor inspection of deliverables. The research recommends OWMEB to oversight the contracts critically to keep the projects on track and monitor the results constantly as well as to recruit. More experienced and qualified staff with sufficient quantity for its contract management function.

A case study conducted by Addis Mesfin (2014) on Building Construction Projects in Ethiopia under the title “The Study of Construction Contract "Ethiopian Building Construction Projects: Risk Management Practices." A questionnaire study was conducted in Ethiopia on various randomly selected building construction enterprises to assess their risk awareness and how they manage hazards in their projects. Poor contract management was discovered to be one of the key causes of risk, with a high probability of occurrence and a high level of influence on project objectives, according to the research findings. It was also discovered that the majority of building projects in Ethiopia are not completed according to the original plan, resulting in delays, cost overruns, and poor quality. The study forwarded recommendations on the need of special attention on managing Financial and Contractual areas of risk since they were identified as most important risks in building construction projects of Ethiopian.

Another case study was conducted by Tigist Belachew (2016) on Addis Ababa Light Railway under the title “Assessment on the practices of Project Contract Administration”. The methodology was designed as interview and focus group discussion and descriptive analysis were made. According to the findings of the study, the project contract administration have implications on the project success. The study forwarded recommendations on the need of having a well-established contract is as good as having a good fence which leads to a smooth relationship with the stakeholders i.e. having a clear contract demarcation (specifications of instructions) first which later on leads to success with a proper follow up and monitoring.

Lakew A. (2018) examined the practice of project contract management of the HBSC Kilinto II Project by addressing the process namely: contract terms and conditions, contract monitoring, contract documentation, and contract controlling and closing.

According to the findings of project work, there are standard templates, procedures, and policies for the project. On the other side project team lacks training regarding contract management, lack of proper documentation, significant delay, poor implementation of terms and conditions, lack of regular monitoring of contracts, also controlling and closing have been found as the areas that need improvement. Thus, a recommendation has been made under this study on what actions should be taken to improve project contract management practice for current and future projects of the Heineken Brewers ShareCompany.

2.4. ResearchGap

Several works of literature have been reviewed concerning contract administration and management. Much of the literature review explains the process of contract management and on the construction contract administration practices with limited studies analyzing the relationship between the study contact administration problems and especially the effect of these problems with relation to the performance of the construction projects. For instance, Mayie B. (2016) studied Wakiso district contract management techniques on road construction project performance as well as Aluonzi G., Oluka N., Nduhura A. (2016) investigate the link between contract management and road maintenance project performance in the Arua Municipality, also Mutua M, Waiganjo E, and Oteyo N. (2014) research on the impact of contract management on the execution of outsourced projects in Nairobi County, Kenya's medium manufacturing firms

Besides various studies that have been done in Ethiopia concerning the contract administration and management such as Bekele H. (2017) conducted A case study research on the construction contract administration practices of the new headquarter design-build (DB) project of commercial bank of Ethiopia, Lakew A. (2018) examined practice of project contract management of HBSC Kilinto II Project, Dinku M. (2019) investigate the construction contract administration practices in concrete pole factory expansion projects of Kabew Construction Private limited company. Moreover, Hirpassa D. (2018) assessed contract administration's role on the project performance at Oromia Regional State, specifically at Oromia Water, Mineral, and Energy Bureau.

The above studies are mainly focused on Contract management procedures and road

construction projects. The research tries to examine how contractual issues are influencing the performance of the projects and leading to project failure, moreover this research adopted the contract administration problems from the study held by Davison and Wright's work (2004) to examine the consequences of contract administration problems for contract types, however, the researchers do not relate how these problems are likely to affect project performance. Generally, This research is distinct from the earlier a variety of studies and enhances the existing literature in the following ways: Firstly, it has implemented different research methods that are not used by the previous studies. Secondly, the study tries to answer how contract administration problems are likely to affect project performance which is the research gap study will try to address.

2.5. Conceptual Framework

The conceptual framework is illustrated to provide clear relations of dependent and independent variables as they associate with each other in this research. The framework, therefore, demonstrates the link between contract administration issues and the performance of Addis Ababa's building construction projects.

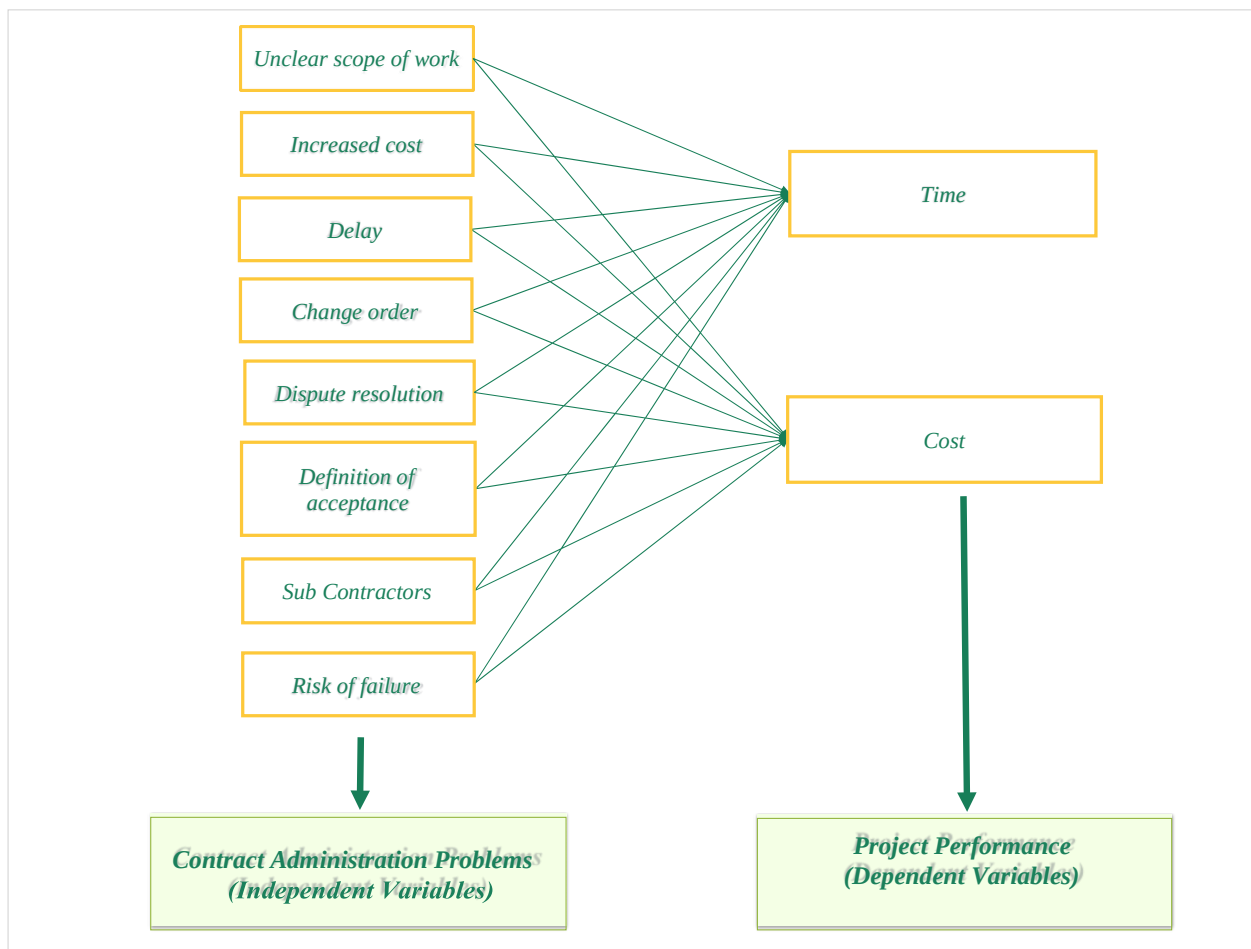
This research took the Davison and Wright (2004) used a conceptual model to survey members of the National Institute of Government Purchasing (NIGP) and Institute of Supply Management to see if there was a link between contract administration issues and contract type by examining the consequences issues with contract administration for contract types.

However, the conceptual model only examines the link between contract administration issues and the type of contract besides does not relate how these problems are likely to affect project performance this study will try to address this research gap.

To evaluate the accomplishment of construction projects the research applied earned value management (EVM) to compute the index of schedule performance and cost performance index. According to Eirgash M. (2019), EV / AC Cost Performance Index (CPI) More than one equals profit, while less than one equals loss. EV / PV Schedule Performance Index (SPI)

More than one indicates that you are ahead of schedule, while less than one indicates that you are behind time.

Figure 1.1 The impact of Contract Administration on Project Performance



Source: Adapted From Davison and Wright (2004)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This section presents and explains the methods that were adopted to carry out this study and achieve the required objectives also to answer the research questions. The focus area of the research is identifying the extent to which contract administration problems contribute to the overall Projects for building construction performance being executed by GC-1 Contractors within AddisAbaba.

3.2. Research Design and approaches

3.2.1 Research Design

The blueprint for data collection, measurement, and analysis is the research design, which is the conceptual framework within which research is conducted. Kothari C.R. (2004). Hence, the following research design was formulated.

The appropriate research design was reflected after identification of the problem which has been done through unstructured literature review, archival study, and informal discussion with colleagues and professionals in the sector, then a specific question to be answered has been determined and a measurable hypothesis was developed.

The research design that was applied for this research was basic, descriptive and explanatory research design, as basic research, the primary aim of the study is to improve knowledge and understanding of the relations among variables in addition to contribute and fill the gap of the existing body of knowledge. According to Kothari (2004), the descriptive The term "design" refers to the process of characterizing the characteristics of a particular situation. As descriptive research; this study was Interested in describing the existing performance of the projects and characteristics of the respondent also to reveal the prevalence of contract management issues on theproject.

Besides, this study as an explanatory research design; explains the difficulties with contract administration have an impact on the dependent variables project performance the study has a formulated hypothesis and tests these hypotheses then examine relationships and influence of contract administration problems and project performance.

This research is also correlational because it attempts to determine whether There is a link between contract administration issues and project performance in the building projects. In addition since The study's goal was to find out more about a particular phenomenon at a particular point in time it was a cross-sectional study.

3.2.2. Research Approach

This study follows a deductive approach because a set of hypotheses have formulated that need to be confirmed or rejected during the research process, and the study transfers from developing a theoretical framework into a specific and particular conclusion.

This study is mixed research which adopted a combination of qualitative and quantitative research approaches were conducted, it undertakes qualitative approach because the study explores information through the collection of relevant data through interviews, observations, and archival documents such as project contract document, monthly reports, and payment certificates. A quantitative approach was implemented for the reason that it includes gathering and translating data into numerical form so that statistical analysis can be made to determine to what extent there is a relationship between the independent and dependent variables to conclude.

3.3. Population and Sampling Techniques

The population of the study is GC-1 national contractors. According to the ministry of construction, assessment and competency certification bureau the list of registered GC-1 contractors are 341 contractors, out of which 33 contractors are currently executing building projects that are located at Addis Ababa and 50 of these contractors building construction projects are considered as the sampling frame of the study.

Since the sample frame of the study is of manageable size and have well-defined characteristic a total population sampling technique or census sampling technique was applied which a type of purposive sampling where the whole population is studied. Then the questionnaire was distributed to contract engineers, project managers, and office as well as site engineers who were acquainted with the concerned construction projects during the specified time.

3.4. Types and Sources of Data

Both primary and secondary data collection approaches were adopted to achieve the aim of this study and to gather relevant information on the stated problem.

3.4.1. Primary Data Sources

Primary data refers to information attained first hand by the researcher. As per Kothari C.R., (2004) the primary data are those which are collected for the first time and thus happen to be originally collected. To assemble primary data both open and close-ended questionnaires were prepared and distributed to construction professionals working at the offices and sites of the construction companies which are directly in authority on the building projects. A pilot survey was conducted to test whether the questionnaires adequately address the critical aspect of the research objectives. Actual project information was obtained by applying a desk study approach from archival documents which included the contract documents, project schedules, variation orders, payment certificates, and a progress report.

3.4.2. Secondary Data Sources

The secondary data are those data have previously been collected and put through the statistical process by someone else. Kothari C.R., (2004) The information for this study was gathered from a variety of sources by reviewing relevant literature, publications, and studies to get the in-depth information to establish the conceptual basis of the research.

3.5. Data Analysis and Interpretation

To accomplish the predefined objective of the study, data collected from respondents are presented, analyzed, interpreted, and evaluated as follows: the data obtained through questionnaires were checked for their reliability by Cronbach's alpha test before being analyzed.

To analyze contract administration's incidence issues, and to summarize the collected data and conduct analysis, the appropriate descriptive statistics have been employed like percentages, tables, mean scores, etc.

Correlation analysis and multiple regression were conducted to examine the association and influence of contract administration problems on GC-1 contractors building construction project performance, the regression analysis was estimated using ordinary least square (OLS) method using STATA 14 software to answer the research questions proposed by the study. Diagnostics tests and model specification tests were computed on the regression result such as Normality, Multicollinearity, Heteroskedasticity, and autocorrelation to ensure that the data suits the basic assumptions of the classical linear regression model. Finally, the research findings and responses will be properly examined, categorized, and tabulated.

To assess how well the projects are performing, the study used Earned Value Management Analysis. Primarily The cost performance index and the schedule performance index are two different types of cost performance indexes. were applied. The two indexes that are used in the research provides an instant measure of performance against both the cost plan and the schedule are calculated and defined as:

Cost Performance Index - (CPI) (Cost efficiency) the ratio of the value created to the amount spent at a point in time on the project

$$CPI = BCWP/ACWP$$

Schedule Performance Index - (SPI) (Schedule efficiency) -The ratio of the earned value created to the amount of value planned to be created at a point in time on the project

$$SPI = BCWP/BCWS$$

Variables description

Two dependent variables, Cost and schedule performance, eight independent variables, namely, delay, subcontractor issues, the definition of acceptance, change order, the unclear scope of work, increased cost, dispute resolution, and risk of failure were considered for this study. The definitions and hypotheses of each variable are discussed below.

Dependent Variables

According to Alan W. (2003) in the earned value method of performance estimation, three measures of cost are required at the reporting point to calculate the cost and schedule performance index. The standard terms for these three values are Budgeted Cost for Work Scheduled (BCWS) or planned value is the sum of all the planned costs in the project, up to the reporting date. Budgeted Cost for Work Performed (BCWP) or Earned value is the cost of all the progress achieved on the project up to the reporting date and it represents what has been earned, not simply what has been spent and Actual Cost of Work Performed (ACWP) or Actual cost is the total of all expenditure on the project up to the reporting date, it is the sum of what has been spent, in addition to (BAC) Budget at Completion is when the project's scope is completed, the entire approved budget.

