ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

"THE EFFECT OF PRICE ESCALATION ON THE SUCCESS OF BUILDING CONSTRUCTION PROJECTS OF ADDIS ABABA; THE CASE OF PROJECTS PERFORMED BY GRADE-1 CONTRACTORS"

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JUNE 2024

ADDIS ABABA, ETHIOPIA

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ASSESSMENT OF CLAIM AND ITS IMPACT IN BUILDING CONSTRUCTION PROJECTS IN ADDIS ABABA: IN SELECTED GRADE 1 CONTRACTORS

By: Brook Beksissa

Advisor: Wasihun Mohammed (PhD)

A RESEARCH PROJECT WORK SUBMITTED TO SCHOOL OF COMMERCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS DEGREE IN PROJECT MANAGEMENT

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Declaration

I, the undersigned, hereby declare that this thesis entitled "**The effect of Price Escalation on the success of Building Construction projects of Addis Ababa; the case of projects performed by Grade-1 Contractors**" is my original work and that all sources of materials used for this study have been identified and acknowledged as complete references. This research study has not been previously submitted in full or partial fulfillment for a degree in this or any other recognized educational institution. This research study is being submitted in partial fulfillment of the requirement for Master of Arts in Project Management.

Author	**Date**	**Signature**
Brook Beksissa	_____	_____

STATEMENT OF CERTIFICATE

This is to certify that Brook Beksissa has completed his project work entitled "**The effect of Price Escalation on the success of Building Construction projects of Addis Ababa; the case of projects performed by Grade-1 Contractors**". In my opinion, his project is appropriate to be submitted as a partial fulfillment of the requirements for the award of Degree in Masters of Project Management.

Research Advisor	**Signature**	**Date**
Wasihun Mohammed (PhD)	_____	_____

ADDIS ABABA UNIVERSITY
SCHOOL OF COMMERCE
DEPARTEMENT OF PROJECT MANAGEMENT

THE EFFECT OF PRICE ESCALATION ON THE SUCCESS OF BUILDING CONSTRUCTION PROJECTS OF ADDIS ABABA; THE CASE OF PROJECTS PERFORMED BY GRADE-1 CONTRACTORS

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Abstract

The research aimed at studying the effect of price escalation on the success of building construction projects in Addis Ababa. Additionally, the research attempts to show that price escalation is regarded as a critical success factor in the building construction companies. 10 building construction companies in the capacity of Grade-1has been considered for this study. Other grades have not been considered due to time and cost limitations. A quantitative approach was used in this research. Questionnaire was developed based on the internal and external causes of price escalation to study the effect of the price escalation on the success criteria of the building projects performed by the respective companies. A descriptive analysis indicates that price escalation is a significant challenge faced by most construction firms, with 94% of firms encountering issues related to price escalation in their building construction projects. The application of price adjustment requires careful consideration and negotiation to ensure they are fair and reasonable for all parties involved has taken the highest score with mean of 4.40 and standard deviation of 0.605 on a 5 point Likert scale from a total of 67 responses. A correlation analysis reveals that there is a strong and positive relationship between the price escalation and project success criteria. A regression analysis found that project schedule change, poor estimation, fluctuation in money exchange rate and increase in global demand of construction materials have significant contribution to the project success criteria. The study concludes that construction firms need to focus on improving cost estimation, planning and scheduling processes, and managing external factors like material costs and exchange rates in order to mitigate the negative effects of price escalation on project success. Careful consideration and negotiation of price adjustment mechanisms is also crucial.

Key Words: Price escalation, project success, Building Construction, Addis Ababa

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Table of Contents

List of Tables

List of Figures

List of Abbreviation

GDP - Gross Domestic Product

PMI- Project Management Institute

KPMG- Klynveld Peat Marwick Goerdeler

CII- Construction Industry Institute

CPI- Consumer Price Index

PPI- Producer Price Index

ROI- Return on Investment

FIDIC- Fédération Internationale Des Ingénieurs-Conseils(International Federation of Consulting Engineers)

FPPA- Federal Public Procurement Agency

GCC- General Conditions of Contract

SCC- Special Conditions of Contract

BIM- Building Information Modeling

SNNPRS- Southern Nations, Nationalities, and Peoples' Region

MRA- Mean Response Analysis

AADCB- Addis Ababa Design and Construction Works Bureau

IBM- International Business Machines Corporation

SPSS- Statistical Package for the Social Sciences

CHAPTER ONE-INTRODUCTION

1.1 Background of the study

The construction industry is a multifaceted sector that encompasses the planning, design, and execution of various projects, ranging from residential buildings to large-scale infrastructure developments. It plays a crucial role in driving economic growth, creating jobs, and shaping the built environment. According to the World Economic Forum, the construction industry accounts for more than 8% of global GDP in developing countries and is a significant contributor to overall economic activity. Agenda, I. (2016)

The construction industry in Ethiopia is a vital sector that contributes to the country's economic development and infrastructure growth. With a focus on both residential and commercial projects, as well as large-scale infrastructure developments, the construction industry plays a key role in providing employment opportunities and driving economic progress. According to a report by the African Development Bank Group, the construction industry in Ethiopia has been experiencing significant growth in recent years, supported by government investments in infrastructure projects. This growth has also attracted foreign investment and expertise, further enhancing the industry's capabilities and capacity.

Building construction projects in Ethiopia play a significant role in the country's economic development and urban transformation. With a growing population and increasing urbanization, there is a high demand for residential, commercial, and infrastructure developments in Ethiopia.

Cost plays a significant role in building construction projects in Ethiopia, as it directly influences the success and viability of these endeavours. Effective cost management is crucial to ensure that projects are completed within budget and on schedule. Cost overruns can lead to financial strain, delays, and potential project failure. Therefore, accurate cost estimation, budgeting, and cost control are essential for the successful delivery of construction projects in Ethiopia.

Construction project success in Ethiopia is influenced by various factors such as political stability, economic conditions, availability of skilled labor, quality of infrastructure, and government regulations. A study by Gebrehiwot T. et al. (2016) found that factors such as poor project planning, inadequate budget allocation, and delays in obtaining necessary permits can significantly effect the success of construction projects in Ethiopia. Additionally, the lacks of access to financing and limited technological capabilities have been identified as

key challenges facing the construction industry in the country. Addressing these factors is crucial for improving the overall success rate of construction projects in Ethiopia. Price escalation is also one of the factors that affect the project success factors and appear to hinder the completion of construction and cause delays in delivering projects.

The effect of price in building construction projects in Ethiopia is significant, as the country has experienced price escalation in materials, labor, and equipment costs over the years. This has been attributed to factors such as inflation, currency devaluation, and supply chain disruptions. Price escalation can lead to cost overruns, delays in project completion, and financial challenges for contractors and developers.

According to a study by Abera et al., (2019), price escalation in construction materials such as cement, steel, and aggregate has been a major concern in Ethiopia, affecting the overall project costs and profitability. The study highlights the need for effective cost management strategies and risk mitigation measures to address price volatility and ensure project success.

In conclusion, price escalation in building construction projects in Ethiopia can have a significant effect on project outcomes and stakeholders' financial well-being. It is essential for industry professionals to monitor price trends, implement cost-effective strategies, and adapt to market conditions to mitigate the effect of price fluctuations on construction projects.

This research focus on identifying one of the construction project success factors which is price escalation so that it will help improving the success rate of the future construction projects. This research has been conducted on Projects performed by Grade-1 Contractors to show different effects of price escalation.

1.2 Statement of the problems

Construction projects have problems with construction techniques and management as well as limitation of funds and time. The critical problems are inability to complete the projects on schedule, low quality work and cost overrun. In general, most (if not all), construction projects experience time overrun and cost overruns during their execution phase. An examination of the records of more than four thousand construction projects by Morris, P. W. et al., (1987), showed that projects were rarely finished on time or within the allocated budget. Price escalation in construction projects poses a significant challenge to achieving project success, as it can lead to cost overruns and delays in project completion.

According to the study conducted by Alemu, et al, (2018), addressing the issue of price escalation in building construction requires careful monitoring of market trends, proactive cost management strategies, effective project planning, and collaboration among stakeholders to mitigate the effect of rising costs on construction projects. Effective cost management practices are essential to mitigate these risks (Price escalation) and ensure project success.

1.3 Research questions

This section encompasses questions that the researcher wants to ask to shape the study. These are:

1. How does the price escalation affect the success of building construction projects in Ethiopia?
2. What is recommended for tackling the effect of price escalation in the success of building construction projects in Ethiopia?
3. What strategies can be implemented to mitigate the effect of price escalation in the success of building construction projects in Ethiopia?
4. How effective is the price escalation management practice on the success of the building construction projects in Ethiopia?

1.4 Objectives of the study

In line with the problem stated and the research questions described above, the following are the objectives of the study.

1.4.1 General objectives of the study

The aim of this research is to measure the effects of price escalation on the success of building construction projects in the Addis Ababa; in case of projects performed by Grade-1 Contractors.

1.4.2 Specific objective of the study

1. To determine the level of effect of price escalation on the success of building construction projects in Ethiopia
2. To measure the challenges in managing the effect of price escalation on the success of building construction projects Ethiopia
3. To measure the current mitigating practice of price escalation risks on the success of building construction projects in Ethiopia
4. Developing recommendations for managing price escalation risks in future construction projects.

5. To measure the applicability of price adjustment in the Contractual clauses of the building construction projects in Ethiopia

1.5 Significance of the Study

Construction industry is based on majorly on the three constraints, those being cost, quality and time. Any project must meet these three requirements in order for it to be successful and satisfy all stakeholders. Price escalation affects the completion of time by increasing the cost of the project. That being said price escalation has a negative effect on projects and its management, especially here in Ethiopia, makes the problem even worse. Poor management of price escalation and the inadequate ways to mitigate price escalation is affecting the industry and the economy of the country. Moreover, the finding of this study will be advantageous to the stakeholders including researchers will be assistance academicians in enlargement of the prospectus with respect to this study hence providing a deeper understanding of the determinant effects that affect project success. Overall, a study on price escalation in building construction projects can provide valuable insights that can help improve project outcomes, enhance industry practices, and contribute to the overall efficiency and effectiveness of construction projects.

1.6 Scope and Limitations of the research

1.6.1 Scope of the study

The notion of price escalation in construction projects is so broad that it cannot be restricted to a company's building projects alone. This research has limited to building construction projects performed by Grade-1 Contractors in the industry.

Methodological scope: The researcher has using explanatory research design and quantitative research method statistical analysis. Questionnaire and document review was used for the study.

Geographic Scope: The projects conducted in Addis Ababa was considered for the study.

1.6.2 Potential limitations of the study

It would be possible to do additional research with a different focus on construction firms other than the ones chosen for this study, as well as on other construction projects like building roads or bridges. Time constraints are another issue with this paper. This was an effect on the quality of data collection.

1.7 Organization of the study

This research has been organized in to five chapters. Chapter one will be introduced the topic, presented a background to the study, put forward a problem statement, enumerated the research objectives and questions, will be discussed the significance of the study to the various stakeholders, exposed the scope of the study, limitations and organization of the chapters making up the study.

Chapter Two will review present literature and preceding studies relating to the subject. The chapter will be compared the findings and theoretical keystones of other studies and assessed their correlations to this study. The study will consider other literary works, textbooks, journals, reviewed web articles, and other reliable sources of data.

Chapter Three will present the methodology used in undertaking the study. The chapter will take an in-depth look into research design, research population, the data collection, method of data analysis, sample and sampling technique will be discussed.

Chapter Four will analyze the data collected and discussions of the study. The chapter will give a detailed presentation of the collated data, analysis of the data and a discussion of the findings.

Chapter Five will present a summary of the research findings, itemizing all the findings made under the various research objectives and making recommendation based on the findings obtained. The recommendations were mostly geared towards the management and staff of the selected work units. The conclusion of the study put the entire study into perspective and summed up the theme, findings and the directions for future studies.

CHAPTER TWO-LITERATURE REVIEW

This chapter presents a literature review of the research work that was done by various scholars in the field of price escalation and success of construction projects. This includes theoretical review, conceptual frame work and empirical review of literature relevant to the study and summary.

2.1. Theoretical review

2.1.1 The Theory of Price

Price: In the realm of commerce, price refers to the financial compensation that is obligatory or anticipated in return for the acquisition of a particular product or service. It represents the valuation assigned by the seller to a given commodity or facility, and it denotes the monetary sum that customers are willing to offer in order to obtain said item. The determination of prices is contingent upon a range of influential factors, including but not limited to the interplay between supply and demand, the costs incurred during production, the level of competition within the market, and the prevailing conditions of the economic landscape. According to Investopedia 2021, price is the amount of money that a buyer pays to acquire a product or service from a seller. It is determined by factors such as production costs, competition, demand, and market conditions. Prices play a crucial role in the economy as they influence consumer behavior, production decisions, and overall market dynamics.

Price in Construction: In the construction industry, the price refers to the total cost that a client or customer pays for a construction project or service. This cost includes materials, labor, equipment, permits, overhead, and profit margins for the contractor. Prices in construction can vary significantly depending on factors such as project size, complexity, location, materials used, and labor costs (Michael Stone 2019).

Price Escalation: Price escalation refers to the increase in the cost of a construction project over time due to factors such as inflation, changes in material costs, labor cost increases, or unexpected delays. This can result in the final price of the project being higher than initially estimated. Price escalation is a common challenge in the construction industry and can effect project budgets and timelines (Michael J. Kerner January 2021).

Price escalation in construction projects refers to the phenomenon where the cost of building materials, labor, and other project-related expenses increase over time, leading to higher overall project costs. This can be influenced by factors such as inflation, changes in market conditions, fluctuations in commodity prices, and unexpected delays or disruptions.

One way to address price escalation is through the use of escalation clauses in construction contracts, which allow for adjustments to the contract price based on specific predetermined factors. By including these clauses, contractors and owners can mitigate the risk of cost overruns and better manage the effect of price fluctuations (Michael J. Kerner 2021).

According to Investopedia 2021, price escalation can be caused by a variety of factors, including:

1. Inflation: When an economy's general price level rises, so do the costs of goods and services, resulting in price escalation.

2. Supply chain disruptions: Natural catastrophes, geopolitical crises, and transportation challenges can all disrupt the supply chain, resulting in shortages of goods and services and higher pricing.

3. Increased demand: When demand for a product or service exceeds supply, prices tend to rise since sellers can charge more due to the item's scarcity.

4. Changes in input costs: Fluctuations in the cost of raw materials, labor, or other inputs can affect the final price of a product or service, causing price escalation.

5. Government policies: Government rules, taxes, tariffs, or subsidies can also influence pricing, contributing to price escalation.

Project Cost Escalation: Project cost escalation in construction is the process in which the starting budget for a construction project increases over time. This escalation can occur owing to several variables such as inflation, changes in material prices, variations in labor costs, unanticipated delays, and scope modifications.

Inflation has a substantial effect on project cost escalation since it raises the prices of materials, equipment, and labor over time. Furthermore, changes in market conditions and global economic considerations might cause volatility in material pricing, which contributes to cost increases.

Overall, project cost inflation is a serious concern for construction projects, affecting budgets, deadlines, and profitability. Effective cost management tactics, meticulous planning, and proactive risk mitigation are critical for minimizing the effect of cost increases and ensuring project success.

Factors Driving Cost Escalation:

Cost escalation in construction is driven by various factors, each contributing to the overall increase in project expenses. One of the primary drivers is inflation, which effects the prices of materials, labor, and equipment over time. Fluctuations in the economy, changes in currency values, and shifts in market demand all influence inflation rates, consequently affecting construction costs.

Cost escalation in construction is influenced by a variety of causes, each of which contributes to the overall increase in project costs. Inflation is a major factor, influencing the pricing of materials, labor, and equipment over time. Inflation rates are influenced by economic fluctuations, currency value changes, and alterations in market demand, all of which have an effect on construction prices.

Labor costs frequently contribute to cost inflation, with factors such as labor shortages, salary hikes, and changes in labor legislation influencing building prices. Skilled labor shortages can raise wages, resulting in increased labor costs for construction projects.

Additionally, changes in project scope or design modifications can lead to additional costs. As project requirements move up, adjustments to plans and specifications may be necessary, resulting in increased material, labor, and overhead expenses (Brandonme 2024).

2.1.2 Construction project success

Construction project success can be measured by various factors, as indicated in the Project Management Institute's (PMI) definition of project success. The PMI defines project success as achieving the project objectives within the constraints of time, cost, scope, and quality. Successful construction projects are completed on time, within budget, and meet the required quality standards. This definition is widely accepted in the project management field and serves as a reference point for evaluating the success of construction projects.

2.1.3 Construction Projects and its success rate

The success rate of construction projects varies depending on several factors, including project size, complexity, budget, timing, and team experience. However, according to industry surveys, the success rate of building projects is often lower than in other industries.

One study by McKinsey & Company found that large construction projects typically take 20% longer to finish than scheduled and are up to 80% over budget. Another study by KPMG

found that only 31% of construction projects came within 10% of the original budget and only 25% were completed on time.

Effective project management, good communication among all stakeholders, proper planning and risk management, qualified and experienced project team members, and adherence to safety rules and quality standards can all help a construction project succeed.

Overall, successful construction projects involve meticulous planning, clear communication, and proactive management to guarantee that they are completed on time, under budget, and to the satisfaction of all stakeholders.

2.1.4 The effect of Price escalation in the project success

Price escalation is a common challenge in construction projects and can significantly effect project success. According to a report by Dodge Data & Analytics, construction costs have been rising at a rate higher than inflation in recent years. The report found that construction costs increased by 5% in 2018 and were expected to rise by 4.8% in 2019.

Price increases can cause budget overruns, delays, and potential disagreements among project stakeholders. To limit the effect of price inflation, construction project teams must closely monitor costs, conduct extensive risk assessments, and apply effective pricing management measures. Effective cost control and proactive risk management can help to reduce the effect of price increases on project success.

Price escalation can have a significant effect on the success of a construction project. According to a study by the Construction Industry Institute (CII) titled "Cost Escalation in Construction Projects", price escalation can lead to budget overruns, delayed completion, disputes and claims, and effect on ROI. To mitigate the effects of price escalation and ensure project success, construction project teams must conduct thorough cost estimation and risk assessments, monitor costs throughout the project lifecycle, implement price escalation mitigation strategies, and maintain open communication and collaboration among project stakeholders.

Price escalation can have a significant effect on the success of a construction project. Here are some ways in which price escalation can affect project success:

1. Budget Overruns: This might put a strain on project funds, resulting in completion delays or quality sacrifices.

2. Delayed Completion: If building costs rise, contractors may have to renegotiate contracts, obtain alternative materials, or change construction timetables. These adjustments might cause delays in project completion, effecting overall project deadlines and potentially incurring additional expenses.

3. Disputes and Claims: Price increases can lead to disagreements among project stakeholders, including owners, contractors, and subcontractors. Disagreements about cost increases, responsibility for absorbing additional expenditures, or payment delays can result in claims and legal issues, affecting project success.

4. Effect on ROI: Increased prices can have an effect on a building project's return on investment (ROI). Higher construction costs may diminish profit margins or raise financing requirements, affecting the project's financial sustainability.

To ensure project success in the face of price escalation, it is important for construction project teams to:

- Conduct a detailed cost estimation and risk assessments at the start of the project.

- Monitor costs throughout the project lifespan and alter budgets and schedules as necessary.

- Implement techniques to reduce price escalation risks, such as employing fixed-price contracts, hedging against material price variations, or setting up contingency funds.

- Maintain open communication and collaboration between project stakeholders to address cost issues proactively and resolve disputes quickly.

By actively controlling price escalation risks and executing efficient cost control methods, construction projects can minimize the effect of cost rises and raise their chances of success.

2.1.5 Models related to Price escalation

2.1.5.1 Cost-Plus Pricing Model

This model involves adding a percentage markup to the actual cost of the project, which covers the contractor's overhead and profit. However, this model can lead to price escalation if the actual costs exceed the initial estimates (H. Perry Horton, Jr. 2004).

2.1.5.2 Fixed-Price Contract

In this model, the contractor agrees to complete the project for a fixed price. However, if there are unforeseen circumstances or changes in the project scope, the contractor may request additional funds, leading to price escalation. (John T. Jones 2017)

2.1.5.3 Time and Materials Pricing Model

This model involves charging for the actual time spent on the project and the materials used. Price escalation can occur if the project takes longer than expected or if the cost of materials increases. (Sarah K. Johnson 2019)

2.1.5.4 Escalation Clauses

These are clauses included in contracts that allow for price adjustments based on changes in market conditions, such as fluctuations in material prices or labor costs. While these clauses can help protect against price escalation, they can also lead to disputes if not properly defined (Robert L. Smith 2015).

2.1.5.5 Index-Based Pricing

This model ties the price of the project to an economic index, such as the Consumer Price Index (CPI) or the Producer Price Index (PPI). This can help protect against price escalation by adjusting the contract price based on changes in the index (David A. Brown 2018).

2.1.6 Price escalation provision in Construction Contracts

A construction contract's price escalation clause provides for revisions to the contract price based on specified criteria such as inflation, changes in material costs, or unforeseen occurrences that affect the overall project cost. Including a price escalation clause in a construction contract protects both parties against unforeseen cost rises and ensures the project's financial viability.

There are numerous strategies to deal with price inflation in a construction contract, including:

Fixed Price Contract: In a fixed-price contract, the contract price is determined at the start of the project and remains constant regardless of market variations. This type of contract transfers the risk of cost escalation to the contractor, who must precisely predict and account for prospective price increases when submitting their offer.

Cost-Plus Contract: A cost-plus contract reimburses the contractor for real project costs plus a predetermined fee or percentage of profit. This type of contract transfers the risk of cost escalation on the owner, who is obligated to pay any additional costs incurred throughout the project.

Price Escalation Clause: A price escalation clause in the contract provides for modifications to the contract price based on specified parameters such as material cost, labor rate, or inflation. This clause allows both parties to address cost variations in an open and fair manner.

When creating a construction contract that includes a price escalation provision, it is critical to explicitly identify the variables that may cause price adjustments, the mechanism for calculating these adjustments, and any limitations or caps on how much the price can rise. By addressing price escalation early in the contract, both parties may better control their financial risks and keep the project on track.

The Role of Contracts and Agreements:

- Robust Contractual Agreements:

  Contracts that have been well structured can help to control cost increase. Clients should engage closely with legal specialists to include clauses that address anticipated cost increases, offering a formal framework for dealing with any unforeseen scenarios.

- Transparent Communication:

  Effective communication among clients and project stakeholders is critical. Establishing open lines of communication ensures that all parties are notified of any changes that may affect project costs, encouraging a collaborative approach to managing escalation. (Brandonme 2024)

2.1.6.1 Addressing Price escalation in the provisions of Contract

In FIDIC contracts, which are commonly used in international construction projects, price escalation is typically addressed through the provisions of the contract. FIDIC contracts include mechanisms to deal with fluctuations in market conditions and changes in costs that may affect the project budget.

The Variation and Adjustment of Prices clause is a significant component in FIDIC contracts that governs price escalation. This clause provides for contract price adjustments based on

certain circumstances such as changes in law, taxes, or tariffs, currency exchange rate variations, and labor or material cost increases.

FIDIC contracts also include measures for notifying the other party of any potential price escalation events, as well as procedures for determining and carrying out price changes. By putting these measures into the contract, FIDIC intends to establish a fair and open approach for dealing with price escalation issues and successfully managing project costs.

According to Andy Hewitt (2019), parties to FIDIC contracts must carefully evaluate and comprehend the price escalation provisions to ensure that they are sufficiently safeguarded against cost overruns and construction market uncertainty.