Source: Eirgash M. (2019)

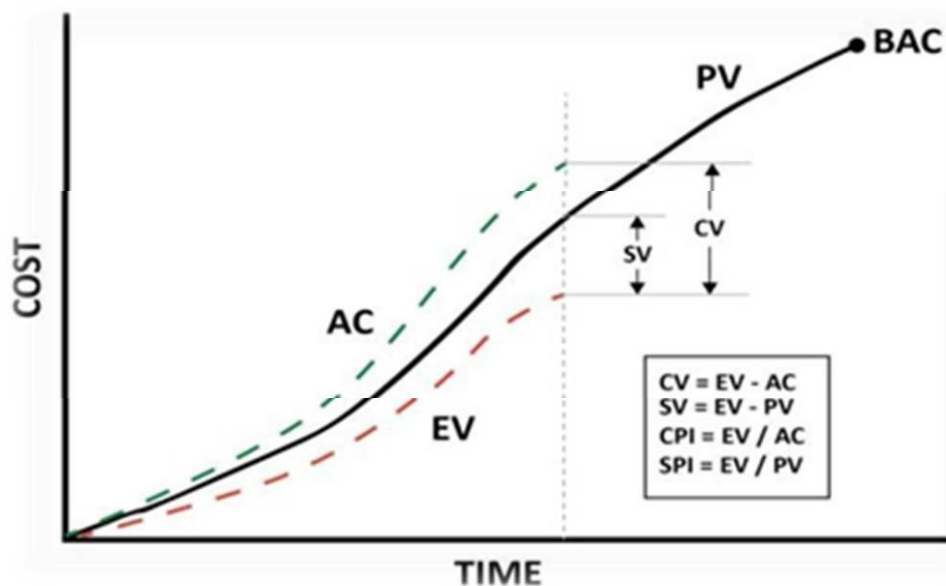


Figure 3.1 Earned Value Analysis curve.earned Value Analysis curve.

Table 3.1.Earned Value Terms.

Term	Description	Interpretation
PV (BCWS)	Planned Value	It is the budgeted cost for the work scheduled to be completed on an activity or WBS component in a particular time
EV (BCWP)	Earned Value	It is the budgeted quantity for work completed on a schedule activity or work breakdown structure (WBS) component during a specific time period.
AC (ACWP)	Actual Cost	It is resolved from accounting records that keeps record of actual expenditure money, that means it is secret and actual money spent by the contractor.
BAC	Budget at Completion	When the project's scope is finished, the total approved budget
EAC	Estimate at Completion	The expected total the project's cost when the defined scope of work is completed.
ETC	Estimate to Complete	The estimated additional cost to complete the project
Cost Variance (CV)	$EV - AC$	_Negative refers to going over budget, while positive refers to staying under budget.
Schedule Variance (SV)	$EV - PV$	_Negative denotes being behind schedule, whereas positive denotes being ahead of schedule.
Cost Performance Index (CPI)	EV / AC	More than 1 means Profit and less than 1 means loss.
Schedule Performance Index (SPI)	EV / PV	More than one indicates that you are ahead of schedule, while less than one indicates that you are behind time.

Source: Eirgash M. (2019)

Cost Performance Index - (CPI) is used to estimate the projected cost to complete the project based on performance to date.

$CPI = 1$ means that the planned and actual costs are the same.

$CPI < 1$ means that the project is under budget.

$CPI > 1$ means that the project is over budget.

Schedule Performance Index - (SPI) is used to estimate the projected time to complete the project based on the performance to date.

$SPI = 1$ means that the project is on schedule.

$SPI < 1$ means that the project is behind schedule.

$SPI > 1$ means that the project is ahead of schedule.

According to Alan W. (2003), the values of the index greater than one (1) indicate the performance of the project either in cost or schedule terms that is better than planned whereas values lower than one indicate a worse position. The CPI is, perhaps, the more useful of the two, it shows the real worth that is being created by the project, and The SPI measures the project progress using money as an analog of time. Both of these performance indices give a valuable clue as to performance to date and what the future may hold.

Independent Variables

Delay; Delays in building projects are the key factors of the failure of the project. When the delay in the project is not established and the remedial action to handle the project is not made in time, the project may incur increased expenses and prolong the length of the project. As per WerkuKoshe, and K. N. Jha (2016) project delays arise at any point of the building process and are typical issues for construction projects in Ethiopia, which gives rise to dissatisfaction to all the parties involved and nowadays it's becoming a major obstruction for development of developing countries like Ethiopia.

Subcontractor Issue; Subcontracting by main contractors to other subcontractors is a big aspect of the building industry. However, issues can be caused by the subcontractor that affect the overall success of the project and the subcontracting procedure. As per Yoke-Lian et al. (2012) cited by Hailu H, (2018) The capacity of the primary contractor to

complete the project on schedule, on budget, and with high quality is primarily dependent on the performance of subcontractors. According to Koshe and Jha (2016) cited by Hailu H, (2018) poor subcontracting performance is one of the reasons of construction project delay in Ethiopia.

The definition of acceptance; According to Davison and Wright (2004), the completed work is not accepted because of the difference in either party's definition of what was supposed to be delivered or provided.

Increased cost; The real expenses of land, materials, equipment, and labor are used to calculate the project's basic costs. These fundamental prices will vary based on upon several factors such as the project specification which defines the project characteristics of a project and the more detailed the specification and the larger the project the more expensive it will be, Location affects project costing via institutional factors and through geographical realities, the form of procurement and contract used by the project sponsor can alter the estimated cost of a project, A site can be affected by soil and drainage conditions and access restrictions which can affect the original cost estimates and The longer the expected construction period, the more account will need to be taken of expected inflationary price increases over time

(https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.pdf)

Change order; according to Dr. Mustafa A. (2014) one of the most prevalent issues in the construction project is change orders and it is a formal written document that specifies the alteration of some part of the construction contract documents. Change, particularly when it occurs in prolonged disputes and lawsuits, is a severe and expensive issue for the construction industry. the research finding of Dr. Mustafa A. (2014) states the major factors that affect change orders in construction project includes time overrun, cost overrun, dispute, arbitration, total abandonment; and litigation, besides the results of the analysis shown time overrun and cost overrun were the two most common effects of change orders on projectperformance

The unclear scope of work; the scope of the project is defined as the work to be done to deliver the product with the features and functions specified. The concept of poor scope has been related to project failure. Inadequate scope definition is negatively associated

with project efficiency. If no boundaries are defined, final project costs appear to be higher due to adjustments that interrupt project flow, trigger rework, increase project time, and lower productivity. (Mirza M., Pourzolfaghar Z., Shahnazari M.2013)

Risk of failure; as per division and wright (2009) risk of failure suggests that there is a strong chance that the project will fail. for instance new technology is being applied, new vendor, new equipment and the project has a tight timeline or there is a budget constraint.

Dispute resolution; Conflicts in construction projects are unavoidable, it is evident and disputes always affect the productivity and performance of a project, therefore dispute and conflict resolution techniques have been key to the management of projects regardless of the scale of the project. According to Aryal S and Dahal RK (2018), if disputes are not resolved promptly, they continue to drag on, intensify and cause disruptions in the project, which causes project delays which lead to lawsuits, involve the settlement of litigation and potentially damage contractual relationships. As a result, the reduction of the quality of the work and an increase in project cost. As per to research done by Loke Yi San (2013) most significant effects of internal conflict are delay in project duration, loss of profitability, and project cost overruns.

3.6. Model Specifications

To understand which among the independent/explanatory variables are related to the dependent variable, and to explore the forms of these relationships multiple regression will be conducted to show the relationship and significance between contract administration problems and building construction project performance, through ordinary least square (OLS) method and by adopting the following linear regression models.

The independent variables of this study contact administration problems are derived based on previous studies of by Davison and Wright (2004) on the consequence of contract administration problems for the contract type the researchers considered 12 contract administration problems however on this research only 8 of the problems are considered, therefore the models are developed as follows

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots\dots\dots + \beta_n X_n + \varepsilon_i$$

Where

Y denotes the dependent variable which is explained by the independent variables β_0 is constant

$\beta_1, \beta_2, \beta_3, \dots, \beta_n$ are the regression coefficients associated with the independent variables $X_1, X_2, X_3, \dots, X_n$ respectively

ε_i is the random error component

Accordingly, the models specified for this study can be expressed as follows:

$$Y_1 = \beta_0 + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + \beta_{17}X_{17} + \beta_{18}X_{18} + \varepsilon$$
$$Y_2 = \beta_0 + \beta_{21}X_{21} + \beta_{22}X_{22} + \beta_{23}X_{23} + \beta_{24}X_{24} + \beta_{25}X_{25} + \beta_{26}X_{26} + \beta_{27}X_{27} + \beta_{28}X_{28} + \varepsilon$$

More specifically, the specification of the variables was specified as follows: Y = Cost and schedule performance of construction projects.

β_0 = the constant

$X_1 \dots X_n$ = the predictors or independent variables (delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively)

$\beta_1 \dots \beta_n$ = the estimates of the independent variables and the beta coefficient of delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively

ε = the error term.

3.7. Validity and Reliability test

The validity of the appropriateness and meaningfulness of the researcher data obtained through the instrument is ensured by consulting professors and professionals on the subject matter. On the other hand, a reliability test was performed to test the overall reliability and consistency of respondents' answers to all the items in the measure. The Cronbach Alpha test was used to show reliability, all of the respondents were accepted based on the alpha value to be Cronbach's alpha 0.8028 indicating that the questionnaire items were consistently more than 0.70.

3.8. Ethical Considerations

The study has been conducted using the following ethical considerations, the study participants were informed about the purpose of the research, the methods being used and the possible outcomes then answered the questionnaire anonymously. Participants are volunteers and take part in the study without being coerced and no remunerations are paid.

Research data collected and information obtained from the companies are strictly confidential and protected at all stages of the study, besides the data are used only for academic purposes. Therefore, company and project identifiers such as names and geographical locations are not mentioned for the intention of confidentiality.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1.Introduction

This chapter of the research deals with the analysis of data which were collected from desk study, and questionnaire survey which is presented, analyzed, interpreted, evaluated and discussed in detail to examine the extent to which contract administration problems contribute to the overall building construction performance project being executed by GC-1 Contractors within AddisAbaba.

Questionnaires were used to collect data to understand the contribution of contract administration on the performance of the construction project. The questionnaires were distributed to thirty-three (33) Grade one contractors. A total of fifty (50) questioners was distributed to building projects being constructed by the contractors and valid responses were obtained from forty-One (41) willing and cooperative contractors. Therefore, the overall rate of response to the survey was (82%). The target construction projects were projects located in Addis Ababa, Ethiopia.

The questionnaires consisted of a close-ended and some open-ended questions with four sections. The first section deals with a personal and organizational profile of respondents and the second section is concerned with general questions regarding contract administration problems were as the third section involves ranking the frequency of occurrence of the contract administration problems in the project by using a Likert scale of four ordinal measures. A sample of the questionnaires is attached in Appendix A. Besides, desk studies were conducted to gather more information regarding project data.

4.2 Demographic data

Table 4.1 - Frequency and percentage distribution of respondent's general information

Frequency and percentage distribution of respondent,,s general information		
Gender of the respondent	Frequency	Percentage
Female	15	36.59%
Male	26	63.41%
Age of the respondent	Frequency	Percentage
<30 years	28	68.29%
31-40 years	9	21.95%
41-50 years	3	7.32%
>50 years	1	2.44%
Respondents level of education	Frequency	Percentage
Master's Degree	8	19.51%
Bachelor Degree	30	73.17%
Diploma	3	7.32%
Respondents current working position	Frequency	Percentage
Project Manager	8	19.51%
Contract Administrator	8	19.51%
Project Coordinator	6	14.63%
Construction Engineer	7	17.07%
Site Engineer	2	4.88%
Office Engineer	8	19.51%
Quantity Surveyor	2	4.88%

Source: Researcher's survey, 2022

According to the analysis of the questionnaire, (63.41%) of the contractors have between 15-25 years of experience were as (12.20%) of the contractors have between 26-36 years of experience and (2.44%) of the contractors have more than 37 years of experience.

As shown in Table 4.1 above the study try to ensure that there was a proportionate representation of both males and females' points of view. It was indicated that out of the total respondents 15(36.59%) of respondents were female and 26 (63.41%) respondents were male this shows that the study findings can be concluded in respect of both males and females.

Related to respondents age, out of the total respondents the 28 (68.29%) of respondent's age were less than 30 years, 9 (21.95%) of respondent's age were between 31- 40 years, 3 (7.32%) of respondent's age were between 41- 50 years and the remaining 1 (2.44%) of respondent's age was above 50years.

The study tries to know the educational and professional capability of respondents with their ability to interpret and understand the research instruments for consistent findings. As shown in Table 4.1 below the survey result shows that 19.51 percent of the respondents have MSc. Educational qualification and the rest 73.51 percent BSc. Degree Educational qualification, while

7.32 percent of the respondent had a Diploma. This shows that the survey was well represented by qualified professionals with sufficient knowledge.

The questionnaire was to be completed by respondents who were involved in construction works, in contract administration, preparation of design documents, and supervision of the site work. As it is indicated in Table 4.1 below (19.51%) of respondents were project managers, another (19.51%) were contract administrators, (14.63%) were project coordinators, (17.07%) construction engineers, (4.88%) were site engineers, (19.51%) were office engineers, and the last (4.88%) were quantity surveyors.

Table 4.2 - Frequency and percentage distribution of respondent's familiar with the contract administration problem

<u>Tabulation of Familiarity</u>			
<u>Familiarity</u>	<u>Freq.</u>	<u>Percent</u>	<u>Cum.</u>
No	10	23.26	23.26
yes	33	76.74	100.00
Total	43	100.00	

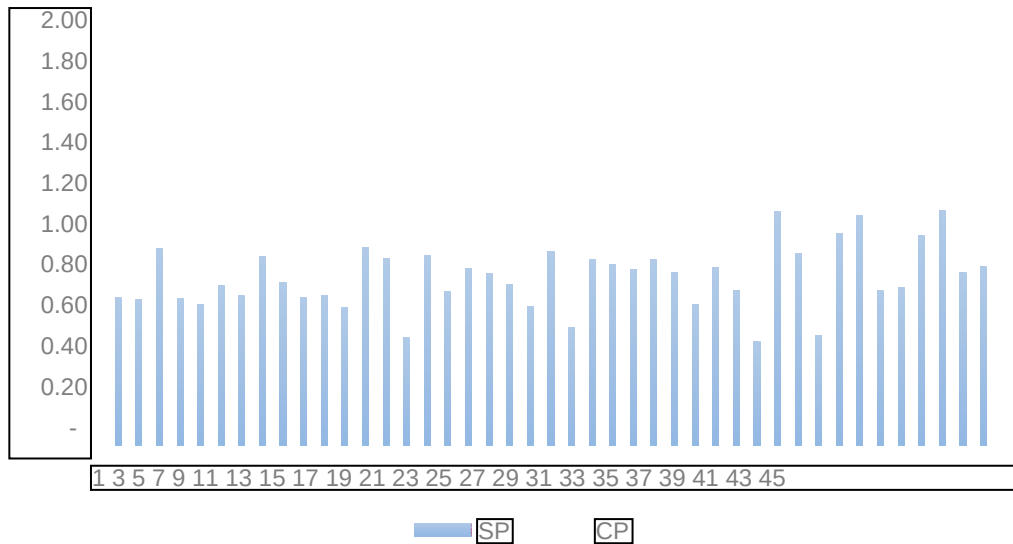
Source: Researcher's computation through Stata 14 (2022)

The respondents were asked whether they are familiar with the contract administration problem or not. According to the survey stated in Table 4.2, the numbers of respondents that are familiar with contract administration problems were much higher (76.74%), the rest (23.26%) are not familiar with the problems. This further indicates that respondents are well acquainted with contract administration problems and so they can give accurate information.

4.3. Current performance of GC-1 contractor's building project

To measure the performance of the projects Earned value management (EVM) was computed particularly, cost performance index (SPI) and Schedule Performance Index (SPI) are used to determine the project's performance.

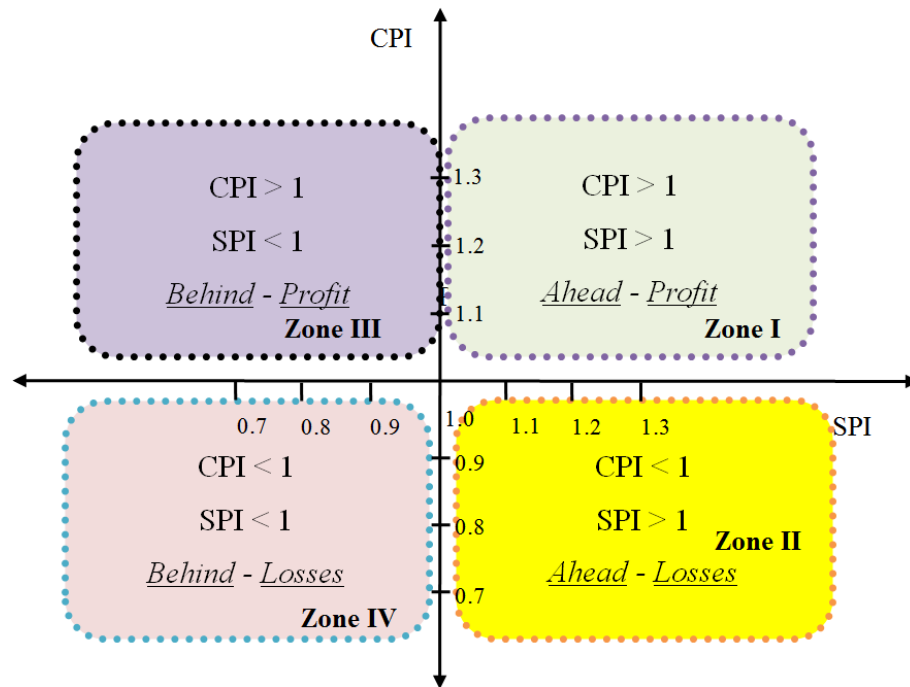
According to Alan W. (2003), the values of the CPI and SPI index greater than one (1) indicate the performance of the project either in cost or schedule terms that is better than planned whereas values lower than one indicate a worse position. Eirgash M. (2019) also states that projects with CPI more than one means profit and less than one indicate a projected loss. Whereas more than one SPI points out ahead of schedule and less than one means behind the schedule.



Source: Researcher's EVM Analysis, 2022

Figure 4.1 Graphical representations of SPI and CPI Analysis of Projects

Accordingly, based on the analysis of the data and the figure above only Two (2) projects have SPI greater than one which indicates that these projects are ahead of schedule while the remaining 41 projects have SPI less than one which means they are behind the schedule. Then again 27 projects have CPI greater than one which shows that the projects are earning a profit, whereas, 3 projects have CPI equal to one which means that the planned and actual costs of these projects are the same, however, 13 projects have CPI less than one that points out that these projects are incurring a loss. For more information in detail, the analysis summary is attached in AppendixB



Source: Eirgash M. (2019)

Figure 4.2 SPI and CPI Analysis Matrix of a Project Source: Researcher's EVM Analysis, 2022

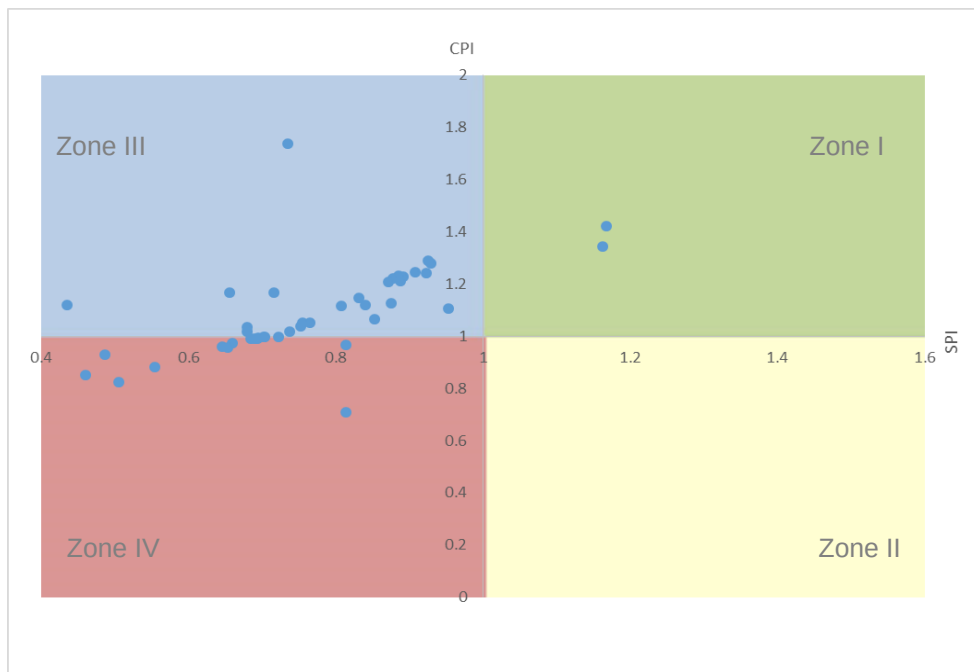


Figure 4.3 SPI and CPI Analysis Matrix of GC-1 Building Projects within Addis Ababa

As illustrated by Eirgash M. (2019) in figure 4.2 and research's SPI and CPI analysis matrix of projects in Figure 4.3, projects can be categorized into four (4) zones based on their cost performance index (SPI) and Schedule Performance Index (SPI), then projects in the zone I have $CPI > 1$ and $SPI > 1$ which indicates that the projects are ahead of schedule and earning a profit. Based on the research analysis only two (2) projects are grouped in a zone I, whereas projects in the zone II have $CPI < 1$ and $SPI > 1$ which shows that the projects are ahead of schedule at the same time generating a loss, based on the analysis of the data none of the projects are in this zone, while 28 projects have $CPI > 1$ and $SPI < 1$ meaning these projects are in zone III which implies that the projects are behind schedule and creating a profit. on the other hand, 13 projects are in zone IV with both CPI, as well as SPI, less than 1, which indicate the cost performance of this projects are not proceeding well and the schedule performance is slightly worse meaning the projects are running behind the schedule and in a loss.

4.4. Existence and Extent of the Contract Administration Problem

The next step in this research was to check whether contract administration problems occur and the implication of these problems in GC-1 contractors building construction projects which are the specific objectives of the research.

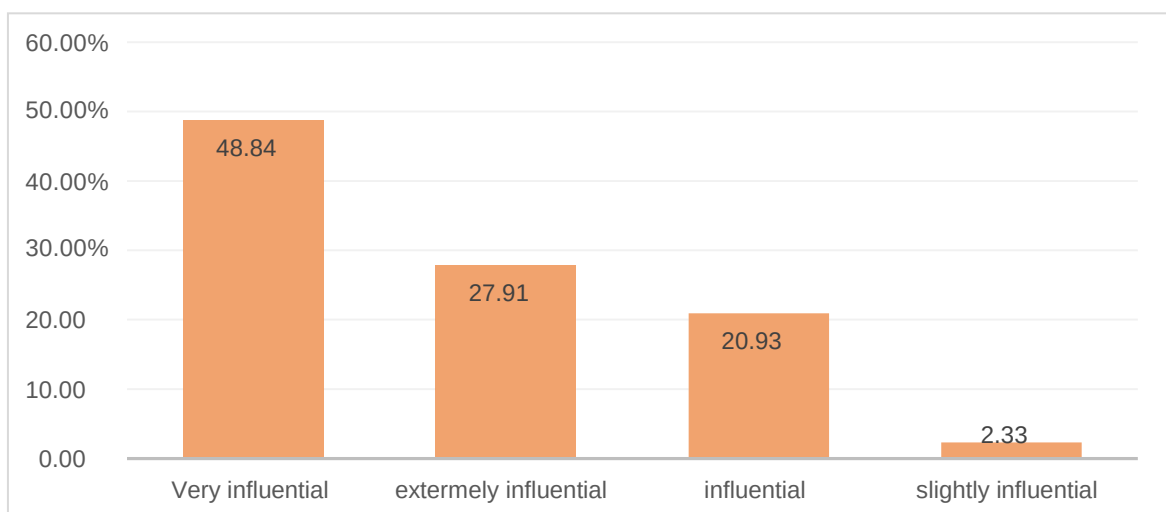


Figure 4.4; Respondent responses on the influence of construction contract administration problems on the performance of building project

Source: Researcher's survey, 2022

To answer this question, data was gathered from 43 building construction projects that are currently being undertaken by the GC-1 contractor within Addis Ababa. Professionals involved in the projects were asked how they consider the influence of construction contract administration problems on the performance of building construction projects.

The majority of the respondents in the questionnaire acknowledged that contract administration problems are very influential on project performance. From their experience 48.84 % agree that contract administration problems are very influential on project performance, 27.91% reveals the contract administration problems are extremely influential. Whereas 20.93% of the responses stated influential and the remaining 2.33% responded that the problems with contract administration are slightly influential.

4.4.1. Descriptive Analysis for the occurrence of contract administration problems

To recognize Contract administration issues on GC-1 contractors building construction projects and to identify which problems happen the most, the mean score of each problem is calculated. For computation, a scoring mechanism for the frequency of occurrence of each contractual problems is provided as, Always = 4, Often = 3, Sometimes = 2, Never = 1.

Unclear scope of work

The scope of the project is defined as the work to be done to deliver the product with the features and functions specified therefore the scope of the project must be clearly defined.

Table 4.3: Unclear scope of work-related problems mean score value

Unclear Scope of Work	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Lack of understanding the contract conditions	13	18	9	3	2.05
Incomplete scope of work	8	18	11	6	2.35
Faulty design and drawings	10	19	9	5	2.21
Inadequate description of the specification	11	13	14	5	2.30

Over or under measurement in bill of quantity	6	18	12	7	2.47
Conflicting information in drawing and bill of quantity	11	19	6	7	2.21
The omission of items in drawing and bill of quantity	8	14	15	6	2.44
Aggregate Mean	2.29				

Source: Researcher's survey, 2022

From Table 4.3, it can be referred that in GC-1 Contractor's building project compared to other unclear scopes of work-related problems there is a lower difficulty in understanding the contract conditions with a mean score value of (2.05). Meanwhile over or under measurement in the bill of quantity has got the highest mean score value of (2.47), which means that there is a great problem in properly billing the projects.

Definition of acceptance

The definition of acceptance refers to when there is a failure in the acceptance of the final project work.

Table 4.4: Definition of acceptance related problems mean score value

Definition of Acceptance	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Delay in inspection and approval of completed works	6	17	16	4	2.42
Defective and non-compliant works are not detected early	3	15	19	6	2.65
Poor information and communication channels	10	14	13	6	2.35
Poor quality assurance planning and control techniques	6	11	19	7	2.63
Inadequate annual and continual evaluations	6	13	20	4	2.51
Inefficient coordination among stakeholders	7	17	12	7	2.44
Lack of common understanding of quality control	5	13	20	5	2.58
Corrupt practices and negligence	4	18	9	12	2.67
Aggregate Mean	2.53				

Source: Researcher's survey, 2022

As observed in Table 4.4. The highest value under this contract administration problem goes to corrupt practices and negligence with a mean value of 2.67. It implies that the major problem of the definition of acceptance in the GC-1 Contractor's building project is corruption and negligence. The other mean values for the problem of definition of acceptance indicate that defective and non-compliant works are not detected early, there are deprived quality assurance planning and control techniques, there is no common understanding in quality control with a mean value 2.65, 2.63 and 2.58 respectively. Whereas the mean value of responses indicated poor information and communication with a mean value of 2.35 which is lower than all responses for other definitions of acceptance problems. This implies that there is a lower communication problem in the projects.

Change order

A change order is a work that is applied to or excluded from a contract's initial scope of operation, which changes the original contract amount and/or the date of completion.

Table 4.5: Change order related problems mean score value

Change Order	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Lack of pre-determined change control mechanisms	4	17	12	9	2.62
Sources of change and hidden charges are not recognized and defined promptly	15	9	11	7	2.24
Insufficient analysis to determine the impact of the changes	5	9	21	7	2.71
Fixing low prices and time extension for changes	6	14	10	12	2.67
Insufficient clarification and negotiations of change orders	12	10	9	11	2.45
Late notification, responses and decision making on variations and changes	8	9	20	5	2.52
Undocumented change orders and extra work	13	6	12	11	2.50
Undocumented design changes and updated specifications	12	7	14	9	2.48
Aggregate Mean					2.52

Source: Researcher's survey, 2022

To understand the occurrence of charge order related problems in the project, this study comprised the following problems which are summarized and presented in the above Table 4.6. Accordingly, insufficient analysis to determine the impact of change is the most occurring problem in the GC-1 building project with a mean value of 2.70, following fixing low price and time extension for change orders, and lack of predetermined change control mechanism with a mean value 2.67 and 2.62 respectively. On the other hand, there is a lower occurrence for not recognizing the source of change and hidden changes promptly with a mean value of 2.24.

Delay

Delays shall be considered to be delays in the completion of activities from the period specified in the contract or may be described as late completion or late commencement of activities according to the baseline schedule.

Table 4.6: Delay related problems mean score value

Delay	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Failure to give possession of site by the date stated in the contract.	2	19	10	11	2.71
Delay in preparation and delivery of drawings and specification	5	8	14	15	2.93
Unrealistic contract duration and Inaccurate time estimation	5	12	18	7	2.64
Late information and instruction supply	10	11	13	8	2.45
Difficulties in detecting causes for delay	2	14	17	9	2.79
Aggregate Mean					2.70

Source: Researcher's survey, 2022

The highest mean value from the contractual delay problem goes to delay in preparation and delivery of drawing and specification with a value of 2.93 followed by difficulties in detecting causes for the delay with the value of 2.79, unrealistic contract duration, and inaccurate time estimation with the value of 2.64. The project delay problems that occur lowest is late information and instruction supply with a mean value of 2.45.

Dispute resolution

Conflict resolution is a concept relating to a variety of procedures that can be used to settle a dispute, dispute, or argument.