The Federal Public Procurement Agency (FPPA) issued a circular in August 2011 regarding price adjustment clauses in public procurement contracts. Price adjustment clauses are contractual provisions that allow for price adjustments under particular situations, such as changes in labor prices, material costs, or other factors that may affect the project's ultimate cost.

The following clause is specified in the General Conditions of Contract (Version 1, August 2011) on how to adjust price escalation and provided guidelines or regulations on the inclusion and implementation of price adjustment clauses in public procurement contracts. These guidelines may have specified the conditions under which price modifications are permitted, the calculating methods to be utilized, and any procedures for seeking and approving price adjustments.

How to adjust price escalation

62. Price Adjustments

62.1 Adjustments of contract prices shall be allowed after twelve (12) months from the effective date of the Contract where it is verified that the performance of the contract requires more than 18 months.

62.2 Request for price adjustment in relation to a particular work items under this Contract may be filed by the Contractor after twelve (12) months from the effective date of the Contract where it is verified that the performance of the contract requires more than 18 months, which adjusted price takes effect as the new Contract Price in relation to that work item on the expiration of 30 days from the date on which the Public Body receives notification of

that adjusted price from the Contractor, unless another date is agreed in writing between the Parties.

62.3 All prices shall be firm unless the Contractor has provided claim for price adjustment. The Contractor may invoke this provision at any time during the Contract by notice in writing to the Engineer.

62.4 The Public Body can increase or decrease the Contract Price amount as described by this Clause.

62.5 Price Adjustment shall be applicable as payable in full for the original scheduled completion period.

62.6 In the event the completion of contract exceeds the original scheduled period:

(a) In case of default on the part of the Contractor causing delay in original scheduled completion, the rate of Price Adjustment will be frozen at the original scheduled date of completion; however Price Adjustment will be applicable till actual completion. While computing Price Adjustment beyond the scheduled completion period, in the event the rate is reduced, then that reduced rate will be applied.

(b) The Price Adjustment will be payable in full for the extended period if the Contractor has been granted an extension of time for no fault on the part of the Contractor, duly approved by the Public Body.

62.7 Unless specifically stated otherwise in the Contract, the basis for compensation will be only those categories of inputs, which are specifically listed as specified items in the SCC.

62.8 An adjustment of the Contract Price, depending of selected categories of contract price, shall be limited to an amount which takes account of price indexes or price indicators issued by Ethiopian Central Statistical Agency or Public Procurement and Property Administration Agency.

62.9 Notwithstanding the provision of GCC Sub-Clause above, price information available from a renowned local producer or competent foreign institution may be used in case the Ethiopian Central Statistical Agency or Public Procurement and Property Administration Agency are not in a position to issue current price indexes,

62.10 Contractor shall submit to the Public Body for review and approval all calculations and supporting information necessary to determine the price adjustment.

62.11 Adjustments in compensation may be either plus or minus depending on the differences between the Benchmark Price Index and the Monthly Price Index.

62.12 To determine the adjustment on each item any such price variation shall be calculated in accordance with the following formula by applying the combination of above said criteria:

$$PA = \left[NV + A\frac{(MLI - BLI)}{BLI} + B\frac{(MMI - BMI)}{BMI} + C\frac{(MEI - BEI)}{BEI} + D\frac{(MFI - BFI)}{BFI} \right](BC)Q$$

Where:

PA = The amount of the Price adjustment to be paid to, or recovered from, the Contractor, in currency specified in SCC;

NV= The fraction which represents Non Variable element of the Contract Price that is free of contract price adjustment, as specified in the Contractor's Bid;

A = The fraction of the Contract Price subject to adjustment in accordance with movements of the selected Average Labor Category Earnings Index;

MLI = The most recently available selected Average Labor Category Earnings Index on the date on which the Public Body received notification of the proposed increased price from the Contractor;

BLI = Benchmark Average Labor Category Earnings Index applicable to the Works either:

(a) at the bid closing date, or

(b) if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

B = The fraction of the Contract Price subject to adjustment in accordance with movements of the selected Material Price Index

MMI = The most recently available selected Material Price Index on the date on which the

Public Body received notification of the proposed increased price from the

Contractor;

BMI = Benchmark selected Material Price Index applicable to the Works either:

(a) at the bid closing date, or

(b) if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

C = The fraction of the Contract Price subject to adjustment in accordance with

movements of the selected Equipment Price Index

MEI = The most recently available selected Equipment Price Index on the date on which the

Public Body received notification of the proposed increased price from the Contractor;

BEI = Benchmark selected Equipment Price Index applicable to the Works either:

(c) at the bid closing date, or

(d) if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

D = The fraction of the Contract Price subject to adjustment in accordance with

movements of the Average Fuel Price Index

MFI = The most recently available Average Fuel Price Index on the date on which the Public

Body received notification of the proposed increased price from the Contractor;

BFI = Benchmark Average Fuel Price Index applicable to the Works either:

(a) at the bid closing date, or

(b) if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

BC = Current Contract Price applicable to the Works

Q = Quantity;

And where:

(a) NV+A+B+C+D are equal to 1.00

62.13 The fraction for each specified element and exact combination of elements that will be applied in the formula for price adjustment shall be determined in the SCC.

62.14 An increase in the Contract Price takes effect as the new Contract Price in relation to the selected category on the first day of the next Payment Period following receipt of an application for increase provided the application is received no later than 14 days prior to the commencement of that Payment Period.

62.15 An increase in the Contract Price takes effect as the new Contract Price in relation to the selected categories of inputs on the expiration of 30 days from the date on which the Public Body receives notification of the increased price from the Contractor, unless another date is agreed in writing between the Parties;

62.16 When the Contractor varies the Contract Price of a Product or Service it must supply a copy of a revised Pricing Schedule which incorporates the proposed changes in price and specifies the date on which the proposed variation in price is to take effect in accordance with GCC Sub-Clauses 62.14 and 62.15.

62.17 The Contractor shall, when it notifies or requests a price adjustment under GCC Sub-Clause 62.12, provide to the Public Body such Document or other information as the Contractor considers appropriate for the purpose of substantiating the requested price adjustment.

61.18 Where the Public Body questions a price increase notified or requested under GCC Sub-Clause 62.12, and the Contractor is not able, on the basis of the information it provided to the Public Body, to substantiate to the Public Body any, or a part of, the notified or requested price adjustment, the Contract Price shall be increased by only so much as the Contractor is able to substantiate and:

(a) the substantiated increased Contract Price shall take effect as the new Contract Price in relation to the Works as the case may be, on the date referred to in GCC Sub-Clause 62.14 or 62.15 unless another date is agreed in writing between the Parties; and

(b) the Contractor shall, if it has not already done so, supply a suitably revised Pricing Schedule in accordance with the requirements of GCC Sub-Clause 62.16.

62.18 Any discount offered by the Contractor under this Agreement cannot be reduced during the Term of this Contract without the agreement in writing of the Public Body.

2.1.7 Effects of Price Escalation of construction material on building projects

Effects are the outcomes that will be experienced when price escalation occur on construction project. Those projects that have not been scrapped or significantly delayed as a result of price escalation difficulties have frequently experienced higher project costs. Contractor and supplier fears regarding potential, future price escalation, and the absence of price escalation clauses in most construction contracts, often leads to higher contract prices and larger project costs (Pearl, 1994).

According to Van der Schans (2005), the effect of price increases is being felt in the public construction industry. Significant price rises create unique challenges for public initiatives. Between the times the budget was approved by the financers and the time bids were submitted for construction projects, material prices rose dramatically, and bids came in at prices far exceeding the allowed contract amounts. Public authorities are therefore faced with the option of putting projects on hold while extra financing is sought, withdrawing the project if further funds are not forthcoming, or attempting to limit the project scope.

According to the study by Asteway (2008), indicated that unpredictable pricing variations have an effect on both the contractors' ability to complete their projects and the overall success of the project. It suggested that such pricing variations caused project delays. In addition to the delay, it was discovered that contractors' cash flow problems, profit loss, and poor quality output might all come from unanticipated price fluctuations. Therefore, it can be understood that price changes might result in poor project performance by prolonging project time, increasing project cost, and forcing contractors to produce low-quality projects.

Fetene (2008) states that cost overruns have obvious effects for the key stakeholders in particular, and on the construction industry in general. To the client, cost overrun implies added costs over and above those initially agreed upon at the onset, resulting in less returns on investment. To the end user, the added costs are passed on as higher rental or lease costs or prices. To the professionals, cost overrun implies inability to deliver value for money and could well tarnish their reputations and result in loss of confidence reposed in them by

Clients. To the contractor, it implies loss of profit for non-completion, and defamation that could jeopardize his or her chances of winning further jobs, if at fault. To the industry as a whole, cost overruns could bring about project abandonment and a drop in building activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks.

The study of Fetene (2008) further identified the following as the major effects of cost overruns delays during construction, supplementary agreement, additional cost, budget short fall adversarial Relationship between participants of the project, loss of reputation to the consultant, the consultant will be viewed as incompetent by project owners, high cost of supervision and contract administration for consultants, delayed payments to contractors, the contractor will suffer from budget short fall of the client and poor quality workmanship.
Escalation in the price of building material is destroying the construction industry as numerous contractors are incapable of precisely predicting anticipated profit on the project, a circumstance that has contributed to laying-off of workers and closure of companies in some extreme cases (Ayodele & Alabi, 2011).

According to study by Akanni et al. (2014), possible effects that escalation in the price of building materials have on delivery of construction projects were identified as: fluctuation in cost of construction; project abandonment; completion at the expense of other projects; delay in progress of project works; other valuable projects not being commissioned; rate of unemployment of construction workers; poor workmanship due to inadequate materials to use; low quality local materials; and hindered implementation of innovation in construction.

Akanni et al. (2014), in their study of the implications of the rising cost of building materials in Nigeria, identified fluctuation in construction costs as the most important effect of increase in the price building materials. The study illustrates that the cost of constructing the same building is swiftly rising due to increase in the price of building materials. Abandonment of a construction project refers to ceasing every work or suspending the project for a long duration. Their study also explains that an upward review of contract amount leads to conflicts between contractors and clients, probably resulting in cases of abandonment where investments are tied down, since such project will not be ready for use at the expected time.

Vamsidhar et al. (2014) indicated that price escalation results delay in construction projects, reduced scope of projects or projects being cancelled. Escalation clauses could also affect

public projects negatively due to the fact that prices being submitted are not being guaranteed during long period of time. Due to escalation fears, clients are finding fewer numbers of bidders for their projects. Hence, some projects need finding alternatives financial sources or canceling the project if additional money is not at hand. Contractor and supplier fears concerning probable price escalation and the lack of price escalation clauses in most construction contracts, usually leads to higher contract prices and larger project costs (Vamsidhar et al., 2014).

2.1.8 Managing price escalation

Understanding the factors that drive escalation is crucial in order to measure or manage escalation on construction projects. This is especially crucial in the current situation, where price fluctuations have been so volatile that it has been difficult to foresee or estimate what bid prices would actually be (Peter & William, 2006).

Jeffrey M. Reichard (2021) discusses that mitigating the effects of price escalations should start in the bidding process. During the bidding phase of a project, contractors, subcontractors, and suppliers should identify which materials are most susceptible to price volatility and discuss them with the upstream contracting party. Downstream contractors and suppliers also should be wary of bidding requirements which require them to bear the sole risk of any price escalations and should modify their standard bidding forms and proposals to include general price escalation clauses. The best way to mitigate risks associated with material cost volatility is to include price escalation provisions in your contracts. There are many different types of price escalation provisions that can be included in a construction contract, but the three most common types are: (1) any-increase escalation clauses, (2) threshold escalation clauses, and (3) delay escalation clauses (Jeffrey M. Reichard, 2014).

Gashaw (2013) explain that a variety of different factors work together to increase costs in the construction market. Many of the strategies will necessitate novel approaches to construction design and procurement as well as redistribution of the risk allocation in projects.