Table 4.7: Dispute resolution related problems mean score value

Dispute resolution	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Lack of pre-determined dispute resolution mechanisms	8	16	10	8	2.43
Lack of awareness to notice sources for the claim	7	8	23	4	2.57
Poor communication to gather the required information to analyze a claim	9	14	10	9	2.45
Ambiguous procedures for claim examination and presentation	9	15	12	6	2.36
Aggregate Mean					2.45

Source: Researcher's survey, 2022

To recognize the occurrence of dispute resolution problems in the project, the following problems are summarized and presented in the above Table 4.6. Accordingly, there is lack of awareness to notice source for claims which letter might change and grow to dispute with a mean value of 2.57, following poor communication to gather the required information to analyze a claim, and lack of predetermined dispute resolution mechanism with a mean value 2.45 and 2.43 respectively. On the other hand, there is a lower occurrence for ambiguous procedures for claim examination and presentation with a mean value of 2.36.

Subcontractor

Subcontracting is the process of transferring or outsourcing to another entity known as a subcontractor a part of the responsibilities and duties under a contract.

Table 4.8: Subcontractor related problems mean score value

Subcontractor Issues	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Sub-contractors does not carry out and complete works in accordance with the program	6	14	17	6	2.53
Sub-contractors perform unsatisfactorily work	7	12	17	7	2.56
Misunderstanding of drawing and specification	4	17	16	6	2.56
Aggregate Mean					2.55

Source: Researcher's survey, 2022

As per table 4.8, the highest mean value from subcontract related contract administration problem goes to performing unsatisfactorily work, misunderstanding of the project drawing, and specification with the mean value of 2.56 followed by not carrying executing and completing the work in accordance to the program with the lowest mean value of 2.53.

Increased cost

Cost increase or budget overrun involves when unexpected incurred costs and these costs are more than budgeted amounts.

Table 4.9: Increased cost-related problems mean score value

Increased Cost	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
Poor project (site) cost control	10	13	15	4	2.31
Cost estimating error	14	9	17	2	2.17
Improper supervision of Increment of the foreignexchange rate and Inflation	7	13	14	8	2.55
Withhold of payment by the client	4	24	13	1	2.26
Delay in valuation and certification of interim payment	5	16	18	3	2.45
Theinaccuracyofvaluationandcertificationofworkdone	12	16	8	6	2.19
Front-loading (Assigning costs or benefits to the early stages of a contract, project, or time).	7	17	11	7	2.43
Inadequate construction project cost records	10	17	8	7	2.29
Unmanaged project cash flow records	10	10	13	9	2.50
Aggregate Mean					2.64

Source: Researcher's survey, 2022

The highest mean value from source of the increased cost goes to improper supervision of increment of the foreign exchange rate and inflation with a value of 2.55 followed by unmanaged cash flow records with a value of 2.50, delay in valuation, and certification of interim payment 2.45. The cost estimating error with a mean value of 2.17 has the lowest occurrence.

Risk of failure

The risk of failure implies a high chance of default, such as the introduction of new technologies, new equipment, new suppliers, and a tight schedule or budget limitation for the project.

Table 4.10: Risk of failure related problems mean score value

Risk of Failure	Frequency of Occurrence				Mean
	Never (1)	Some times (2)	Often (3)	Always (4)	
The project has new technology, new equipment, and a new vendor.	11	14	10	7	2.31
The project has a tight timeline	1	15	22	4	2.69
The project has Constricted Budget	2	16	19	5	2.64
Aggregate Mean					2.55

Source: Researcher's survey, 2022

Based on the mean comparison of the problems shown in table 4.10, it can be seen that the project has a tight time line is ranked first followed by budget constraint and the project is using new technology, new equipment, and new vendors with a mean value of 2.69, 2.64 and 2.31 respectively.

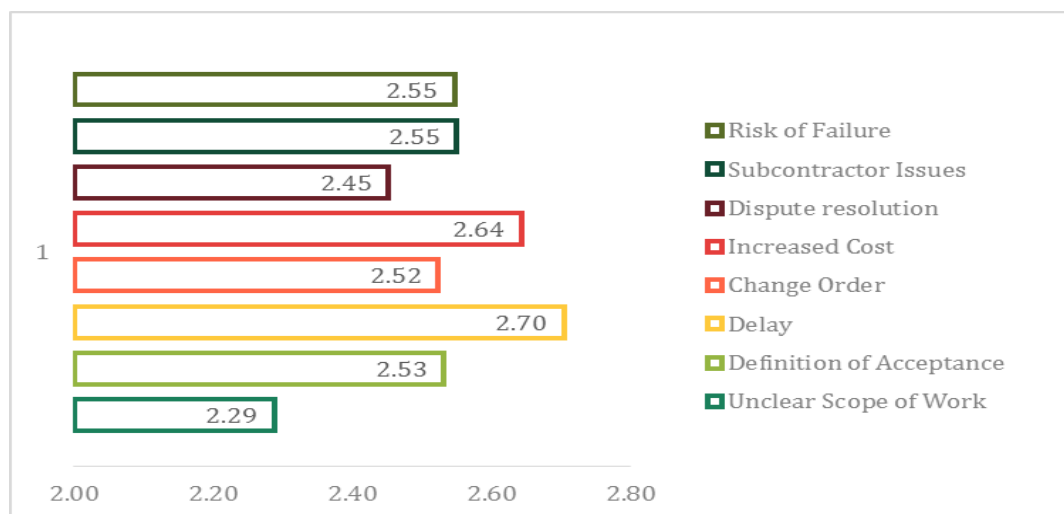


Figure 2 Figure 4.5 MSV for contract administration problems

Source Recsearcher's Survey, 2022

According to Figure 4.5, the highest mean score goes to delay which means that delay is the most occurring contractual problem, following increased cost and definition of acceptance with a mean score value of 2.64 and 2.53 respectively. On the other unclear scope of work has the lowest occurrence compared to other contract administration problems with a mean score value 2.29

4.4.2. Correlation analysis of the variables

Correlation analysis was assessed as the correlation is a base for multiple regression analysis and as correlation measures the degree of linear association between variables it is a preliminary indication that there is a relationship between the predictor and the outcome. The values of the correlation coefficient are always ranged between +1 and -1. A correlation coefficient of +1 indicates that the existence of a perfect positive association between the two variables, while a correlation coefficient of -1 indicates a perfect negative association. A correlation coefficient of zero, on the other hand, indicates the absence of relationship (association) between two variables (Brooks, 2008).

Table 4.11: Correlation analysis result of SPI and independent variable**Correlation**

Variables	-1	-2	-3	-4	-5	-6	-7	-8	-9
(1) SPI	1								
(2) USW	-0.363	1							
(3) SC	-0.335	0.044	1						
(4) DOA	-0.271	0.105	0.164	1					
(5) CO	-0.285	0.131	0.139	-0.345	1				
(6) DE	-0.381	0.093	0.087	0.388	-0.319	1			
(7) IC	-0.825	0.154	0.233	0.16	0.181	0.205	1		
(8) DR	-0.267	-0.067	0.05	0.529	0.181	0.148	0.319	1	
(9) ROF	-0.026	0.112	-0.067	0.265	-0.005	0.147	-0.079	0.232	1

Source: Researcher's computation through stata14 (2022)

Table 4.11 above shows the correlation matrix among dependent schedule performance index (SPI) and independent variables. It shows that unclear scope of work (USW), subcontractor issues (SC), the definition of acceptance (DOA), delay (DE), increased cost (IC), change order (CO), risk of failure (ROF), dispute resolution (DR) have negative correlation influence on schedule performance of building construction projects with the correlation coefficient value of - 0.363, -0.335, -0.271, -0.285, -0.381, -0.825, -0.267 and -0.112 respectively. This means any decrease/increase in these variables leads to an increase/decrease in the schedule performance of the building projects.

Table 4.12: Correlation analysis result of CPI and independent variable**Correlation**

Variables	-1	-2	-3	-4	-5	-6	-7	-8	-9
(1) CPI	1								
(2) USW	-0.366	1							
(3) SC	-0.312	0.044	1						
(4) DOA	-0.301	0.105	0.164	1					
(5) CO	-0.261	0.131	0.139	-0.345	1				
(6) DE	-0.379	0.093	0.087	0.388	-0.319	1			
(7) IC	-0.842	0.154	0.233	0.16	0.181	0.205	1		
(8) DR	-0.285	-0.067	0.05	0.529	0.181	0.148	0.319	1	
(9) ROF	-0.055	0.112	-0.067	0.265	-0.005	0.147	-0.079	0.232	1

Source: Researcher's computation through stata14 (2022)

The correlation matrix among dependent cost performance index (CPI) and independent variables as stated in Table 4.12 below indicates that unclear scope of work (USW), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), delay (DE), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) have negative correlation influence on Cost performance of building construction projects with the correlation coefficient value of -0.366, -0.312, -0.301, -0.261, -0.379 -0.842, -0.285 and -0.055 respectively. This indicates that any decrease/increase in these variables leads to an increase/decrease in the cost performance of the building projects.

According to Brooks (2008) if there is a correlation coefficient along with the independent variables is 0.8 and above, multicollinearity problems will exist. However, the correlation matrix in correlation tables revealed the absence of a strong relationship among the independent variables.

4.4.3. Regression Result and Interpretation

Multiple regression analyses were conducted to examine the influence of unclear scope of work, delay, change order, dispute, and definition of acceptance, increased cost, sub-contract, and risk of failure on cost and schedule performance of building project. Using the STATA 14 in the case of multiple regression the researcher has come to the following results:

4.4.3.1. Regression analysis of contract administration problems and projects cost performance

4.4.3.1.1. Regression Model Tests

To test the validity of the multiple regression models and for valid hypothesis testing as well as to make data available for reliable results, the test of assumption of the regression model is required. As a result, the study has gone through the most critical regression diagnostic tests consisting of Normality, Multicollinearity, Autocorrelation, Heteroskedasticity, Link model specification tests, and Ramsey omitted variable test accordingly.

Ramsey Omitted Variable Test

The Ramsey omitted variable test runs the Ramsey regression specification error test (RESET) for omitted variables. If the p-value is insignificant, say, at the 5 percent level, one can accept that the model has no omitted variables, (Gujarati, 2004).

In this study to test for omitted-variable, the researcher used the “ovtest” command. The null hypothesis is that the model does not have omitted-variables,

Ramsey RESET test using powers of the fitted values of CPI Ho: model has no omitted variables

$F(3,30) = 0.21$ Prob > F = 0.8877

Figure 4.6: Ramsey RESET test result of CPI and independent variable

Source: Stata 14 output, 2022

It is clear from the Figure above that the p-value is higher than the usual threshold of 0.05 (95% significance), so we fail to reject the null and conclude that the models have no omitted variables.

Model Specification Test

Command used to test model specification is a link test. The null hypothesis is that there is no specification problem.

Table 4.13: link test result of CPI and independent variable

Source	SS	df	MS	Number of obs = 42		
Model	0.927	2	0.463	Prob> F = 0.000		
Residual	0.135	39	0.003	R-squared = 0.873		
Total	1.062	41	0.026	Root MSE = 0.059		
CPI	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
_hat	1.173	0.798	1.47	0.149	-0.441	2.787
_hatsq	-0.076	0.351	-0.22	0.829	-0.786	0.633
_cons	-0.097	0.449	-0.22	0.831	-1.004	0.811

Source: Stata 14 output, 2022

Table 4.13 reveals that the regression model is correctly specified since the p-value of _hatsq in the model is statistically insignificant with a value of 0.829 therefore we fail to reject the null hypothesis and conclude that the models are correctly specified.

4.4.3.1.2. Diagnostic Test

In this study diagnostic tests were carried out to ensure that the data fits the basic assumptions of the classical linear regression model.

Heteroskedasticity Test

The test of heteroskedasticity is a test of an important assumption of the classical linear regression model is that the variance of each disturbance term i , conditional on the chosen values of the explanatory variables, are homoscedastic or equal (homo) spread (scedasticity), that is equal variance. (Gujarati, 2004).

A method used to detect heteroskedasticity in the study is the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity by applying the “hettest” command in Stata 14. The null hypothesis is that residuals are homoscedastic or constant variance. If the p-value is sufficiently small, that is, below the chosen significance level, then heteroskedasticity is a problem for the model otherwise heteroskedasticity is not a problem for the model. (Wooldridge. (2005).

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of CPI $\chi^2(1) = 1.82$

Prob > $\chi^2 = 0.1775$

Figure 4.7: Breusch-Pagan / Cook-Weisberg test result of CPI and independent variable

Source: Stata 14 output, 2022

As indicated in Figure 4.7 above the result from the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity indicates that there is insignificant heteroskedasticity since the P-value is greater than 1%, 5% and 10% levels of significance. Thus, there is no heteroskedasticity problem in the model

Autocorrelation Test

As noted in Brooks (2008), the test of autocorrelation is a test of that the covariance between the error terms over time is zero meaning that the errors are uncorrelated with one another. If the errors are not uncorrelated with one another, it would be stated that they are „auto correlated' or that they are „serially correlated' therefore the null is hypothesis no serial correlation. Breusch- Godfrey LM test for autocorrelation method is used to detect Autocorrelation in the study by applying the “estatbgodfrey” command in Stata 14.

Table 4.14: Breusch-Godfrey LM test result of CPI and independent variable

Breusch-Godfrey LM test for autocorrelation	df	Prob > Chi2
2.119	1	0.145

H0: no serial correlation

Source: Stata 14 output, 2022

As indicated in Table 4.14 above the result from the Breusch-Godfrey LM test for autocorrelation indicates that insignificant autocorrelation is a P-value greater than 1%, 5%, and 10% levels of significance. Thus, there is no autocorrelation problem for the model.

Normality Test

According to Gujarati. (2009) normality tests are used to determine whether a data set is well- modeled by a normal distribution or not, or to compute how likely an underlying random variable is to be normally distributed. The null hypothesis for the normality test is formulated as Error term is normallydistributed.

Shapiro-Wilk W test for normal data and Kernel density estimate to view graphically was conducted for the model to assess if is there enough evidence for non-normality to overthrow the null hypothesis of the study that the data are normally distributed.

Table 4.15: Shapiro-Wilk W test result of CPI and independent variable

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	42	0.976	0.971	-0.062	0.525

Source: Stata 14 output, 2022

Based on the results shown in the above table 4.15 the Prob< W value listed in the output are the p-value, the chosen alpha level is 0.05 and since the p-values are greater than 0.05, the null hypothesis is not rejected which indicates that the data are normally distributed.

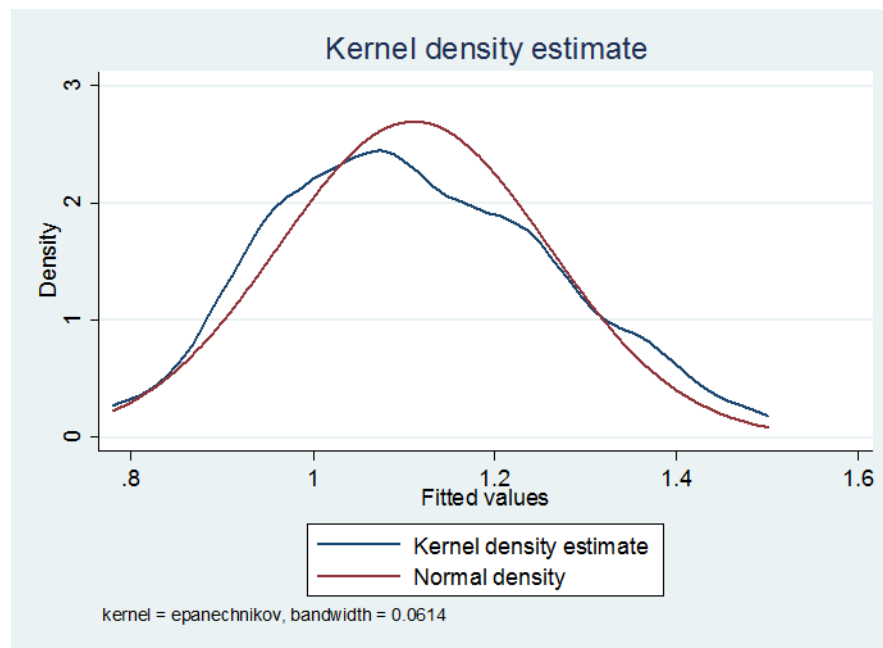


Figure 4.8: Kernel density estimate result of CPI and independent variable

Source: Researcher's Computation through Stata 14 (2014)

the Figure 4.8 below shows similarly the distribution of the population was normal. Because the curve is a bell curve that the population is normally distributed.

Multicollinearity Test

As referred by Brooks (2008), Multicollinearity problem arises when the explanatory variables are highly correlated with each other. If there is no relationship between the explanatory variables, they would be said to be orthogonal to one another. Multicollinearity is a problem that emerges when the explanatory variables are significantly associated with each other. In the model variance inflation factor (VIF) was performed to check the level of multicollinearity, according to Gujarati (2004), a VIF statistic below ten implies non- existence of severe multicollinearity problems.

Table 4.16 Variance Inflation Factor (VIF) result

<u>Variance inflationfactor</u>		
	VIF	1/VIF
DOA	2.4	.417
DR	2.106	.475
CO	1.803	.555
DE	1.325	.755
IC	1.321	.757
USW	1.18	.847
SC	1.174	.851
ROF	1.168	.856
MeanVIF	1.56	

Source: Regression output of STATA14 from survey data, 2022

In the result shown in table 4.16 above the VIF result is 1.56 this implied that there is no multicollinearity problem in the model.

4.4.3.1.3. Evaluating the model

Evaluating whether the model constructed was successful in explaining the total variation in the dependent variable cost performance of the projects. The adjusted R-square is an important measure indicating the percent of how much of the total variance is explained by the independent variable.

Table 4.17 – Model Measures

Source	SS	df	MS	Number of obs	=	42
				F(8, 33)	=	28.21
Model	.926500705	8	.115812588	Prob > F	=	0.0000
Residual	.135489833	33	.004105753	R-squared	=	0.8724
				Adj R-squared	=	0.8415
Total	1.06199054	41	.025902208	Root MSE	=	.06408

Source: Regression output of STATA14 from survey data, 2022

As indicated in Table 4.17 the adjusted R-square in the data analysis is 0.8415 which indicating the 84% of the variance in the dependent variable cost performance is explained by the independent variables. Thus, the independent variables are good predictors of the dependent variables, cost performance. The The regression model's relevance is examined with an F-statistic and the following hypotheses are formulated

Ho: the regression model does not explain a significant percentage of the variation in the construction project cost performance

Ha: the regression model explains a significant percentage of the variation in the construction project cost performance.

The regression F test results ($F = 28.21$) is significant at $p < 0.01$. Therefore, the null hypothesis is rejected. Thus, there is a provision that the regression model explains the dependent variable, construction project cost performance which answers the second research question that is; does contract administration problems have a substantial impact on a company's performance GC-1 national contractor's building construction projects within Addis Ababa,Ethiopia?

4.4.3.1.4. Interpretation of the Regression Results

The multiple regression coefficients in the tables below refer to that the influence of each contract administration problems (independent variables) on the model. The predictor variables with a higher beta coefficient and the lower p-value ($p < 0.05$) have a significant contribution to the project performance (dependent variable). Whereas, predictor variables that have the small beta coefficient and higher p-value have little or no influence on the model. This answers the third research question that is; which contract

administration problems have a significant outcome on the performance of GC-1 national contractor's building construction projects within Addis Ababa, Ethiopia?

Table 4.18 Coefficients for independent variable on project cost performance

Linear regression

CPI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
USW	-.024	.011	-2.23	.033	-.047	-.002	**
SC	-.008	.011	-0.66	.511	-.031	.016	
DOA	-.044	.017	-2.63	.013	-.077	-.01	**
CO	-.042	.012	-3.53	.001	-.066	-.018	***
DE	-.036	.011	-3.18	.003	-.06	-.013	***
IC	-.119	.012	-10.13	0	-.143	-.095	***
DR	.026	.014	1.85	.073	-.003	.055	*
ROF	-.006	.011	-0.56	.579	-.029	.016	
Constant	1.764	.067	26.16	0	1.627	1.901	***
Mean dependent var	1.110		SD dependent var		0.161		
R-squared	0.872		Number of obs		42.000		
F-test	28.207		Prob> F		0.000		
Akaike crit. (AIC)	-103.743		Bayesian crit. (BIC)		-88.104		
*** <i>p</i> <.01, ** <i>p</i> <.05, * <i>p</i> <.1							

Source: Regression output of STATA14 from survey data, 2022

The regression results have indicated that the influence of eight contract administration problems on the cost performance of building construction projects being executed by GC-1 contractors located in Addis Ababa. It is represented in table 4.18 that out of the eight contract administration problems unclear scope of work has a negative and significant influence on cost performance of the project at $p < 0.05$ level. Whereas, delay, the definition of acceptance, change order and increased cost has a negative and significant effect on cost performance of the project at $p < 0.001$ level the degree of

significance, but dispute resolution, subcontract issues and risk of failure does not have a significant effect on the project's cost performance of GC-1 national contractor's building construction projects within AddisAbaba.

From the above table of multiple regression coefficients, the following regression equations were developed:

$$Y_1 = \beta_0 + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + \beta_{17}X_{17} + \beta_{18}X_{18} + \varepsilon$$

$$Y_1 = 1.764 + -0.024X_{11} + -0.008 X_{12} + -0.044X_{13} + -0.042X_{14} + 0.036X_{15} + -0.119X_{16} + 0.026X_{17} + -0.006X_{18}$$

Y_1 = dependent variable (cost performance) $\beta_0 = 1.764$

β_{11} , β_{12} , β_{13} , β_{14} , β_{15} , β_{16} , β_{17} and β_{18} = the beta coefficient of delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively

X_{11} , X_{12} , X_{13} , X_{14} , X_{15} , X_{16} , X_{17} , and X_{18} = the predictors or independent variables (delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively.

This section reviews the relationship of the eight independent variables, delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) with cost and schedule performance of GC-1 national contractor's building construction projects within Addis Ababa, Ethiopia.

Unclear Scope of Work (USW)

As indicated in the regression result of this study on table 4.18 unclear scope of work had a negative and significant influence on the cost performance of GC-1 national contractors building construction projects within Addis Ababa. The relation is significant at a 5% significant level with a coefficient of (-0.024), this implies that when there is one percent more ambiguity in the scope of work the cost performance of the projects decreases by 2.4%.

Subcontractor issues (SC)

The regression result of this study on table 4.18 revealed that subcontractor issues had a negative but insignificant influence on cost and schedule performance of GC-1 national contractor's building construction projects and the relation is insignificant at 5% significant level with a coefficient of (-0.008). The finding of this study suggests that subcontractor issues do not have a significant influence on the cost performance of GC-1 national contractor's building construction projects since the study could not get enough statistical significance. Therefore, the researcher accepts the null hypothesis that subcontractor issues (SC) have no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa, Ethiopia

Definition of acceptance (DOA)

Regression results suggest that the definition of acceptance has a statistically significant negative influence on the cost performance of GC-1 national contractor's building construction projects with P-value 0.013 at a 5% significance level with a coefficient of (-0.044). Therefore, The null hypothesis, which claims that the definition of acceptance has no substantial impact on the performance of grade one contractors' building construction projects in Addis Ababa, is rejected. This implies that with every 1% improvement in the acceptance definition keeping other variables constant had a resulting decrease by 4.4% in cost performance of GC-1 national contractor's building construction projects

Change Order (CO)

This study's regression result on table 4.18 revealed that change order had a substantial and harmful influence cost performance of GC-1 national contractor's building construction projects. The relation is significant at 1% significant level with a coefficient of (-0.042) with P- value 0.001. Hence, The null hypothesis is rejected by the researcher that change order has no discernible impact on the success of building construction projects of grade one contractors in Addis Ababa. This suggests that when change order increased by one percentage, the cost performance of GC-1 national contractor's building construction projects decreased by 4.2%

Delay (DE)

Delay has a negative and significant influence on the cost performance of GC-1 national contractor's building construction projects within Addis Ababa. The relation is statistically significant at a 1% significant level with a coefficient of (-0.036) in determining the cost performance of GC-1 national contractor's building construction projects. There is a significant negative relationship between delay(DE) and the cost performance of GC-1 national contractor's building construction projects. Therefore, the researcher rejects the null hypothesis that delay (DE) has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa. Holding other independent variables constant, when Delay (DE) increased by one percentage, the cost performance of GC-1 national contractor's building construction projects would be decreased by 3.6 %, and statistically significant at 1% of the significance level.

Increased Cost (IC)

The regression result revealed that there is a significant negative relationship between increased cost and cost performance of GC-1 national contractor's building construction projects within Addis Ababa at a 1% significance level and with the coefficient of (-0.119). The researcher rejects the null hypothesis which states increased cost has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa.

This means, holding other independent variables constant when cost increased by one percentage, the cost performance of GC-1 national contractor's building construction projects within Addis Ababa would be decreased by 11.9%.

Dispute Resolution (DR)

The regression result of this study on Table 4.18 revealed that dispute resolution had a negative but insignificant influence on cost performance of GC-1 national contractor's building construction projects and the relation is insignificant at 5% significant level with a coefficient of (0.026) in determining on cost performance of GC-1 national contractor's building construction projects. Accordingly, the researcher accepts the null hypothesis

which states dispute resolution has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa.

Risk of Failure (ROF)

The risk of failure had a negative but insignificant influence on the cost performance of GC-1 national contractor's building construction projects and the relation is insignificant at a 5% significant level with a coefficient of (-0.006) in determining on cost performance of GC-1 national contractor's building construction projects. Accordingly, the researcher accepts the null hypothesis which states the risk of failure has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa.

4.4.3.2. Regression analysis of contract administration problems and projects schedule performance

4.4.3.2.1. Regression Model Tests

The test of multiple regression models is needed for valid hypothesis testing and to make data accessible for accurate tests. The model has therefore passed the most important diagnostic regression tests consisting of Normality, Multicollinearity, Autocorrelation, Heteroskedasticity, Link model specification tests, and Ramsey omitted variable test accordingly.

Model Specification Test

Command used to test model specification is a link test. The hypotheses used are: H_0 :

There is no specification problem

H_a : There is specification problem

When testing for model specification the probability value $\text{_hatsq} > 0.05$ indicates that there is no specification problem.

Table 4.19: link test result of SPI and independent variable

Source	SS	df	MS	Number of obs = 42		
Model	0.728	2	0.364	Prob> F = 0.000		
Residual	0.120	39	0.003	R-squared = 0.858		
Total	0.848	41	0.021	Root MSE = 0.056		
SPI	Coef.	Std.Err.	t	P>t	[95%Conf. Interval]	
_hat	1.425	0.655	2.170	0.036	0.100	2.751
_hatsq	-0.264	0.405	-0.650	0.518	-1.084	0.555
_cons	-0.166	0.261	-0.640	0.527	-0.693	0.361

Source: Stata 14 output, 2020

Table 4.19 reveals that the regression model is correctly specified since the p-value of _hatsq in the model is statistically insignificant with a value of 0.518 therefore we fail to reject the null hypothesis and conclude that the models are correctly specified.

Ramsey Omitted Variable Test

The Ramsey omitted variable test runs the Ramsey regression specification error test (RESET) for omitted variables. (Gujarati, 2004). The hypotheses used are:

H0: the model has no omitted-variables

Ha: the model has omitted-variables

Ramsey RESET test using powers of the fitted values of SPI

Ho: model has no omitted variables

F(3,30)= 0.35

Prob>F= 0.7876

Figure 4.9: Ramsey RESET test result of SPI and independent variable

Source: Stata 14 output, 2022

According to Figure 4.9 below that the p-value is higher than the usual threshold of 0.05 (95% significance), so we fail to reject the null and conclude that the models have no omitted variables.

4.4.3.2.2. Diagnostic Test

Diagnostic tests were performed to ensure that the data matched in with the basic assumptions of the classical linear regression model.

Heteroskedasticity Test

As Brooks (2008) shows, this assumption demands that the error variance be constant. When there is no continuous difference between the errors, it is assumed that the principle of homoscedasticity was violated.

H0: The variance of the error is homoscedasticity

H1: The variance of the error is heteroscedasticity

If the p-value is sufficiently small, that is, below the chosen significance level, then the variance of the error is homoscedastic.

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of SPI

chi2(1)=2.72

Prob> chi2 = 0.0993

Figure 4.10: Breusch-Pagan / Cook-Weisberg test result of SPI and independent variable

Source: Stata 14 output, 2022

As indicated in Figure 4.10 above the result from the Breusch-Pagan / Cook-Weisberg test indicates that there is insignificant heteroskedasticity since the P-value is greater than 1%, 5%, and 10% levels of significance. Thus, there is no heteroskedasticity problem in the model.

Autocorrelation Test

As noted in Brooks (2008), the test of autocorrelation is a test of that the covariance between the error terms over time is zero meaning that the errors are uncorrelated with one another. If the errors are not uncorrelated with one another, it would be stated that they are "auto correlated" or that they are "serially correlated"

H0: There is no autocorrelation.

H1: There is autocorrelation.

Table 4.20: Breusch-Godfrey LM test result of SPI and independent variable

Breusch-Godfrey LM test for autocorrelation	df	Prob>Chi2
chi2		
2.119	1	0.145

H0: no serial correlation

Source: Stata 14 output, 2022

As indicated in Table 4.20 above the result from the Breusch-Godfrey LM test indicates that insignificant autocorrelation is a P-value greater than 1%, 5%, and 10% levels of significance. Thus, there is no autocorrelation problem for the model.

Normality Test

This method is used to determine whether or not the data will usually be transmitted. To test if the residuals have natural distribution. The null hypothesis for the normality test is

formulated as Error term is normally distributed.

Shapiro-Wilk W test for normal data and Kernel density estimation was performed for the model to determine whether there is sufficient evidence of non-normality to overthrow the study's null hypothesis that the data is normally distributed.

H0: Error terms are normally distributed

Ha: Error terms are not normally distributed

When testing for normality:

Probability value $W > 0.05$ indicates that the data are normally distributed

Probability value $W < 0.05$ indicates that the data are not normally distributed

Table 4.21: Shapiro-Wilk W test result of SPI and independent variable

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
rr	42	0.956	1.804	1.246	0.106

Source: Stata 14 output, 2022

Based on the results shown in the above Table 4.21 the Prob< W value listed in the output are the p-value, the chosen alpha level is 0.05 and since the p-values are greater than 0.05, the null hypothesis is not rejected which indicates that the data are normally distributed.