Price escalation happens during a project's planning, design, and execution phases. Every stage of a project should use price escalation management. The first step is to recognize that escalation is an actual threat to construction programs and projects and to recognize it

existence. There is still a high degree of ambitious thinking in project budgeting, expecting that escalation is not going to remain high. Project owners must first:

- Recognize the reality of the bid market
- Recognize the reality of the bid volatility: Material prices will continue to fluctuate, although perhaps not to the extent seen in recent years (Gashaw, 2013).

The most crucial action project owners can do to minimize the effects of the unstable construction market is to share the risk. This takes the burden of handling market volatility off the back of the contractors and vendors and in turns reduces the pressure for bidders to charge premium (William & Peter, 2006).

Gashaw (2013) discuss that the first step is for project owners to assume more responsibility for the risk related to changes in material price. The owner is better able to manage the risk because they are much more diversified. At every stage of the design and construction process, this can be accomplished in a variety of ways.

Gashaw (2013) identified and summarized the following methods to manage price escalation as variables Consider fluctuation/escalation clauses, Bulk material purchases and suppliers' partnerships, Use Cost-Plus contracts, Develop program-wide contingencies and risk management protocols, Regular cost monitoring throughout the project, Consider locally available material in design.

Using Technology for Cost Control:

- Project Management Tools:

  Clients can leverage advanced project management tools to track and control costs in real-time. These tools facilitate data-driven decision-making, allowing clients to identify cost trends and implement corrective measures promptly. (Brandonme 2024)
- Building Information Modeling (BIM):

  Integrating BIM into the project lifecycle enhances visualization and collaboration. Clients benefit from a more accurate representation of the project, enabling them to foresee potential challenges and make informed decisions to curb cost escalation. (Brandonme 2024)

Strategies for Mitigating Cost Escalation:

- Contingency Planning:

  Incorporating a contingency budget within the overall project estimate provides a financial buffer for unforeseen circumstances. This strategic approach cushions the effect of unexpected cost escalations. (Brandonme 2024)

- Regular Audits and Reviews:

  Clients should conduct regular project audits and reviews to assess ongoing costs against the budget. This proactive measure identifies deviations early on, allowing clients to implement corrective measures promptly. (Brandonme 2024)
- Empowering Clients with Knowledge:

  Decoding project cost escalation empowers clients to overcome the challenges of project management with confidence. By understanding the contributing factors, implementing strong contractual agreements, harnessing technology, and adopting proactive strategies, clients can mitigate the effect of cost escalation on their projects. (Brandonme 2024)
- Continual Learning and Adaptation:

  In the project management field, continual learning and adaptation are imperative. Those who stay informed, welcome innovative solutions and foster transparent communication with stakeholders are better equipped to decode and effectively manage project cost escalation, ensuring the success of their endeavors. (Brandonme 2024)

2.1.9 Challenge of price escalation and adjustment practice

According to MD Wondimu (2019), Price escalation can have a severe influence on building construction projects if the contracts do not include provisions for dealing with escalation. If the risk of material price increases is equitably allocated among contract parties, projects are likely to be completed. However, contracts can be written so that the risk of major price inflation is borne only by one party, usually the client. In other circumstances, the price adjustment administration methods are so bad that they cannot be considered applicable. According to Getaneh (2017), the most typical problems effecting price adjustment on construction contracts are constant weighting coefficients throughout the project duration. Use of foreign nation indices, which may not reflect the actual conditions. Different estimators produce different weighted coefficients. It does not take into account actual labour work time or changes in project cost. Constant input material amounts, computation time, and a focus on extreme pricing.

D Wondimu (2019) identified and summarized problems in price escalation and adjustment as follows after review contract documents, claims submitted by contractors and correspondence letters in SNNPRS Construction Authority Archives.

- Clients refuse to comply with escalation provisions.
- Escalation provisions do not fully compensate for price increases.

- Construction price indices may overstate or underestimate market conditions, including price increases.
- Steel price escalation in projects with a contract length under 18 months.
- Price adjustment clauses are limited by the contract's special conditions.
- Contractors do not follow required processes for requesting price adjustments.
- There is no public database to record and update steel prices for contracts or other purposes.
- Contractors fail to provide the required base cost index in their bidding documents for approval by the Engineer.

According to Flyvbjerg et al. (2022) the fast rising expenses result in the complexities of "price escalation." Rising costs lead to major price escalation issues in the absence of fair and balanced contracts, as well as appropriate dispute resolution methods. This halts ongoing projects and gravely jeopardizes the prospects for preserving and growing future commercial connections. Problems with construction price escalation include clients refusing to honor the escalation terms; escalation clauses do not appropriately compensate increases in pricing; and uncompensated increases in the cost of construction supplies. Similarly De Vynck (2002) stated that the contract price adjustment formula is a means of compensating or reimbursing for price variations in labor costs, material prices, plant and equipment, and fuel. The formula's objective was to meet the needs of contractors who needed a clear-cut, agreed-upon recovery formula approach to avoid disagreements and disputes with employers and subcontractors, as well as to give a reasonable reimbursement for unexpected price variations.

Hardilo (2020) identified and summarized the challenges in price escalation and adjustment as follow: Constant weighting coefficients throughout the project's duration. Use of foreign nation indices may not reflect the actual conditions. Constant input material quantities, Clients reject honoring the escalation provisions. Escalation clauses do not fully compensate for increases in prices. Construction price indices may overstate or underestimate market conditions, such as how prices have risen. Material price escalation occurs in projects with contract length of shorter than 18 months. Special Contract Conditions limit the implementation of Price Adjustment Clauses. Contractors do not furnish the required base price index. There is no public database to record and update steel prices for contractual or other purposes.

2.1.10 Overcoming the Cost Escalation Challenges

Overcoming cost escalation difficulties in construction necessitates a multifaceted approach that includes good planning, comprehensive risk mitigation methods, and a strong understanding of market trends and economic indicators. By proactively addressing these concerns, construction firms may reduce the effect of cost increases and ensure project success.

Effective Planning and Risk Mitigation

Overcoming cost escalation challenges in construction requires a diversified approach that encompasses effective planning, thorough risk mitigation strategies, and a keen awareness of market trends and economic indicators. By addressing these factors proactively, construction firms can mitigate the effect of cost escalation and ensure project success.

Market Trends and Economic Indicators

Rigorous risk mitigation is another essential component of solving cost escalation concerns. Construction firms must identify and assess potential hazards throughout the project's lifecycle, from pre-construction to conclusion. This includes analyzing market trends, economic indicators, and supply chain vulnerabilities to predict and reduce possible cost increases. Implementing effective contract management systems, maintaining open communication with suppliers and subcontractors, and diversifying sourcing tactics can help to reduce the effect of cost escalation on project budgets.

Staying informed about market trends and economic data is critical for efficiently managing cost escalation in construction. Construction organizations can anticipate changes in project costs by tracking factors such as inflation rates, material prices, and labor market circumstances and adjusting their strategy appropriately. To avoid cost escalation risks, organizations may need to renegotiate contracts, investigate alternate sourcing possibilities, or adapt project timetables during economic downturns or supply chain interruptions.

2.2. Empirical Review

It has been suggested that because of the instability of the external environment and the complex nature of the building sector, price escalation is an expected phenomenon. The purpose of this portion of the study is to present different research findings about the causes, effect and mitigation of price escalation on the success of construction projects.

Y Belay and D Jain (2023) conducted a research study in Adama, Ethiopia to assess the factors causing price escalation in building construction projects and their effects. Thirteen possible factors and five effects were identified through literature review and project archives. A survey with 48 participants was conducted, with 43 responses received. The most significant factors causing price escalation were fluctuation in foreign currency exchange rates, material cost increases, unstable market conditions, unbalanced demand and supply of materials, and project schedule changes. The most significant effects of rising prices on building construction projects were delayed progress, cash flow problems, higher project costs, and increased disputes between contracting parties. The Spearman rank correlation coefficient was used to evaluate agreement among respondents on the ranking of factors and effects, showing a positive relationship among clients, consultants, and contractors in Adama city.

Hamelmal et. al (2023) have conducted a research study on the Investigation of Price Escalation and Its Mitigation Mechanisms on Selected Building Construction Projects of Jimma University. The motive of the observation was to assess fee escalation, escalation factors and mitigation mechanisms in deciding on construction initiatives. From February 1 to 30, 2020, a questionnaire was administered to twelve workers and interviews with seven key informants were conducted for an in-depth look at four selected Jimma University construction projects, which were project A to project D. Relative importance index values were generated and ranked for the elements affecting fee escalation to see their relative significance. It was found that there has been a moderate degree of charge increase within the initiatives studied, from 12% to 21%. The mitigation modalities observed with the aid of the projects, particularly inserting escalation clauses in contractual agreements, making changes requiring funding and increasing time limits, seem to be inadequate, as they do not provide a foundation for choices and remedy of disputes instead of mitigating the escalation of tasks starting from 3.21% to 12%.

Ali T. and Ramon L. (2006) conducted a research study on Modeling Cost Escalation as a Risk Factor in Construction Projects. The paper presents a computer model for large construction projects that considers cost escalation effects. It uses probabilistic modeling to calculate total program cost distribution, accounting for project delays and uncertainty in escalation factors. The model simulates project durations and escalation rates as random variables, allowing for assessment of possible cost overruns and budget adequacy. Unlike

other approaches, this model integrates schedule and cost uncertainty in a more comprehensive probabilistic manner.

Y Frimpong et al, (2003) conducted a research study on Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. According to the researchers view, Delay and cost overruns are common in construction projects and groundwater construction projects in Ghana are not an exception. The paper presents the results of a questionnaire survey conducted to identify and evaluate the relative importance of the significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. Respondents of this survey included personnel from owners, consultants and contractors involved in groundwater projects in Ghana. The results of the study revealed the main causes of delay and cost overruns in construction of groundwater projects included: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performances; and escalation of material prices. Hence, effective project planning, controlling and monitoring should be established to enhance project performance in order to minimize or avoid delay and cost problems in groundwater construction projects.

Humphrey D. et al, (2018) conducted a research study on Major Determinants of Prices Increase of Building Materials on Ghanaian Construction Market. The researcher mentioned that prices increase of building materials is a common trend in both developed and developing countries. The prices increase of building materials results in high cost of housing. The aim of the study was to identify the major determinants of prices increase of building materials on Ghanaian construction market, and also to assess the relationship between the independent variables of the prices increase. A five-point Likert scale was used for the study; from strongly disagree (1) to strongly agree (5). The variables in the questionnaire were ranked based on the response of the participants of the study using Mean Response Analysis (MRA) statistics. Spearman correlation matrix was used to determine the relationship between the variables of prices increase of building materials. Crude oil prices, energy cost, local taxes and charges, cost of fuel and power supply, high running cost, high prices of raw materials, cost of transportation and the high cost of labour were found to be the major determinants of prices increase of building materials on Ghanaian construction market. The study further found multicollinearity relationship among variables of prices increase of building materials, of which the highest correlation coefficient was found between fast-growing demand due to high global economic growth and over-dependence on imported

building materials. The study recommends that further research should be carried out to determine the control measures of increase prices of building materials in Ghana.

Kamil H. (2023) conducted a research study on Assessment on the Causes and Effects of Price Escalation of Building Construction: In the Case of Addis Ababa Design and Construction Works Bureau. The researcher discusses the challenges faced by the construction sector in managing major capital construction projects, particularly focusing on price escalation issues within the Addis Ababa Design and Construction Works Bureau (AADCB). The study aims to assess the causes and effects of price escalation in building construction projects, identify problems related to price escalation, and propose methods to manage and administer price escalation within the AADCB. Data was collected through questionnaires and analyzed using statistical methods. Internal causes of price escalation include poor estimation and planning, while external causes include material cost fluctuations and limited capacity of material producers. The effects of price escalation include higher project costs, cash flow problems, delays, and disputes. Recommendations are provided to minimize the effect of price escalation on the AADCB and improve overall performance in the construction industry.