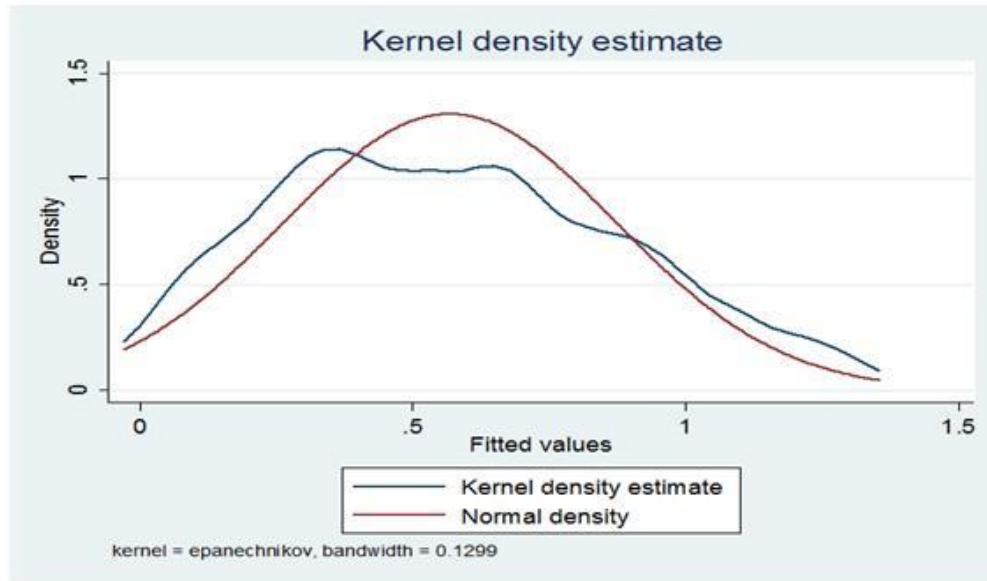


Figure 3 Figure 4.11: Kernel density estimate result of SPI and independent variable

Source: Researcher's computation through stata14 (2022)

the Figure 4.11 above shows similarly the distribution of the population was normal. Because the curve is a bell curve that the population is normally distributed.

4.4.3.2.3.Evaluating the model

Evaluating if the constructed model has been successful in describing the total variance in the dependent variable project schedule performance. The adjusted R-square is a significant measure that indicates the percentage of how much of the total variance the independent variable explains.

Table 4.22 – Model Measures

Source	SS	df	MS	Number of obs	=	42
				F(8, 33)	=	24.68
Model	.72678047	8	.090847559	Prob> F	=	0.0000
Residual	.12146721	33	.003680825	R-squared	=	0.8568
				Adj R-squared	=	0.8221
Total	.84824768	41	.020688968	Root MSE	=	.06067

Source: Regression output of STATA14 from survey data, 2022

As indicated in Table 4.22 the adjusted R-square in the data analysis is 0.8221 indicating 82% of the variance in the dependent variable schedule performance is explained by the independent variables. Thus, the independent variables are good predictors of the dependent variables.

The significance of the regression model is tested with an F-statistic and the following hypotheses are formulated

Ho: the regression model does not explain a significant percentage of the variation in the construction project schedule performance

Ha: the regression model explains a significant percentage of the variation in the construction project schedule performance.

The regression F test results ($F = 8, 33$) is significant at $p < 0.01$. Therefore, the null hypothesis is rejected. Thus, there is a provision that the regression model explains the dependent variable, construction project schedule performance which answers the second research question that is; does contract administration problems have a significant influence on the performance of GC-1 national contractor's building construction projects within Addis Ababa, Ethiopia?

4.4.3.2.4. Interpretation of the Regression Results

In the tables below, the multiple regression coefficients refer to the effect on the model of each contract administration problem (independent variables).

Table 4.23 Coefficients for independent variable on project schedule performance**Linear regression**

SPI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
USW	-.022	.01	-2.11	.043	-.043	-.001	**
SC	-.011	.011	-0.99	.328	-.033	.011	
DOA	-.035	.016	-2.26	.03	-.067	-.004	**
CO	-.041	.011	-3.64	.001	-.064	-.018	***
DE	-.036	.011	-3.37	.002	-.058	-.014	***
IC	-.102	.011	-9.14	0	-.125	-.079	***
DR	.023	.013	1.75	.089	-.004	.05	*
ROF	-.001	.01	-0.14	.889	-.023	.02	
Constant	1.377	.064	21.56	0	1.247	1.507	***
Mean dependent var	0.792		SD dependent var	0.144			
R-squared	0.857		Number of obs	42.000			
F-test	24.681		Prob> F	0.000			
Akaike crit. (AIC)	-108.332	Bayesian crit. (BIC)		-92.693			

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Regression output of STATA14 from survey data, 2022

The regression results have indicated that the influence of eight contract administration problems on the schedule performance of building construction projects being executed by GC-1 contractors located in Addis Ababa. it is represented in Table 4.23 that out of the eight contract administration problems unclear scope of work and the definition of acceptance has a negative and significant influence on schedule performance of the project at $p < 0.05$ level. Whereas, delay, change order and increased cost has a negative and significant effect on schedule performance of the project at $p < 0.001$ level the degree of significance, but dispute resolution, subcontract issues and risk of failure does not have a significant effect on the project's schedule performance of GC-1 national contractor's building construction projects within Addis Ababa.

From the above table of multiple regression coefficients, the following regression equations were developed:

$$Y_1 = \beta_0 + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + \beta_{17}X_{17} + \beta_{18}X_{18} + \varepsilon$$

$$Y_2 = 1.377 + -0.022X_{21} + -0.011X_{22} + -0.035X_{23} + -0.041X_{24} + -0.036X_{25} + -0.102X_{26} + 0.023X_{27} + -0.001X_{28}$$

Y_1 = dependent variable (schedule performance) $\beta_0 = 1.377$

$\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, \beta_{16}, \beta_{17}$ and β_{18} = the beta coefficient of delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively

$X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17}$, and X_{18} = the predictors or independent variables (delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) respectively

Unclear Scope of Work (USW)

As indicated in the regression result of this study on Table 4.23 unclear scope of work had a negative and significant influence on the cost performance of GC-1 national contractors building construction projects within Addis Ababa. The relation is significant at a 5% significant level with a coefficient of (-0.022), this implies that when there one percent increase in the ambiguity of scope of work the schedule performance of the projects decreases by 2.2%. Therefore, The null hypothesis that an unclear scope of work has no effect on the performance of building construction projects is rejected by the researcher. of grade one contractors in Addis Ababa.

Subcontractor issues (SC)

The regression result of this study in Table 4.23 revealed that subcontractor issues had a negative but insignificant influence on schedule performance of GC-1 national contractor's building construction projects and the relation is insignificant at 5% significant level with a coefficient of (-0.011). Therefore, The researcher adopts the null

hypothesis that subcontractor difficulties (SC) have no bearing on building construction project performance. of grade one contractors in AddisAbaba.

Definition of acceptance (DOA)

Regression results suggest that the definition of acceptance has a statistically significant negative association with the schedule performance of GC-1 national contractor's building construction projects with P-value 0.013 at a 5% significance level with a coefficient of (-0.035). Therefore, The null hypothesis, which claims that the definition of acceptance has no substantial impact on the performance of grade one contractors' building construction projects in Addis Ababa, is rejected. This implies that every one percent increase in the Definition of acceptance keeping other things constant had a resulting decrease in schedule performance of GC-1 national contractor's building construction projects by 3.5%.

Change Order (CO)

The regression result of this study in Table 4.23 revealed that change order had a negative and significant influence schedule performance of GC-1 national contractor's building construction projects. The relation is significant at 1% significant level with a coefficient of (-0.041) with P- value 0.001. Hence, The null hypothesis that changing order has no effect on the performance of building construction projects is rejected by the researcher. of grade one contractors in Addis Ababa, Ethiopia. This suggests that one percent change order the schedule performance of GC-1 national contractor's building construction projects decreased by 4.1%

Delay (DE)

The result of this study in Table 4.23 revealed that delay has a negative and significant influence on the schedule performance of GC-1 national contractor's building construction projects within Addis Ababa. The relation is statistically significant at a1% significant level with a coefficient of (-0.036) in determining the schedule performance of GC-1 national contractor's building construction projects. There is a significant negative relationship between delay (DE) and schedule performance of GC-1 national contractor's building construction projects. Therefore, The null hypothesis that delay (DE) has no

influence on the performance of building construction projects is rejected by the researcher. of grade one contractors in Addis Ababa. Holding other independent variables constant, when Delay (DE) increased by one percent, the cost performance of GC-1 national contractor's building construction projects would be decreased by 3.6%, at 1% of the significance level.

Increased Cost (IC)

The regression result found that higher cost has a substantial negative link with schedule performance. of GC-1 national contractor's building construction projects within Addis Ababa at a 1% significance level and with the coefficient of (-0.102). The null hypothesis, which claims that rising cost has no meaningful effect on the performance of building construction projects, is rejected by the researcher of grade one contractors in Addis Ababa. This means, additional uncontrollable variables when it comes to cost increased by one percent, schedule performance of GC-1 national contractor's building construction projects within Addis Ababa would be decreased by 10.2%

Dispute Resolution (DR)

The regression result of this study in Table 4.23 revealed that dispute resolution had a negative but insignificant influence on schedule performance of GC-1 national contractor's building construction projects and the relation is insignificant at 5% significant level with a coefficient of (0.023) in determining on cost performance of GC-1 national contractor's building construction projects. This implies that the researcher accepts the null hypothesis that dispute resolution has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa.

Risk of Failure (ROF)

Risk of failure had a negative but insignificant influence on schedule performance of GC-1 national contractor's building construction projects and the relation is insignificant at 5% significant level with a coefficient of (-0.001) in determining on cost performance of GC-1 national contractor's building construction projects and this implies that the researcher accepts the null hypothesis that risk of failure has no significant effect on the performance of building construction projects of grade one contractors in Addis Ababa

4.5. Discussion on Result

The result of this study showed that all contract administration problems (unclear scope of work, subcontractor issues, the definition of acceptance, delay, increased cost, change order, risk of failure, and dispute resolution have negative correlation influence on both cost and schedule performance of GC-1 national contractor's building construction projects. Moreover, from these problems subcontractor issues, dispute resolution, and risk of failure have no significant influence on both cost and schedule performance of GC-1 national contractor's building construction projects. The study also indicated that delay is the most occurring contract administration problems on GC-1 national contractor's building construction projects located in Addis Ababa.

According to Rendon (2009) Doran, Mansfield, and Ugwu (1994) cited by Aluonzi G., Oluka N., Nduhura A. (2016), noted that the cause for Untimely financing and delayed payment for finished works, poor contract administration, changes in site conditions, and material shortages all contribute to delays and cost overruns in Nigerian public roadways and building projects. Moreover, Alinaitwe (2007) cited by Aluonzi G., Oluka N., Nduhura A. (2016), also links the poor performance of projects to poor contract administration, citing late payments and a lack of frequent client-contractor meetings as examples and variation of prices on the study of the construction sector in Uganda. These arguments are largely according to the findings of these studies.

The findings contradict the study of Mutua M, Waiganjo E, and Oteyo N. (2014) on the impact of contract management on the execution of outsourced projects in Nairobi County, Kenya's medium manufacturing firms the survey indicated that dispute resolution mechanism is important in achieving projects success.

The finding of This is in line with Mirza M's findings., Pourzolfaghar Z., Shahnazari M. (2013) empirical evidence indicates that poor scope definition has been linked to project failure and inadequate scope definition negatively correlates to project performance, it has also been known as a significant problem and final project costs tend to be higher, increasing project time.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION

This chapter of the research presents a summary of the main component of the study, conclusions of key findings, the recommendations forwarded by the researcher, and direction for future research.

5.1. Summary of Findings

The overall objective of this study is to analyze the influence of contract administration problems in the performance of grade one contractor's building project in Addis Ababa. It is undertaken to assess the current performance of grade one contractor's building project located in Addis Ababa, to examine the extent of this problems attribution to cost and schedule performance of construction project and to identify contract administration problems which have asignificant outcome on the performance of the grade one GC's projects in Addis Ababa. The study enclosed the data of 33 grade one contractor's which are currently executing building construction projects located in Addis Ababa. To undertake the study primary data was gathered by using a structured questionnaire and 50 questionnaires were distributed to building construction projects which are undertaken by grade one contractor's and 43 questionnaires were properly filled and returned.

The performance of these 43 projects is measured using EVM specifically CPI and SPI, as shown in the result only three projects have SPI greater than one while the remaining 40 projects have SPI less than one showing that 40 projects behind the schedule. Then again 30 projects have CPI gather than one, however, 13 projects have CPI less than one that points out that these 13 projects are incurring a loss. On the other hand, out of these 43, projects, 13 have both CPI as well as SPI are less than 1.0, which indicates the projects are running behind the schedule and in a loss.

The correlation analysis is used to know the relationship between contract administration problems and the performance of grade one contractor's building project in Addis Ababa and There is a negative association, according to the findings between schedule performance of building construction projects and unclear scope of work (-0.3632), subcontractor issues (-0.3347), the definition of acceptance -(0.2714), delay (-0.2851), increased cost (-0.3808), change order (-0.8252), dispute resolution(-0.2668), risk of failure (-0.0257). Furthermore, the result showed that there is a negative correlation between cost Building construction projects' cost performance and unclear scope of work (-0.3662), subcontractor issues (-0.3116), the definition of acceptance (-0.3008), change order (-0.2613), delay (-0.3788), increased cost (-0.8418), dispute resolution(-0.2853), risk of failure (-0.0547),

Using a multivariate regression model, researchers looked into the impact of contract administration issues that were delay (DE), subcontractor issues (SC), the definition of acceptance (DOA), change order (CO), the unclear scope of work (USW), increased cost (IC), dispute resolution (DR), and risk of failure (ROF) on project performance. Besides project data that are used to calculate the projects schedule performance index (SPI) and cost performance index (CPI) were collected by applying a desk study approach from the source documents which included the contract documents, variation orders, and a progress report of grade one contractor's projects located in Addis Ababa and the outputs of the study were computed by using STATA version 14.

Multiple regression models were employed to measure the influence of contract administration problems on project performance. The coefficient of the adjusted R-sq. value is 84% and 82% which indicates that the dependent variables of cost and schedule performance of GC- 1contractor's building construction projects located in Addis Ababa were well explained by the eight independent variables that are listed in the models at $P < 0.001$ significance level. Post estimation tests were made and all the data fitted the assumptions, therefore the data was found to be homoskedastic, free of autocorrelation, free of multi-collinearity, and normally distributed, also the models are correctly specified and have no omitted variables. Finally, the regression results were presented and analyzed.

The multiple regression analysis results indicated that contract administration problems unclear scope of work ($\beta = -0.024437$, $p < 0.05$), definition of acceptance ($\beta = -0.0435441$, $p < 0.05$), change order ($\beta = -0.0419251$, $p < 0.001$), delay ($\beta = -0.0363916$, $p < 0.01$) and increased cost ($\beta = -0.1194744$, $p < 0.001$) have negative statistically significant effect on cost performance of project.

On other hand, unclear scope of work ($\beta = -0.0218402$, $p < 0.05$), definition of acceptance ($\beta = -0.0354628$, $p < 0.05$), change order ($\beta = -0.0408837$, $p < 0.001$), delay ($\beta = -0.0364631$, $p < 0.01$) and increased cost ($\beta = -0.1021004$, $p < 0.001$) has negative effect on schedule performance of project.

5.2. Conclusion

Most of the researches conducted regarding contract administration are only related to the practices of construction contract administration and management, factors affecting the contract administration and the only the consequence of the contract administration problems and contract type, as far as the knowledge of the researcher is concerned, there is no empirical research done concerning the influence of contract administration problems on project performance, which is the motivate of the researcher in filling the gap.

The goal of this study was to look into the impact of contract administration issues in the performance of grade one contractor's building project in Addis Ababa. To achieve the intended objectives the study used qualitative and quantitative approaches also cross-sectional data analysis methodology. The study use a questionnaire survey and desk study as a research instrument and used correlation analysis and OLS regression model to estimate the contribution of contract administration problems on building project performance which is measured by earned value measurement particularly cost and schedule performance index.

The analysis indicates the SPI result of three projects is greater than one is imply that these project might be accomplished before the planned date thus projects have good schedule performance while the remaining 40 projects have SPI less than one showing that they are behind the schedule and the project won't be accomplished fairly as planned.

Then again 30 projects have CPI greater than one which shows that the projects are earning a profit, however, 13 projects have CPI less than one that points out that these projects are incurring a loss. On the other hand, out of these 43 projects, 13 have both CPI as well as SPI is less than 1.0, which indicates the projects are running behind the schedule and in the loss.

According to the regression result the unclear scope of work, the definition of acceptance, change order, delay, and increased cost have a statistically significant and negative influence on cost and schedule performance of grade one contractor's building project in Addis Ababa. This conclusion indicates that any decrease/increase in the unclear scope of work, the definition of acceptance, change order, delay, and increased cost leads to an increase/decrease in cost and schedule performance of grade one contractor's building project within Addis Ababa. However, dispute resolution, subcontract issues, and risk of failure have insignificantly influence on cost and schedule performance of grade one contractor's building project within AddisAbaba.

5.3. Recommendations

Based on the findings obtained from the result of the study, the researcher forwards these recommendations.

Contract administration should be given the necessary attention by each project stakeholder. Contract administrators need to be actively engaged in administering the contracts throughout the project lifecycle to help ensure the performance of the project is adequate, stakeholders are well knowledgeable regarding the financial and schedule status of the project, and all contract requirements are met. Hence, for proper supervision and contract administration by the Engineer and to avoid any dispute and delays in contract execution the consultant must be appointed by the employer before the signing of the contract agreement with the contractor and the contractor should also institute contract administration team within their company to handle contractual issues.

Projects are unique to each during implementation also it's vital to handle contractual issues of vast and complex construction projects. However, there is a lack of trained professionals involved in the contract administration Thus it is important that the professionals involved incontract administration to be a specialized, experienced and

more coordinated effort of training professional's needs to be carried out through construction and project management courses both at the undergraduate and postgraduate levels, with an emphasis on construction law, and contract administration. For practicing professionals a regular training courses or skills development seminars need to be held frequently and there should be domestic and international experiences sharing.

It is critical to evaluate the performance of the projects starting from the contract agreement signing to every milestone of the construction projects and closely monitoring project contracts during projects implementation and inspection of deliverables to take prompt corrective measures before the contract administration problems escalated to high risk of failure and to decide whether the project is suffering too much to consider termination before it is too late.

It is essential to have a clear understanding of the scope of work before the commencement of the project as well as contracts should be approved and get signed before the work execution. Contract documents should be clear and as brief as possible, integrating impeccable contract conditions with balanced risk-sharing provisions between stakeholders. Besides, it is strongly recommended that the project designs should be based on adequate site investigation, clear and complete drawings, well-defined specifications, and performance standards that will lead to efficient contract administration and success with a proper follow-up and monitoring of project performance.

Inefficient coordination and communication among stakeholders, delay in inspection and continual evaluation of completed works also lack quality assurance planning and common understanding in quality control among stakeholders leads to not detecting defective and non-compliant works promptly which have adverse influences on the construction project performance and hence, stakeholders should have enhanced information channel and constant evaluation of completed works with adequate quality assurance mechanisms in the implementation of the project.

For the contractor to proceed with the construction work according to the schedule the employer must hand over possession of as much of the site and the means of access, thus the study recommends that the required land acquisition must be completed in advance of

contract agreement so that timely handover of the sites is made to the contractor. Furthermore, since delays in decision making and information at the contract administration phases are immense clients should work on attaining timely responses for issues forwarded from the consultant and contractor.

Contractors are recommended to develop adequate documentation and recording mechanism on the project cost and cash flow, effects of delays, variations, and events/changes during contract/project implementation and also generally improve on their record-keeping and ensure a more efficient project change management system.

5.4. Direction for the further researcher (s) and Limitations of the study

Finally, it is recommended to study and evaluate other types of construction projects for instance roads and water work construction projects which differ from the population used in this research. The limitations of the study are it does not address the consultant, client and other important stockholders perspective, moreover, the research is conducted on grade one contractors while ignoring lower grade contractors, besides because of broadens, time, financial and experience constraints the research only focus on building construction projects that are located in Addis Ababa it is recommended for future researchers to include other stockholders perspective and other grade contractor and also borderer geographical scope. Furthermore, only eight of the contract administration problem out of twelve problems developed by Davison and Wright (2004) are considered in the research, therefore it is recommended that further study can be extended by including the remaining and more problems in contract administration also by including other project performance measurement other than included in this study.

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APPENDIX A

[QUESTIONNAIRE SURVEY]



SEEK WISDOM, ELEVATE YOUR INTELLECT AND SERVE HUMANITY !

Addis Ababa University
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COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

DEPARTMENT OF PROJECT MANAGEMENT

**THE INFLUENCE OF CONTRACT ADMINISTRATION PROBLEMS IN THE
PERFORMANCE OF GRADE ONE CONTRACTORS BUILDING PROJECT
WITHIN ADDIS ABABA, ETHIOPIA**

By: WondewosenKebede

Advisor: DakitoAlemu(PhD)

A research Project Work Submitted to the school of graduate studies of
AAU in Partial Fulfillment of the Requirement for the degree of Master of
Art in Project Management

April, 2022

Addis Ababa, Ethiopia

The Purpose of the Questioner Survey:

This questioner survey is being conducted as part of the MA Project work the influence of contract administration problems in the performance of construction projects.

The information obtained through this questioner will be strictly confidential and will be used only for academic purposes. Accordingly, your open and prompt response is highly essential to fulfill the objective of this research and to address the problem.

If any further information or clarification is required, you may contact the researcher through: Phone: +251 985433638/912641628

Email: Wondewosenkebede@gmail.com

Section A - Personal and organizational profile of respondent

- 1) Name of Organization (Optional): _____
- 2) Type of Organization?
☐ Contractor ☐ Consultant
- 3) Year of establishment of the organization:
- 4) What is your gender:
☐ Female ☐ Male
- 5) Age: _____
- 6) Please indicate your highest formal academic qualification:
☐ PhD ☐ Masters ☐ Bachelor ☐ Diploma Other (please specify)
- 7) Current position in the organization: _____

Section B - General Questions

1. Are you familiar with contract administration problems?
☐ Yes ☐ No
2. Is there a contract administrator who is assigned to the project?
☐ Yes ☐ No ☐ I don't know
3. If the answer to the above question is No, then who is responsible for administering the construction contract?
Project Manager ☐ Architect ☐ Set Engineer ☐ Quantity Surveyor
Other (please specify) _____
4. Who appointed the contract administrator?
Contractor ☐ Consultant ☐ Employer (Client)
5. In your opinion, how do you consider the influence of construction oncontractadministration problems on the performance of the building project?

☐ Extremely influential	☐ Very influential	☐ Influential	☐ Slightly influential	☐ Not Influential
--	---	--------------------------------------	---	--

Section C-Contract administration problems

Instruction: You are kindly required to respond to each item in subsequent sections using the following scale by ticking the appropriate option.

The table below consists of a list of possible contract administration problems identified from various works of literature. Based on your experience what is the likely occurrence and influence of these problems in the project?

Frequency of Occurrence	Assigned weight
Always	4
often	3
Some times	2
Never	1

Contract Administration Problems	Frequency of Occurrence			
	Never (1)	Some times(2)	Often (3)	Always (4)
Unclear Scope of Work				
Lack of understanding the contract conditions				
Incomplete scope of work				
Faulty design and drawings				
Inadequate description of the specification				
Over or under measurement in Bill of Quantity				
Conflicting information in drawing and Bill of Quantity				
The omission of items in drawing and Bill of Quantity				
Definition of Acceptance				
Delay in inspection and approval of completed works				
Defective and non-compliant works are not detected early				
Poor information and communication channels				

Poor quality assurance planning and control techniques				
Inadequate annual and continual evaluations				
Inefficient coordination among stakeholders				
Lack of common understanding of quality control				
Corrupt practices and negligence				
Delay				
Failure to give possession of the site by the date stated in the contract.				
Delay in preparation and delivery of drawings and specification				
Unrealistic contract duration and Inaccurate time estimation				
Late information and instruction supply				
Difficulties in detecting causes for delay				
Change Order				
Lack of pre-determined change control mechanisms				
Sources of change and hidden charges are not recognized and defined promptly				
Insufficient analysis to determine the impact of the changes				
Fixing low prices and time extension for changes				
Insufficient clarification and negotiations of change orders				
Late notification, responses and decision making on variations and changes				
Undocumented change orders and extra work				
Undocumented design changes and updated specifications				
Increased Cost				
Poor project (site) cost control				
Cost estimating error				
Improper supervision of Increment of the foreign exchange rate and Inflation				
Withhold of payment by the client				
Delay in valuation and certification of interim payment				
The inaccuracy of valuation and certification of work done				

Front-loading (Assigning costs or benefits to the early stages of a contract, project, or time).				
Inadequate construction project cost records				
Unmanaged project cash flow records				
Dispute resolution				
Lack of pre-determined dispute resolution mechanisms				
Lack of awareness to notice sources for the claim				
Poor communication to gather the required information to analyze a claim				
Ambiguous procedures for claim examination and presentation				
Subcontractor Issues				
sub-contracts does not carry out and complete works in accordance with the program				
subcontractors perform unsatisfactorily work				
Misunderstanding of drawing and specification				
Risk of Failure				
The project has new technology, new equipment, and a new vendor.				
The project has a tight timeline				
The project has Constricted Budget				

Thank you for your cooperation and time!

APPENDIX B

[EARNED VALUE ANALYSIS RESULT]

Project ID	Contract Amount		duration		time elapsed to date	delay in days	Project Progress	Actual Cost	EV	PV	SV	SPI	CV	CPI
	initial	Rev	initial	Rev										
1	514,392,809.16		1,300		936	936	50%	258,785,321.58	257,196,404.58	370,362,822.60	(113,166,418.02)	0.69	(1,588,917.00)	0.99
2	202,718,441.98		1,300		1,613	1,613	85%	173,867,509.88	172,310,675.68	251,495,617.87	(79,184,942.18)	0.69	(1,556,834.20)	0.99
3	420,000,000.00		1000	1850	1,000	(850)	50%	163,000,000.00	210,000,000.00	227,027,027.03	(17,027,027.03)	0.93	47,000,000.00	1.29
4	2,000,000,000.00		540	1500	348	(1,152)	16%	323,000,000.00	320,000,000.00	464,000,000.00	(144,000,000.00)	0.69	(3,000,000.00)	0.99
5	130,434,782.61	491,417,587.40	720	4600	5,164	564	74%	373,560,414.70	363,649,014.67	551,669,656.81	(188,020,642.13)	0.66	(9,911,400.02)	0.97
6	798,503,069.65		575		1,440	1,440	74%	571,879,115.35	592,890,872.01	787,962,829.13	(195,071,957.12)	0.75	21,011,756.66	1.04
7	50,364,863.90		365	1000	1,092	92	77%	38,677,474.09	38,601,936.00	54,998,431.38	(16,396,495.38)	0.70	(75,538.09)	1.00
8	607,996,936.13		900	1180	408	(772)	31%	151,000,000.00	186,047,062.46	210,222,669.44	(24,175,606.99)	0.89	35,047,062.46	1.23
9	1,216,928,290.93		1116	1850	750	(1,100)	31%	358,417,839.99	377,445,737.00	493,349,307.13	(115,903,570.13)	0.77	19,027,897.01	1.05
10	2,000,000,000.00		540	1560	360	(1,200)	16%	323,000,000.00	320,000,000.00	461,538,461.54	(141,538,461.54)	0.69	(3,000,000.00)	0.99
11	94,013,442.24		720		706	706	69%	65,000,000.00	64,869,275.15	92,133,173.40	(27,263,898.25)	0.70	(130,724.85)	1.00
12	131,488,331.70	159,753,789.83	731		1,080	1,080	95%	158,890,205.35	152,309,263.23	236,024,751.06	(83,715,487.83)	0.65	(6,580,942.12)	0.96
13	111,719,767.33	154,366,732.62	540	2409	2,340	(69)	90%	108,857,801.64	139,393,159.56	149,945,269.54	(10,552,109.99)	0.93	30,535,357.92	1.28
14	1,496,915,534.28		1098		63	63	5%	61,279,496.26	74,845,776.71	85,206,940.70	(10,361,163.99)	0.88	13566280.45	1.22
15	1,135,490,490.91		1100	1300	360	(940)	14%	193,033,383.45	158,968,668.73	314,443,520.56	(155,474,851.83)	0.51	(34,064,714.72)	0.82
16	52,945,227.79		1400		1,080	1,080	69%	29,649,327.56	36,395,259.96	40,843,461.44	(4,448,201.48)	0.89	6,745,932.40	1.23
17	50,364,863.90		365	1130	1,200	70	77%	38,677,474.09	38,601,936.00	53,484,811.22	(14,882,875.22)	0.72	(75,538.09)	1.00
18	294,371,492.42		1040		104	104	8%	21,311,159.98	24,472,725.00	29,437,149.24	(4,964,424.24)	0.83	3,161,565.02	1.15
19	126,520,245.00		1095		679	679	50%	56,659,982.00	63,336,843.00	78,454,106.26	(15,117,263.26)	0.81	6,676,861.00	1.12
20	350,000,000.00		720		763	763	80%	266,000,000.00	280,000,000.00	370,902,777.78	(90,902,777.78)	0.75	14,000,000.00	1.05
21	194,713,673.13		365	610	720	110	77%	156,880,806.44	150,114,098.07	229,825,974.84	(79,711,876.77)	0.65	(6,766,708.37)	0.96
22	225,689,456.87		1678		1,220	1,220	66%	119,668,983.64	148,955,041.53	164,094,258.02	(15,139,216.49)	0.9	29,286,057.89	1.24