Prashant K. (2020) conducted a research study on Assessment of the cause & effect of Price Escalation on Public Sector Construction in Capital City of Ethiopia: Using Relative Importance Index. The researcher highlights the significant issue of cost escalation in the Ethiopian construction industry, particularly affecting building projects in Addis Ababa. The research aims to understand the causes and effects of cost escalation on public building projects in the city. Through literature review and surveying contractors, consultants, and clients, the study identifies internal and external causes of price escalation, as well as its effects. Major internal causes include poor planning, estimation, and contract management, while external factors include market conditions and material cost fluctuations. The primary effect of price escalation is project delays. Recommendations suggest implementing strong control mechanisms to address inflation and improve project efficiency.

Meron S. (2022) conducted a research study on Assessment of the Effect of Price Escalation in Real Estate Projects. This study investigates the effect of price escalation on real estate projects in terms of cost, time, and quality. It highlights the unique challenges and risks faced by the construction industry, particularly in the context of real estate projects. The research used a descriptive research design and a quantitative method approach, collecting data from

81 participants. The study found that price escalation has significant effects on cash flow, project delay, increased project costs, quality degradation, and disputes among stakeholders in real estate projects.

Simreteab G. (2021) conducted a research study on Improving Price Adjustment Administration in Federal Road Projects. This study focuses on improving price adjustment administration in federal road projects by assessing the current practice of determining price indices when the original source ceases to publish them. It also aims to identify reliable sources to minimize disruptions in publishing indices and develop guidelines for administering price adjustments when suppliers are replaced. The research involved analyzing price adjustment administration in federal road projects and using trend, T-tests, and regression analysis to predict future values of new sources of indices. Data was collected from Ethiopian Road Authority payment certificates and various sources related to construction materials. The analysis suggested using different sources for specific projects and led to the development of guidelines for professionals to determine new index sources effectively.

Mohammed G. (2013) conducted a research study on Assessment of Price Escalation and Adjustment Problems on Federal Road Construction Projects. This research focuses on assessing the causes and effects of price escalation in federal road construction projects in Ethiopia. The study examines both internal factors such as poor estimation and planning, as well as external factors like material cost fluctuations and global demand. Data was collected through questionnaires, archival records, and interviews, and analyzed using statistical methods. Major findings include the effect of price escalation on project costs, cash flow, delays, and disputes. Issues with material cost estimation and selection of appropriate price indices were also identified. Recommendations were proposed to address these challenges and improve performance in the construction industry.

2.3 Conceptual Framework

In light of the above empirical review of literature, the following conceptual framework has been adopted for the study.

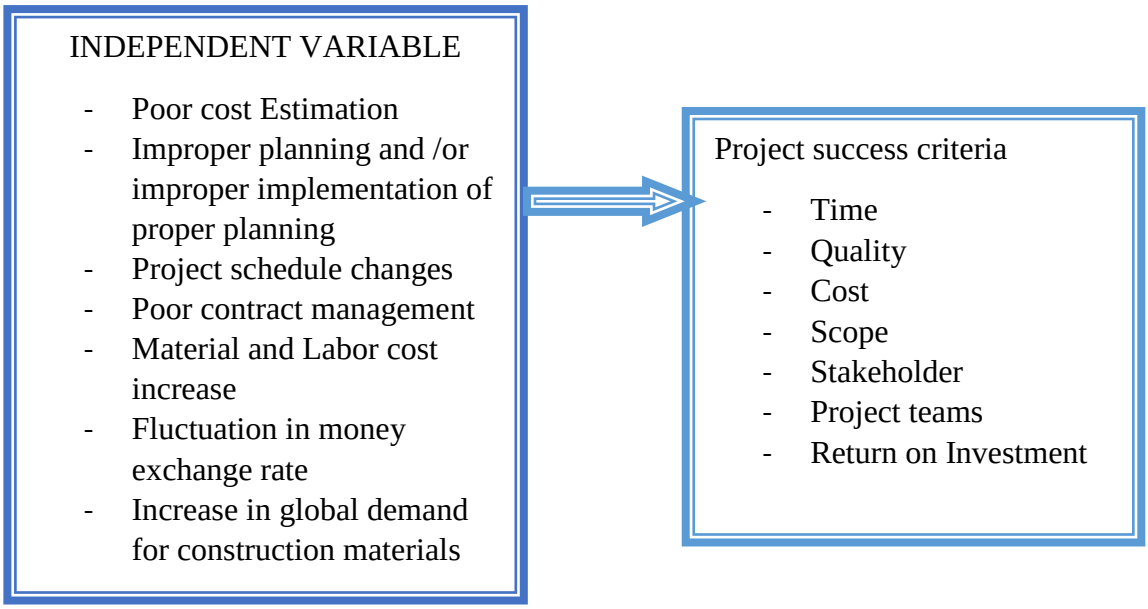

Figure 2.1 Conceptual Framework

2.4 Research Hypothesis

As indicated above in the literature review, causes and effects of price escalation affects the success of building construction project. Accordingly, the research has made an initial assumption that since price escalation affect the success of the project, applying price adjustment clauses in the contract will have a positive impact on the project to be succeeded. Validated items was used to measure the effect of price escalation on the project success criteria on a 5 point Likert scale (5= very strongly agree, 1= very strongly disagree).

The following hypothesis was then proposed and tested:

Proposition:

Price escalation is positively associated with project success criteria.

Hypothesis H1:

Price escalation is positively associated with delay in project completion

Hypothesis H2:

Price escalation is positively associated with Quality compromised

Hypothesis H3:

Price escalation is positively associated with Cost overrun

Hypothesis H4:

Price escalation is positively associated with Change in scope

Hypothesis H5:

Price escalation is positively associated with Dispute between stakeholders

Hypothesis H6:

Price escalation is positively associated with project teams not satisfied

Hypothesis H7:

Price escalation is positively associated with effect on Return on Investment

CHAPTER THREE-RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is a critical component in the research process, as it details each step that is taken in conducting a study. The research may then be seen as a catalyst for expanding the influence in the discipline being studied. Brynard (2006) State that research methodology focuses on the process of research and the decisions made by the researcher to successfully execute a study. These section offerings further concisely the research methodology, methods and instruments were employed to conduct this research. It focuses on the areas such as the type of research, target population, sample size, sampling technique, sources of data, and instruments of data collection, procedures of data collection and method of data analysis, and presentation reporting.

3.2 Research Design

This paper is a quantitative research. The research aims to measure the level of effect and its mitigation practice of price escalation of selected Grade-1 construction companies. Furthermore, it is required to determine that price escalation is regarded as a critical success factor for the selected Grade-1 contractors.

Causes of price escalation was tried to be identified. In addition, ways of mitigating the price escalation for the success of construction projects also part of the research. In other words, the paper identified factors that have effects on the success of construction project.

For the reason stated above, the method that best suited the paper is an explanatory research. Explanatory research was used to conduct research for this study. The explanatory research design was chosen for this study due to its suitability for investigating causal relationships and providing a deeper understanding of the research topic (Johnson & Thompson, 2019). This paper, being an explanatory study, is a base for further research to be conducted and extend the level of knowledge that this paper will provide in the end.

The research adopted a cross-sectional study, as data collection and analysis was conducted at one time only.

The main tool for collecting data was a self-administered questionnaire. The survey questions were designed to address the researcher's major study questions. Furthermore, the questionnaire was prepared after taking into account past research conducted all over the world on price escalation and its mitigation strategy for the success of a construction project. Aside from research conducted in Ethiopia, prior studies from Nigeria and Ghana were used as a background tool to investigate the effect of price escalation and mitigation practices on the success of construction projects. This is suitable for applying previous knowledge and approaches to the context of Addis Abeba's construction trend.

3.3 Research Approach and Strategy

The purpose of this study is measuring the relationship between the effect of price escalation and the success of the project. Cross-sectional field survey using questionnaires was used. Data was collected at one particular time. Since the study tries to explain the relationship between variables quantitative and explanatory methods were adopted.

3.4 Target Population, Sampling Size and Sampling techniques

The target populations for this research are Grade 1 contractors in construction industry. Grade-1 Contractors has registered and working in Ethiopia as per the Ministry of Urban Development, Housing, and construction. GC contractors registered for the budget year of 2022/2023 had been planned to consider as the sampling frame. However it was difficult to get the list of eligible construction companies even though efforts made to obtain it from online and in person. For this reason the researcher was forced to base the study on top ranked 10 construction companies from Grade-1 GC contractor based on the outstanding performances of the projects performed in Addis Ababa.

As a basis for this research, it relied on purposive sampling. This technique is chosen for the purposive judgment of the researcher and the research is based on technical knowledge of the topic, so the samples chosen were those of technical manpower in the industry specifically in the companies by choosing employees that have engineering degree as the case is seen and fixed by this manpower. The population of the study comprised Five hundred eighty four technical employees of the companies (Projects managers, office engineers, site engineers, other engineers like electrical sanitary and mechanical engineers) selected that are engaged in building construction in Addis Ababa with engineering educational background and expertise as price escalation is caused within all fields of construction.

A sample is a smaller group of subject drawn from the population in which a given study was conducted for a purpose of drawing conclusions about the population targeted. For example, Kothari (2004) argued that the result from the sample can be used to make generalizations about the entire population as long as it is truly represented. The study was executed to different personnel who met the study design. The study used a sample of respondents from ten selected Grade-1 Construction companies listed on table 3.1 below; making a total of 646 population.

Table 3.0 Target population

Target population				
Companies	No. of project Sites	Total Engineers on site	Total Engineers in head office level	Total Engineers in Addis Ababa
Company-1	5	32	15	47
Company-2	7	48	8	56
Company-3	3	18	10	28
Company-4	6	25	11	36
Company-5	13	93	35	137
Company-6	7	64	35	99
Company-7	6	41	13	54
Company-8	8	46	15	61
Company-9	5	43	12	55
Company-10	4	57	16	73
Total	**64**	**467**	**179**	**646**

Source: From companies

To select appropriate sample size the following factors are in to consideration:

- Time available for conducting the research work
- Available fund for the study
- Minimum acceptable level of precision (standard margin of error)
- Confidence level
- Sample statistics (i.e. population proportion)

According to Kothari (2004) the sample size can be calculated using the following equation:

$$n = \frac{z^2 * p(1-p)/e^2}{1 + (\frac{z^2 * p(1-p)}{e^2 N})}$$

Where:

N=Sample size to be studied

N-Total population = 646

P = Proportion of the population elements that belong to the defined category,

e= Standard error of the sampling distribution

Assumptions:

- Confidence level = 92%
- Population proportion (P) = 0.5
- Margin of error (E) = ±8% = ±0.08

From the above formula, the sample size for this study was:

$$n = \frac{1.75^2 * 0.5(1-0.5)/0.08^2}{1 + (\frac{1.75^2 * 0.5(1-0.5)}{0.08^2 * 646})}$$

$$n = 100$$

The sample in this study is 100

From the above formula, the required sample for this study was 100 people which will include all interested parts. The interested party had been selected by using purposive and simple random. Out of 100 Questionnaires 67 valid responses were gathered from 10 Grade-1 GC Contractors. The Questionnaire was distributed to each company depending on the availability of the professional staff assigned. For example, one company may have 5 Engineers stationed on site while another company may have 4. After selecting the contractors with the purposive method, a questionnaire was distributed to technical staff members of that company. The researcher was facing some unwilling respondents from each company that refused to take part in this study.

3.5 Method of analysis

The study was adopted both descriptive and inferential methods of analysis. The general information of the respondents was analyzed using descriptive statistics tools of frequency. Awareness of price escalation and the level of mitigation mechanism of price escalation were analyzed using descriptive statistic tools of mean and standard deviation. A cause of project

price escalation, as identified from various literatures was also analyzed using a similar descriptive statistic tool.

Correlation analysis was used to identify the relationship between the dependent and independent variables: Price escalation as well as its mitigation practice and success of construction project. Furthermore, a linear regression analysis was conducted to measure the relationship between Effect price escalation and success of construction project.