Project ID	Contract Amount		duration		time elapsed to date	delay in days	Project Progress	Actual Cost	EV	PV	SV	SPI	CV	CPI
	initial	Rev	initial	Rev										
23	52,945,227.79	69,697,771.79	500	1146	1,080	(66)	52%	41,297,277.68	36,395,259.96	65,683,763.99	(29,288,504.03)	0.55	(4,902,017.72)	0.88
24	39,208,454.66		565		240	240	37%	12,000,000.00	14,515,422.00	16,654,918.79	(2,139,496.79)	0.87	2,515,422.00	1.21
25	3,845,441.59		369		510	510	91%	2,985,666.44	3,484,975.05	5,314,837.97	(1,829,862.92)	0.66	499,308.61	1.17
26	28,231,763.30	31,878,097.43	300		240	240	70%	19,793,651.08	22,314,668.20	25,502,477.94	(3,187,809.74)	0.88	2,521,017.12	1.13
27	11,030,370.99		339		210	210	55%	5,007,799.79	6,066,704.04	6,832,973.18	(766,269.14)	0.89	1,058,904.25	1.21
28	38,441,275.01	71,814,783.39	230		450	220	85%	54,497,597.61	61,042,565.88	140,507,184.90	(79,464,619.02)	0.43	6,544,968.28	1.12
29	17,675,730.47		1640		1,008	-632	50%	9,142,031.64	8,837,865.23	10,864,107.51	(2,026,242.27)	0.81	(304,166.40)	0.97
30	2,975,876.37	3,484,975.05	365		377	12	74%	2,209,393.16	2,578,881.54	3,599,549.57	(1,020,668.04)	0.72	369,488.37	1.17
31	64,953,768.40	70,069,566.23	980		461	-519	32%	22,019,445.35	22,422,261.19	32,961,295.95	(10,539,034.76)	0.68	402,815.85	1.02
32	16,805,659.99	21,908,485.76	706		450	-256	31%	7,299,518.88	6,791,630.58	13,964,332.28	(7,172,701.70)	0.49	(507,888.30)	0.93
33	4,461,343.42	6,683,674.28	180		169	-11	69%	2,651,284.97	4,611,735.25	6,275,227.52	(1,663,492.26)	0.73	1,960,450.28	1.74
34	1,621,800.66		180		156	-24	80%	1,045,568.40	1,297,440.53	1,405,560.57	(108,120.04)	0.92	251,872.13	.24
35	5,395,168.39	6,101,525.28	570		570	0	46%	3,292,973.24	2,806,701.63	6,101,525.28	(3,294,823.65)	0.46	(486,271.61)	0.85
36	16,411,046.55		510		329	-181	75%	9,157,712.72	12,308,284.91	10,586,733.95	1,721,550.96	1.16	3,150,572.19	1.34
37	5,654,654.90		240		111	-129	54%	2,147,639.95	3,053,513.65	2,615,277.89	438,235.75	1.17	905,873.69	1.42
38	3,919,239.27		180		61	-119	25%	962,360.61	979,809.82	1,328,186.64	(348,376.82)	0.74	17,449.21	1.02
39	23,365,710.08		420		420	0	68%	15,357,596.00	15,888,682.85	23,365,710.08	(7,477,027.23)	0.68	531,086.85	1.03
40	30,206,871.85		240		270	30	96%	27,240,349.04	28,978,930.58	33,982,730.83	(5,003,800.25)	0.85	1,738,581.55	1.06
41	1,571,962.80		120		120	0	95%	1,351,840.49	1,497,443.35	1,571,962.80	(74,519.45)	0.95	145,602.86	1.11
42	5,324,197.90		450		470	20	85%	6,388,179.48	4,523,227.62	5,560,828.91	(1,037,601.29)	0.81	(1,864,951.86)	0.71
43	63,720,592.26		540		360	-180	56%	31,860,296.13	35,683,531.67	42,480,394.84	(6,796,863.17)	0.84	3,823,235.54	1.12

APPENDIX C

[STATA OUTPUTS]

Correlation Analysis

	CPI	USW	SC	DOA	CO	DE	IC	DR	ROF
CPI	1.0000								
USW	-0.3662	1.0000							
SC	-0.3116	0.0443	1.0000						
DOA	-0.3008	0.1049	0.1641	1.0000					
CO	-0.2613	0.1313	0.1391	-0.3451	1.0000				
DE	-0.3788	0.0929	0.0872	0.3875	-0.3189	1.0000			
IC	-0.8418	0.1542	0.2328	0.1602	0.1811	0.2045	1.0000		
DR	-0.2853	-0.0673	0.0496	0.5286	0.1807	0.1483	0.3185	1.0000	
ROF	-0.0547	0.1119	-0.0670	0.2648	-0.0052	0.1466	-0.0788	0.2320	1.0000

(obs=4
2)

	SPI	USW	SC	DOA	CO	DE	IC	DR	ROF
SPI	1.0000								
USW	-0.3632	1.0000							
SC	-0.3347	0.0443	1.0000						
DOA	-0.2714	0.1049	0.1641	1.0000					
CO	-0.2851	0.1313	0.1391	-0.3451	1.0000				
DE	-0.3808	0.0929	0.0872	0.3875	-0.3189	1.0000			
IC	-0.8252	0.1542	0.2328	0.1602	0.1811	0.2045	1.0000		
DR	-0.2668	-0.0673	0.0496	0.5286	0.1807	0.1483	0.3185	1.0000	
ROF	-0.0257	0.1119	-0.0670	0.2648	-0.0052	0.1466	-0.0788	0.2320	1.0000

Multiple Regression Analysis

```
. reg CPI USW SC DOA CO DE IC DRROF
```

Source	SS	df	MS	Numberofobs=	42
Model	.926500705	8	.115812588	F(8, 33)=	28.21
Residual	.135489833	33	.004105753	Prob>F =	0.0000
				R-squared =	0.8724
				Adj R-squared =	0.8415
Total	1.06199054	41	.025902208	RootMSE	= .06408

CPI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
USW	-.024437	.0109504	-2.23	0.033	-.0467158 -.0021582
SC	-.0075743	.0113941	-0.66	0.511	-.0307558 .0156072
DOA	-.0435441	.0165431	-2.63	0.013	-.0772013 -.009887
CO	-.0419251	.0118771	-3.53	0.001	-.0660893 -.0177609
DE	-.0363916	.0114319	-3.18	0.003	-.05965 -.0131332
IC	-.1194744	.0117946	-10.13	0.000	-.1434708 -.095478
DR	.0260103	.0140452	1.85	0.073	-.0025648 .0545854
ROF	-.006159	.0110005	-0.56	0.579	-.0285396 .0162217
_cons	1.763949	.0674368	26.16	0.000	1.626748 1.90115

```
. reg SPI USW SC DOA CO DE IC DRROF
```

Source	SS	df	MS	Numberofobs	=42
Model	.72678047	8	.090847559	F(8,33) =	24.68
Residual	.12146721	33	.003680825	Prob>F =	0.0000
				R-squared =	0.8568
				Adj R-squared=	0.8221
Total	.84824768	41	.020688968	RootMSE =	.06067

SPI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
USW	-.0218402	.0103683	-2.11	0.043	-.0429347 -.0007457
SC	-.0107223	.0107884	-0.99	0.328	-.0326715 .0112268
DOA	-.0354628	.0156636	-2.26	0.030	-.0673307 -.0035949
CO	-.0408837	.0112457	-3.64	0.001	-.0637633 -.0180041
DE	-.0364631	.0108242	-3.37	0.002	-.0584851 -.0144411
IC	-.1021004	.0111676	-9.14	0.000	-.1248211 -.0793797
DR	.0233018	.0132985	1.75	0.089	-.0037542 .0503579
ROF	-.001469	.0104157	-0.14	0.889	-.0226598 .0197219
_cons	1.376849	.0638518	21.56	0.000	1.246941 1.506756

Regression Model Tests

Link Test

. linktest

Source	SS	df	MS	Number of obs	=	42
Model	.728089889	2	.364044944	F(2, 39)	=	118.16
Residual	.120157792	39	.003080969	Prob > F	=	0.0000
				R-squared	=	0.8583
				Adj R-squared	=	0.8511
Total	.84824768	41	.020688968	Root MSE	=	.05551

SPI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	1.425079	.6552836	2.17	0.036	.0996431	2.750516
_hatsq	-.2641748	.405225	-0.65	0.518	-1.08382	.5554701
_cons	-.1663835	.2605172	-0.64	0.527	-.6933293	.3605623

. linktest

Source	SS	df	MS	Number of obs	=	42
Model	.728089889	2	.364044944	F(2, 39)	=	118.16
Residual	.120157792	39	.003080969	Prob > F	=	0.0000
				R-squared	=	0.8583
				Adj R-squared	=	0.8511
Total	.84824768	41	.020688968	Root MSE	=	.05551

SPI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	1.425079	.6552836	2.17	0.036	.0996431	2.750516
_hatsq	-.2641748	.405225	-0.65	0.518	-1.08382	.5554701
_cons	-.1663835	.2605172	-0.64	0.527	-.6933293	.3605623

Ramsey Omitted Variable Test

.ovtest

Ramsey RESET test using powers of the fitted values of CPI

Ho: model has no omitted variables

$F(3, 30) = 0.21$

Prob> F = 0.8877

. ovtest

Ramsey RESET test using powers of the fitted values of SPI

Ho: model has no omitted variables

$F(3,30) = 0.35$

Prob>F= 0.7876

Diagnostic Test

Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance

Variables: fitted values of CPI

$\chi^2(1) = 1.82$

Prob> $\chi^2 = 0.1775$

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance

Variables: fitted values of SPI

$\chi^2(1) = 2.72$

Prob> $\chi^2 = 0.0993$

Breusch-Godfrey LM Test for Autocorrelation

```
. estat bgodfrey
```

Breusch-Godfrey LM test for autocorrelation

lags (p)	chi2	df	Prob > chi2
1	2.119	1	0.1454

H0: no serial correlation

```
. estat bgodfrey
```

Breusch-Godfrey LM test for autocorrelation

lags (p)	chi2	df	Prob > chi2
1	1.150	1	0.2837

H0: no serial correlation

Shapiro-Wilk W test for Normal Data

```
. swilk r
```

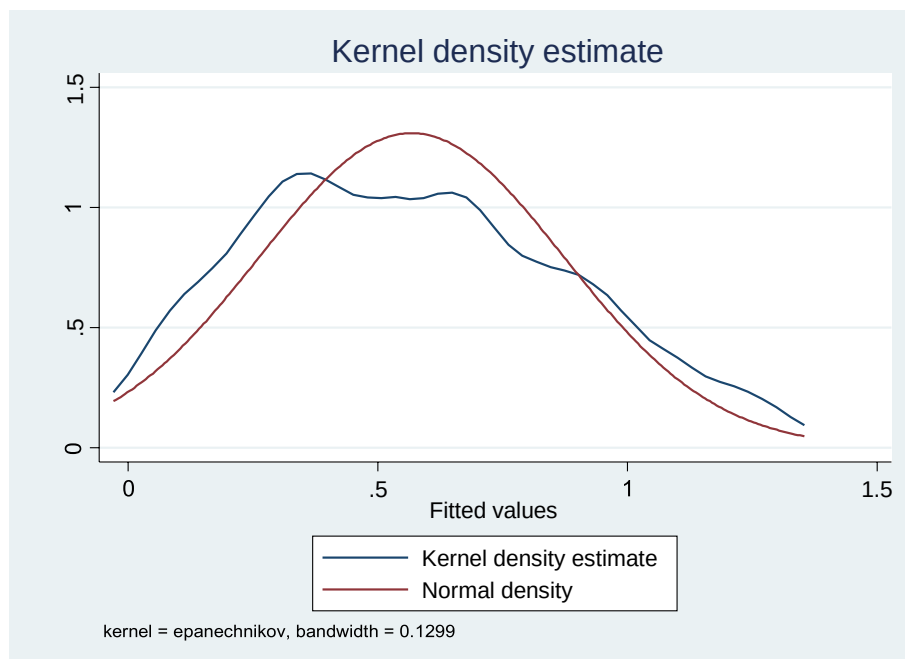
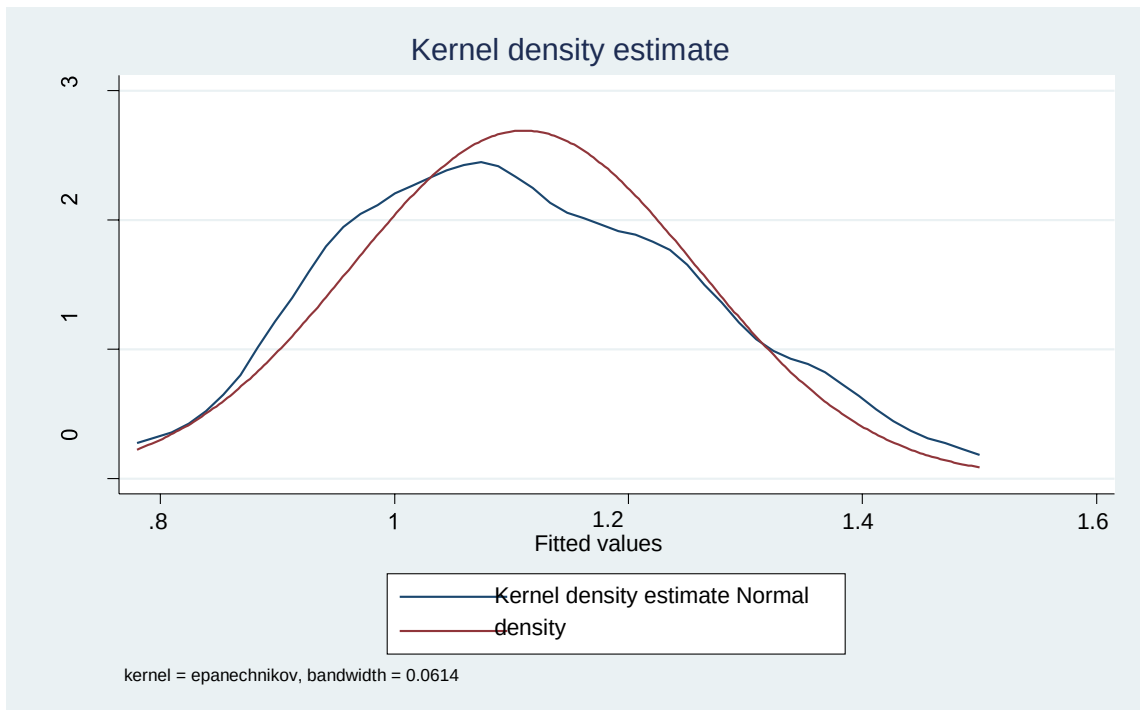
Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	42	0.97635	0.971	-0.062	0.52489

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
rr	42	0.95604	1.804	1.246	0.10642

Kernel Density Estimate



Variance Inflation Factor (VIF) for Multicollinearity Test

```
. vif
```

Variable	VIF	1/VIF
DOA	2.40	0.416733
DR	2.11	0.474825
CO	1.80	0.554636
DE	1.32	0.754854
IC	1.32	0.757223
USW	1.18	0.847416
SC	1.17	0.851447
ROF	1.17	0.856378
Mean VIF	1.56	