3.6 Measurement of Variables

Experiences in the construction sectors from Ethiopia and foreign countries have been studied and adopted for the purpose of this research. Furthermore, dependent variables (project success criteria) have similarly been identified from various literature while independents variables (Internal and external causes of price escalation); Poor cost estimation, Improper planning and /or improper implementation of proper planning, Project schedule changes, Poor contract management, Material and Labor cost increase, Fluctuation in money exchange rate, Increase in global demand for construction materials was used.

Table 3.1 List of Measurements

Variable Type	**Variables**	**Measurements**	**Source**
Independent Variables	Poor cost estimation	Part III Section B- Question 1- 4	Various literatures such as Kamil H.(2023), Yaw Frimpong, Jacob Oluwoye and Lynn Crawford (2003), Humphrey D. et al,(2018) Prashant K. (2020), Yehulum Belay and Deekshith Jain (2023), Meron S. (2022) and Mohammed G. (2013)
	Improper planning &/or improper implementation of proper planning	Part III Section B- Question 5- 8	
	Project schedule change	Part III Section B- Question 9- 13	
	Poor contract management	Part III Section B- Question 14- 16	
	Material cost increases	Part III Section C- Question 1- 4	
	Labor & equipment cost	Part III Section C- Question 5- 10	

	increases		
	Fluctuation in money exchange rate	Part III Section C- Question 14- 16	
	Increase in global demand for construction materials	Part III Section C- Question 11- 17	
Dependent Variable	Project success criteria	Part III Section E- Question 1- 7	

3.7 Source of Data

To help attain the research objectives and answer the research questions relevant data was collected mainly using primary sources. In other words, data was gathered through questionnaires. This is not an unprecedented study. Related studies have been done to study the influence of price increases on construction in Ethiopia and other parts of the world. For this reason, the researcher was using secondary sources of data to include studies conducted so far in relation to price escalation and Ethiopian construction. Based on these previously conducted researches, the researcher was extending existing knowledge by offering some insight on the degree of variation in the effect of price escalation and its mitigation practices with selected Grade-1 contractor.

3.8 Data Collection Methods

Primary data was collected using:

Questionnaires: A self-administered questionnaire was distributed to the sample in the target population. Questions were developed in the questionnaire to answer the research questions and meet the objective of the research.

3.9 Procedures of Data Collection

Having established the samples as discussed earlier a questionnaire was developed and distributed to the selected Grade-1construction companies. For those companies who were willing to fill out the questionnaire without any assurance from the researcher, the survey was immediately distributed to the staff (Project Managers down to Site Engineers, and in some cases Engineers at the Head Offices).

The researcher indicated that the data would strictly be used for research purposes only. In addition a collaboration letter issued from the university was also provided to the approval of the surveys.

3.10 Reliability and Validity

3.10.1 Reliability of the Research

According to Saunders, et al. (2007), Reliability refers to the extent to which data gathering techniques or analysis procedures produce consistent results. A scale's dependability is frequently examined using test-retest reliability or internal consistency. The first indication, the test-retest, is examined by presenting the same scale of measure to the same respondents on two separate dates, and computing the correlation between the two scores obtained. The second indicator, internal consistency, is the degree to which all of the scale's items measure the same underlying attribute (Zikmund et al, 2009). The questionnaire was designed to include comparable questions in several parts. This test-retest method of ensuring the reliability of the questionnaire indicates whether the responses to be provided are logical. Questionnaires were grouped to ensure consistency in responses. IBM SPSS version 27 software was used for analyzing the data. Before feeding the collected data into SPSS a visual check of all the responses was made. This allows the researcher to collect useful information from all of the returned questionnaires. The first visual check was to determine the respondents' eligibility for the research. For example, respondents who fell beyond the scope of the study were declared unsuitable. The next visual check was to ensure that the responses were accurate. A respondent ticking on different replies with similar metrics in separate sections of the questionnaire was also considered useless.

Internal consistency of responses to all similar items was checked using the Cronbach's coefficient alpha. Cronbach's alpha has been checked for different sections of items during analysis. The Cronbach's alpha score for an overall 54 items is outlined in the table below.

Table 3.2 List of Variables

Independent Variables (Price escalation)	**Dependent Variables (Project success)**
Poor cost estimation	Delay in project completion
Improper planning &/or improper implementation of proper planning	Quality compromised
Project schedule change	Cost overrun
Poor contract management	Change in scope

Material cost increases	Dispute between stakeholders
Labor & equipment cost increases	Projects teams not satisfied
Fluctuation in money exchange rate	Effect on Return on Investment
Increase in global demand for construction materials	

Table 3.3 Reliability Statistics for Internal Consistency

Reliability statistics		
Constructs	Cronbach's Alpha	N of Items
Poor cost estimation	0.832	4
Improper planning &/or improper implementation of proper planning	0.888	4
Project schedule change	0.803	5
Poor contract management	0.676	3
Material cost increases	0.806	4
Labor & equipment cost increases	0.910	6
Fluctuation in money exchange rate	0.922	7
Increase in global demand for construction materials	0.881	7
Overall Cronbach's Alpha (Independent Variable)	0.854	8
Overall Cronbach's Alpha Project success criteria(dependent Variable)	0.856	7

3.10.2 Validity of the Research

Validity refers to the truth of the measurement. It is the degree to which the measurement process measures the variable it claims to measure. To ensure the validity of data, the researcher was afforded respondents the chance to discuss the themes of the research and make sure that respondents are alert of the privacy afforded to their answers. This is important to ensure that questions will come back with sincerely without fear of repercussions thereby increasing the validity of the research. The relationship between the researcher and the respondents also has the consequence on validity. The researcher will ensure that respondents recognize what it means is by the research through testing the

research tool on a small group before the research. A number of questions were included to ascertain that all research questions were exhausted and the objectives of the research adequately addressed. The items in the questionnaire were based on experiences from several studies in the Ethiopia, Nigeria and Ghana. It was intended to adopt a similar study here in Addis Ababa by including new additions in the research as how many of the companies are facing the challenge occurred by price escalation and the way the companies are trying to tackle the problem for the success of the Building construction project performed by selected Grade-1 Contractors. Furthermore, the researcher set out with his expectations of the outcomes of the result of the study.

3.11 Ethical Issues

The purpose of the research was thoroughly explained to the sample companies. All data collection process was carried out after consent with the project managers or general managers of the companies. Collaboration letter issued by the University was also provided to show the legitimacy of the study. Data to be collected was used for other purposes than for the success of this research attaining the research questions and objectives. The names of the construction companies and the members who provided relevant data was concealed and not disclosed in this paper.

CHAPTER FOUR-DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Introduction

This chapter of the paper presents and discusses the results of the data gathered and analyzed. The first subsection gives an overview of the demographics of the respondents who took part in this research. The table below summarizes the methods used to analyze and interpret the collected data.

Table 4.1 Data Analysis Methods

Construct Description	Method of Analysis
General Information of respondents	Descriptive statistics of frequencies
Price escalation Awareness and Its mitigation mechanism	Descriptive statistics of frequencies
Existing Price Escalation Management Practices	Descriptive statistics of mean and standard deviation
Internal causes of Price Escalation	Correlated with project success criteria
External causes of Price Escalation	Correlated with project success criteria
Applying Price adjustment in Contract clauses	Descriptive statistics of mean and standard deviation
Project success criteria	Linear Regression analysis

4.1 Response Rate

This paper was conducted on 10 Grade-1 GC construction companies in Addis Ababa. One hundred questionnaires were given out to possible respondents in the sector. Of the two hundred handed out questionnaires sixty seven were filled and returned. From the rough visual check, sixty seven were deemed usable by the researcher.

4.2 General Information of Respondents and Surveyed Companies

The first section of the distributed questionnaire assesses the gender composition, age, educational qualifications, roles and years of experience of the respondents belong to. The sub-chapters hereunder outline the various demographic, educational status, years of working experience and qualification of respondents.

Table 4.2 Summary of General Information

1. Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	17	25.4	25.4	25.4
	Male	50	74.6	74.6	100.0
	Total	67	100.0	100.0	
2. Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25-34 years	35	52.2	52.2	52.2
	35-44 years	23	34.3	34.3	86.6
	45-54 years	9	13.4	13.4	100.0
	Total	67	100.0	100.0	
3. Educational Background					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's degree	35	52.2	52.2	52.2
	Master's degree or above	32	47.8	47.8	100.0
	Total	67	100.0	100.0	
4. Role in the Construction Project					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Architect	2	3.0	3.0	3.0
	Construction Engineer	14	20.9	20.9	23.9
	consultant	2	3.0	3.0	26.9
	Contract Admin/Site/Office Engineer	33	49.3	49.3	76.1
	J.Material Engineer	2	3.0	3.0	79.1
	4. Role in the Construction Project (Continued)				
	Project Coordinator	2	3.0	3.0	82.1
	Project Manager	9	13.4	13.4	95.5
	Resident Engineer	3	4.5	4.5	100.0
	Total	67	100.0	100.0	

5. Years of Experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10 to 15 Years	18	26.9	26.9	26.9
	5 to 10 Years	25	37.3	37.3	64.2
	Less than 5 years	14	20.9	20.9	85.1
	Over 15 Years	10	14.9	14.9	100.0
	Total	67	100.0	100.0	

4.2.1 Gender Composition

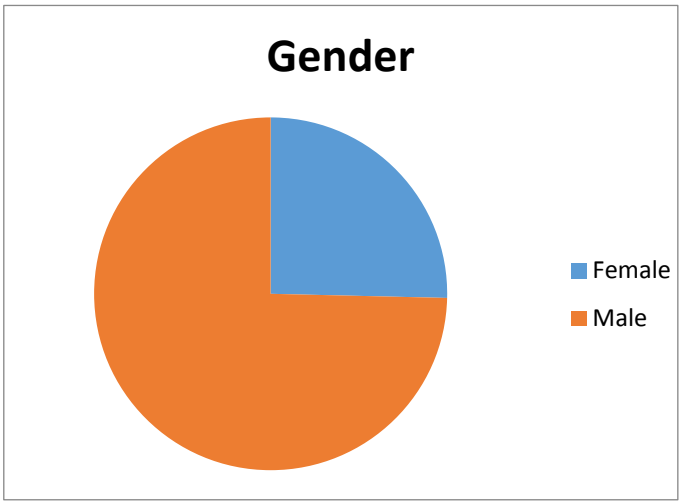

Figure 4.1 Gender Compositions of Respondents

From the table, it can be seen that 74.6% of the participants were Male while the remaining 25.4% were Female. Paraphrasing, of the 67 valid responses fed into the SPSS software, 50 were male while 17 were female. The gender composition shows that the sample population on building construction companies in Addis Ababa is slightly dominated by male respondents.

4.2.2 Age

From the above table, it can be seen that 52.2% of the participants were from 25 to 34 years old which covers half of the participants and 34.3% of the participants were ranged from 35-44 Years old while the remaining 13.4% were ranged from 45 to 54 Years old. The maturity level of someone becomes improved as the age has grown. And if the respondents from the

age of 35 and above taken as matured, it can be concluded that 47.8% of the respondents are matured.

4.2.3 Educational Background

From the summary table above it can be seen that the respondents with a Bachelor's degree qualification is proportional with a Master's degree qualification. From the total sample 35% of the respondents have a Bachelor's degree while 32% of the respondents have a Master's degree.

4.2.4 Role of Respondents in Construction projects

The bar chart below summarizes the roles of the respondents. The positions held by the respondents were grouped into 4, namely, Project Management, Construction Engineer, Contract/Site/ Office Engineer and Other. Accordingly, 33 of the respondents were found to be in the Contract Admin/ Site/ Office Engineer (49.3%), 14 were Construction Engineers (20.9%), 9 were Project Managers (13.4%) and the remaining 11 were occupied other sectors (16.4%). From the open ended section of the roles in the survey it was possible to see 2 Architect, 2 consultants, 2 J.Material Engineer, 2 Project Coordinator and 3 Resident Engineers.

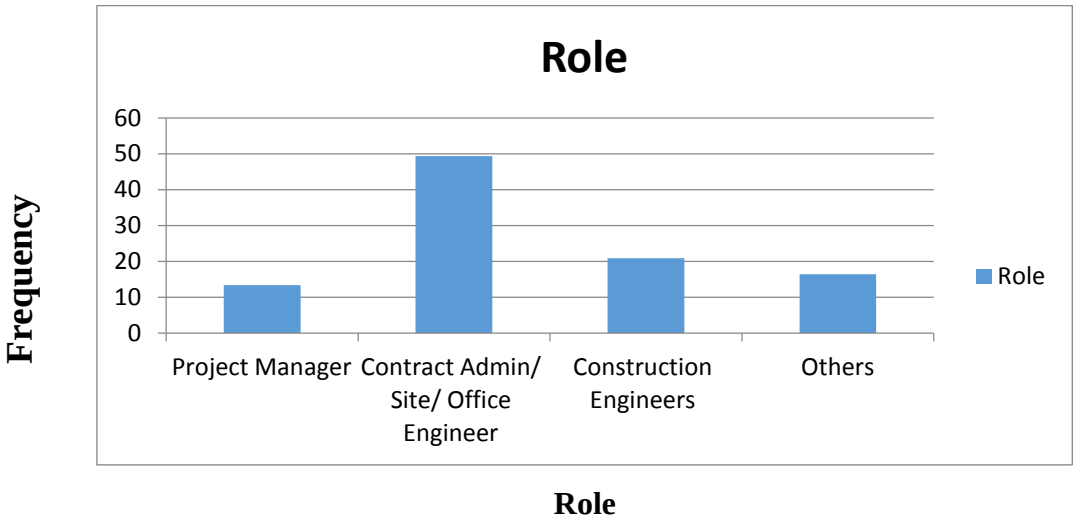

Figure 4.2 Roles of Respondents

4.2.5 Years of Experience

Years of working experience was grouped into 4: 5 years or less, 5-10 years, 10-15 years and over 15 years. Analysis showed that of the total 67 respondents 25 had 5-10 years working experience (37.3%), 18 respondents had working experience between 10-15 years (26.9%)

while 14 worked 5 years or less (20.9%) and 10 had over 15 years of working experience (14.9%).

4.3 Descriptive Statistics of Study Variables

4.3.1 Price escalation awareness and its mitigation mechanism

The second section of the survey asked questions relating to price escalation awareness and its mitigation mechanism of the construction companies. The data gathered from the respondents was fed into SPSS. A question 1 through 12 of the second section in the questionnaire appears to be focused on assessing cost management practices and challenges in building construction projects. The respondents were asked to respond on various aspects related to cost management, price escalation, stakeholder involvement, and the use of price adjustment methodologies. Other questions asked were regarding a comprehensive range of topics related to cost management and price escalation in building construction projects and aims to gather insights into current practices, challenges, and stakeholder involvement in managing cost-related issues. The analysis of responses is elucidated below.

From a total of Sixty-seven responses gathered, a significant Thirty Eight respondents (56.7%) stated that a separate department that handles cost management was not present in their companies whereas Twenty Nine (43.3%) of respondents stated that a separate department was present in their organization.

While sixty one respondents (91%) stated that the cost management is very important in building construction and the remaining six respondents (9%) stated the importance of cost management in building construction.

Forty-two responses (62.7%) were indicated that their firm has the trend to identify the occurrence of price escalation at the planning stage whereas twenty-five (37.3%) responded that there is no trend of identification of the occurrence of price escalation at the planning stage by their firms.

Twenty-three respondents (34.3%) stated that their firm was conducting price escalation reviews and updates during the project life-cycle in a monthly basis while the other twenty-three respondents (34.3%) stated that their firm was conducting price escalation reviews and

updates in a quarterly manner. On the other hand ten respondents (14.9%) stated that their firm was conducting price escalation reviews and updates during project life-cycle when it is occurred. Four respondents (2.9%) stated that it was conducted as the contractor submitted and the other two respondents (2.9%) stated that it was conducted at payment stage. Surprisingly, two respondents (2.9%) stated that there is no need to conduct price escalation and update in their firm due to the foreign currency used in the project.

Fifty-three respondents (79.1%) stated that their companies had used manual records for tracking and monitoring project costs during construction whereas the remaining fourteen responses (20.9%) were found that their companies used cost tracking software for tracking and monitoring project costs during construction.

Sixty-three respondents (94%) stated that their firm has encountered challenges related to price escalation in building construction projects. While the other Four (6%) were found that no encountered challenges related to price escalation in the building construction.

Fifty-one respondents (76.1%) found to be dissatisfied with the price escalation management practices implemented in their building construction projects. The other sixteen responses (23.9%) were found to be satisfied with the price escalation management.

Fifty respondents (74.6%) stated that their firm has involved all stakeholders (Client, contractor, suppliers) in the price escalation management discussions and decisions. The remaining seventeen responses (25.4%) were found that their firm has not involved all stakeholders.

Forty-two respondents (62.7%) stated that the Client for the project is more affected by the price escalation where as the remaining twenty-five respondents (37.3%) were believed that the contractor is more affected by the price escalation.

Sixty-one respondents (91%) were familiar with price adjustment methodologies. The remaining six respondents (9%) were not familiar with the price adjustment methodologies.

Fifty-one respondents (76.1%) stated that the client/owner of the project allow adopting price adjustment in the contract document. The other sixteen responses (23.9%) were found that

the client/owner of the project not allowed adopting price adjustment in the contract document. Another open ended question was communicated to the respondents who were indicating that the client/owner of the project disallow adopting price adjustment in the contract document. The respondents mentioned that the client/owner disallow adopting price adjustment in the contract document due to the reason that the Client doesn't want to allocate additional budget for such cost, DB contract, avoid the inconvenience, lack of awareness, and it is "blocked" for contractors on purpose.

From the descriptive analysis of frequencies it can be said that cost management is considered as the most important aspect in the building construction projects, however a separate department for the cost management of the building projects were not assigned in most of the selected Grade-1 contractors. There is a moderate tendency of identifying the occurrence of price escalation in the planning stage and conducting price escalation reviews and updates during the project life-cycle in a monthly and quarterly basis. The contractors have made a manual record on tracking and monitoring project costs during construction and there is a poor usage of cost tracking software shown in the construction companies. Almost all of the construction companies have encountered a challenge related to price escalation in the building construction projects. Moreover the construction companies are not satisfied with the current price escalation management practices in the building construction projects. On the other hand there is a high tendency of involving all stakeholders in the price escalation management discussions and decisions. Most of the construction companies believed that the client of the projects is the most affected by price escalation. Regarding the price adjustment, almost all of the professionals involved on the building construction projects are familiar with the methodologies. In addition to this, the client/owner of the projects has allowed adopting price adjustment in the contract documents. However some results showed that there are conditions that the client/owner disallows adopting price adjustment in the contract documents such as lack of awareness, blocking the price adjustment for contractors on purpose and avoid additional cost.

Table 4.3 Price escalation awareness and its mitigation mechanism

Question 1. Is there a separate department that handles cost management in your organization?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	38	56.7	56.7	56.7

	Yes	29	43.3	43.3	100.0
	Total	67	100.0	100.0	

Question 2. How would you rate the importance of cost management in building construction projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Important	6	9.0	9.0	9.0
	Very important	61	91.0	91.0	100.0
	Total	67	100.0	100.0	

Question 3. Does your company have a mechanism to identify the occurrence of price escalation at the planning stage of the project?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	25	37.3	37.3	37.3
	Yes	42	62.7	62.7	100.0
	Total	67	100.0	100.0	

Question 4. How often do you conduct price escalation reviews and updates during the project life-cycle?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	As it comes	2	3.0	3.0	3.0
	As it occurs	2	3.0	3.0	6.0
	as the need arises	2	3.0	3.0	9.0
	at payment stage	2	3.0	3.0	11.9
	It depends the one that I work now use dollar as currency so there is not much of escalation to affect the project	2	3.0	3.0	14.9
	Monthly	23	34.3	34.3	49.3
	Not specific	3	4.5	4.5	53.7
	Quarterly	23	34.3	34.3	88.1
	when contractor submit	2	3.0	3.0	91.0
	when it is needed	2	3.0	3.0	94.0
	when it occurs	2	3.0	3.0	97.0
	when the contractors summit a price escalation letter	2	3.0	3.0	100.0
	Total	67	100.0	100.0	

Question 5. How do you track and monitor project costs during construction?

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Cost tracking software	14	20.9	20.9	20.9
	Manual records	53	79.1	79.1	100.0
	Total	67	100.0	100.0	

Question 6. Have you encountered any challenges related to price escalation in building construction projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	4	6.0	6.0	6.0
	Yes	63	94.0	94.0	100.0
	Total	67	100.0	100.0	

Question 7. Are you satisfied with the current price escalation management practices implemented in your building construction projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dissatisfied	51	76.1	76.1	76.1
	Satisfied	16	23.9	23.9	100.0
	Total	67	100.0	100.0	

Question 8. Do you involve all stakeholders (clients, contractors, suppliers) in the price escalation management discussions and decisions?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	17	25.4	25.4	25.4
	Yes	50	74.6	74.6	100.0
	Total	67	100.0	100.0	

Question 9. Which Party do you believe is the most affected by price escalation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Client	42	62.7	62.7	62.7
	Contractor	25	37.3	37.3	100.0
	Total	67	100.0	100.0	

Question 10. Are you familiar with price adjustment methodologies?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	6	9.0	9.0	9.0
	Yes	61	91.0	91.0	100.0
	Total	67	100.0	100.0	

Question 11. Does the Client/owner of the project allow adopting price adjustment in the Contract document?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	16	23.9	23.9	23.9
	Yes	51	76.1	76.1	100.0

	Total	67	100.0	100.0	
Question 12. If your answer to question 11 is "No", please describe the reason.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		55	82.1	82.1	82.1
	Because the Client doesn't want to allocate additional budget for such cost	2	3.0	3.0	85.1
	Because use DB contract	2	3.0	3.0	88.1
	Don't want the inconvenience	3	4.5	4.5	92.5
	Due to lack of awareness	2	3.0	3.0	95.5
	Most of the time price escalation adjustment is "blocked" for contractors on purpose.	3	4.5	4.5	100.0
	Total	67	100.0	100.0	

Alternatively, rating items were developed to further study the Existing Price Escalation Management Practices on the selected Grade-1 contractors. Section A of part III in the questionnaire asked questions relating to the price escalation awareness and its mitigation mechanism. In addition to the previous section of the analysis regarding price escalation awareness and its mitigation mechanism respondents were asked if there is a clear strategy to control price escalation in projects, if regularly updates cost estimation and forecasting processes to address price escalations, if there is active collaboration with contractors and suppliers to tackle price escalation concerns, if there is a contingency plan in place to address unexpected cost increases during construction projects, if proactive exploration of alternative materials or construction methods to mitigate price escalation, if there is an effective communication channel in place to promptly address and resolve price escalation issues and if the contractors are resilient in managing and mitigating price escalation.

The following descriptive analysis presents the responses from the selected Grade-1 contractors and consultants involved in the project. Responses showed that proactively explores alternative materials or construction methods to mitigate price escalation with a mean and standard deviation of 3.48 and 1.146 respectively. Clear strategies to control price escalation in projects are above the mean cut off point of 2.5. The item that was found to show the least mean is a clear strategy to control price escalation in projects. This mean score

was found to be 3.06 with a standard deviation of 0.967. Analysis of selected Grade 1 contractors has indicated that most existing price escalation management practice mean points are well above average.

Table 4.4 Scale Rating of Existing price escalation management practices

	N	Minimum	Maximum	Mean	Std. Deviation
There is a clear strategy to control price escalation in projects	67	2	5	3.06	0.967
Regularly updates cost estimation and forecasting processes to address price escalations	67	2	5	3.24	0.939
Actively collaborates with contractors and suppliers to tackle price escalation concerns	67	2	5	3.28	0.997
There is a contingency plan in place to address unexpected cost increases during construction projects	67	2	5	3.40	1.016
Proactively explores alternative materials or construction methods to mitigate price escalation	67	2	5	3.48	1.146
There is effective communication channels in place to promptly address and resolve price escalation issues	67	2	5	3.33	0.960
Resilient in managing and mitigating price escalation	67	1	5	3.12	1.213

4.3.2 Applying Price adjustment in contract clauses

Part III section D of the questionnaire discusses one of the mitigation mechanism of price adjustment which is apply price adjustment in the contract clauses. Accordingly, mitigating the effect of material cost increases, inclusiveness of the price adjustment in all building construction contracts to account for fluctuations in material prices, providing a fair and equitable solution for both contractors and clients when material costs change during the project, maintaining project profitability and prevent cost overruns due to material price

increases, and requirement of careful consideration and negotiation to ensure they are fair and reasonable for all parties involved have been highlighted to signal applying of price adjustment in contract clauses.

Table 4.5 Applying price adjustment in contract clauses

Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Can help mitigate the effect of material cost increases	67	2	5	4.13	0.815
Should be included in all building construction contracts to account for fluctuations in material prices	67	2	5	4.28	0.755
Price adjustment clauses can provide a fair and equitable solution for both contractors and clients when material costs change during the project	67	3	5	4.18	0.777
Can help maintain project profitability and prevent cost overruns due to material price increases	67	3	5	4.28	0.670
It requires careful consideration and negotiation to ensure they are fair and reasonable for all parties involved	67	3	5	4.40	0.605

As can be seen from the table above, all items had a score above the average cut-off point of 2.5. This indicates that all five items are supporting the application of price adjustment in contract clauses to mitigate price escalation. The application of price adjustment requires careful consideration and negotiation to ensure they are fair and reasonable for all parties involved has taken the highest score with mean and standard deviation of 4.40 and 0.605 respectively from a total of 67 responses. Whereas, the application of price adjustment in contact clauses can help mitigate the effect of material price has got relatively lowest score with mean and standard deviation respectively 4.13 and 0.815.

4.4 Correlation Analysis

Part III section B and C of the questionnaire was developed to study the cause of price escalation on building construction projects on the construction companies. The questions

were identified based on the internal and external causes of price escalation in building construction projects. Four parameters were identified for the internal causes of price escalation which are poor cost estimation, improper planning &/or improper implementation of proper planning, project schedule changes and poor contract management. Similarly four parameters were identified for the external cause of price escalation such as material cost increase, Labor/equipment cost increase, fluctuation in money exchange rate and increase in global demand for construction materials.

A question 1- 4 of Part III Section B of the questionnaire was developed to measure the poor cost estimation while questions 5-8 measured improper planning &/or improper implementation of proper planning. Questions 9 – 13 measured project schedule changes where questions 14 - 16 were used to study the poor contract management.
Similarly question 1- 4 of Part III Section C of the questionnaire was developed to measure the material cost increase while question 5-10 measured labor and equipment cost increase. Questions 11 – 17 measured the fluctuation in money exchange rate where question 18-24 measured the increase in global demand for construction materials.
Correlation analysis was conducted to explore the strength in the relationship between the price escalation variables and success variables of building construction projects. Correlation coefficients are used to assess the strength and direction of the linear relationships between pairs of variables. (MM Mukaka. 2012)

There are two main types of correlation coefficients: Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient (MM Mukaka, 2012). Pearson’s r is a measure that assesses the association between two continuous (or metrics) variables. Spearman’s ρ is a non-parametric measure that assesses the association using two sets of ranked scores of two variables. Similar to Pearson’s r, the range of Spearman’s ρ is also from -1 to 1, but Spearman’s ρ doesn’t require that the two variables be linearly related and does not assume that the variables are measured on interval or ration scales. (J Choi, et al, 2010) A 5 point Likert scale was developed to determine the causes of price escalation on the construction firms making the collected data as an ordinal variable. The data was then transformed using SPSS to relate the internal and external causes of price escalation. Finally, Pearson’s correlation coefficient r has been reported as follows to discuss the relationship of the internal and external causes of price escalation variables.

As can be observed from the tables below all independent variable of the price escalation are positively and strongly related. This relationship for most variables is also significant at the 99% confidence level. This significant relationship is in support of the assumption that the causes of price escalations are related with one another.

Table 4.6 Correlation between price escalation variables

		PCE	IP	PSC	PCM	MCI	LECI	FMER	IGDM
PCE	Pearson Correlation	1	.440**	.482**	.384**	0.213	.665**	.361**	.315**
	Sig. (2-tailed)		0.000	0.000	0.001	0.084	0.000	0.003	0.009
	N	67	67	67	67	67	67	67	67
IP	Pearson Correlation	.440**	1	.677**	0.214	.546**	.441**	.258*	.247*
	Sig. (2-tailed)	0.000		0.000	0.082	0.000	0.000	0.035	0.044
	N	67	67	67	67	67	67	67	67
PSC	Pearson Correlation	.482**	.677**	1	.581**	.443**	.564**	.458**	.444**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	67	67	67	67	67	67	67	67
PCM	Pearson Correlation	.384**	0.214	.581**	1	0.231	.585**	.504**	.301*
	Sig. (2-tailed)	0.001	0.082	0.000		0.059	0.000	0.000	0.013
	N	67	67	67	67	67	67	67	67
MCI	Pearson Correlation	0.213	.546**	.443**	0.231	1	.277*	.623**	.281*
	Sig. (2-tailed)	0.084	0.000	0.000	0.059		0.023	0.000	0.021
	N	67	67	67	67	67	67	67	67
LECI	Pearson Correlation	.665**	.441**	.564**	.585**	.277*	1	.601**	.502**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.023		0.000	0.000
	N	67	67	67	67	67	67	67	67
FMER	Pearson Correlation	.361**	.258*	.458**	.504**	.623**	.601**	1	.592**
	Sig. (2-tailed)	0.003	0.035	0.000	0.000	0.000	0.000		0.000
	N	67	67	67	67	67	67	67	67
IGDM	Pearson Correlation	.315**	.247*	.444**	.301*	.281*	.502**	.592**	1
	Sig. (2-tailed)	0.009	0.044	0.000	0.013	0.021	0.000	0.000	
	N	67	67	67	67	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials

The highest correlation was observed between internal causes of price escalation which are improper planning &/or improper implementation of proper planning and project schedule

change (r=0.677). This is an expected result as improper planning leads to project schedule change.

The second highest relationship was recorded between internal causes and external causes of price escalation which are poor cost estimation and labor & Equipment cost increase (r=0.665). This also is an anticipated result since the increase of labor and equipment price is the result of poor estimation during the planning stage of the project.

Table 4.7 Correlation between project success variables

		DPC	QC	CO	CIS	DBS	PTNS	IROI
DPC	Pearson Correlation	1	.478**	.600**	.373**	.413**	.284*	.381**
	Sig. (2-tailed)		0.000	0.000	0.002	0.001	0.020	0.001
	N	67	67	67	67	67	67	67
QC	Pearson Correlation	.478**	1	.398**	.638**	.566**	.468**	.389**
	Sig. (2-tailed)	0.000		0.001	0.000	0.000	0.000	0.001
	N	67	67	67	67	67	67	67
CO	Pearson Correlation	.600**	.398**	1	.493**	.310*	.402**	.535**
	Sig. (2-tailed)	0.000	0.001		0.000	0.011	0.001	0.000
	N	67	67	67	67	67	67	67
CIS	Pearson Correlation	.373**	.638**	.493**	1	.427**	.582**	.367**
	Sig. (2-tailed)	0.002	0.000	0.000		0.000	0.000	0.002
	N	67	67	67	67	67	67	67
DBS	Pearson Correlation	.413**	.566**	.310*	.427**	1	.458**	.715**
	Sig. (2-tailed)	0.001	0.000	0.011	0.000		0.000	0.000
	N	67	67	67	67	67	67	67
PTNS	Pearson Correlation	.284*	.468**	.402**	.582**	.458**	1	.458**
	Sig. (2-tailed)	0.020	0.000	0.001	0.000	0.000		0.000
	N	67	67	67	67	67	67	67
IROI	Pearson Correlation	.381**	.389**	.535**	.367**	.715**	.458**	1
	Sig. (2-tailed)	0.001	0.001	0.000	0.002	0.000	0.000	
	N	67	67	67	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key: DPC-Delay in Project Completion, QC-Quality Compromised, CO-Cost Overrun, CIS-Change In Scope, DBS-Dispute Between Stakeholders, PTNS-Project Teams not Satisfied, IRON-Effect On Return On Investment

The table above summarizes the relationship between the project success criteria. Highest correlations were found between dispute between stakeholders and effect on the Return on Investment (r= 0.715).

Table 4.8 Correlation between price escalation and project success variables

		PCE	IP	PSC	PCM	MCI	LECI	FMER	IGDM
DPC	Pearson Correlation	.322**	.264*	.432**	0.136	0.228	.371**	.295*	.285*
	Sig. (2-tailed)	0.008	0.031	0.000	0.274	0.063	0.002	0.015	0.020
	N	67	67	67	67	67	67	67	67
QC	Pearson Correlation	.457**	.281*	0.112	0.073	0.204	.431**	0.201	.288*
	Sig. (2-tailed)	0.000	0.021	0.367	0.556	0.099	0.000	0.104	0.018
	N	67	67	67	67	67	67	67	67
CO	Pearson Correlation	0.130	0.077	.318**	0.216	.363**	.337**	.505**	.485**
	Sig. (2-tailed)	0.293	0.536	0.009	0.080	0.003	0.005	0.000	0.000
	N	67	67	67	67	67	67	67	67
CIS	Pearson Correlation	.450**	.299*	0.174	0.179	0.106	.427**	0.126	.382**
	Sig. (2-tailed)	0.000	0.014	0.158	0.147	0.391	0.000	0.308	0.001
	N	67	67	67	67	67	67	67	67
DBS	Pearson Correlation	.497**	0.181	.313**	.250*	0.118	.449**	0.233	.373**
	Sig. (2-tailed)	0.000	0.143	0.010	0.041	0.340	0.000	0.058	0.002
	N	67	67	67	67	67	67	67	67
PTNS	Pearson Correlation	.377**	0.165	.262*	-0.005	-0.001	.416**	0.139	.535**
	Sig. (2-tailed)	0.002	0.181	0.032	0.968	0.992	0.000	0.263	0.000
	N	67	67	67	67	67	67	67	67
IROI	Pearson Correlation	.374**	0.165	.394**	.350**	0.167	.350**	.266*	.342**
	Sig. (2-tailed)	0.002	0.183	0.001	0.004	0.177	0.004	0.030	0.005
	N	67	67	67	67	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials, DPC-Delay in Project Completion, QC-Quality Compromised, CO-Cost Overrun, CIS-Change In Scope, DBS-Dispute Between Stakeholders, PTNS-Project Teams not Satisfied, IRON-Effect On Return On Investment

The table above shows the relationship between the independent variables (price escalation) with project success variables. From the table it can be seen that half of the relationships are significant at the 95% confidence level ($p<0.05$). The correlations range is between -0.05 and 0.535. It can be concluded that most price escalation variables are positively related with project success variables.

Highest correlation was observed between increase global demand in construction materials and project teams not satisfied ($r=0.535$) followed by fluctuation in money exchange rate & cost overrun ($r=0.759$).

4.5 Regression Analysis

A regression analysis was conducted to determine the effect of price escalation on the success of building construction projects.

Before discussing the outputs of the regression tests for violation on the classic linear regression model assumptions was conducted as follows.

4.5.1 Testing for violations of statistical assumptions

Most statistical tests rely upon certain assumptions about the variables used in the analysis. When these assumptions are not met the results may not be trustworthy, resulting in a Type I or Type II error, or over- or under-estimation of significance or effect size(s). (Osborne and Waters, 2002)

The degree to which valid inferences may be drawn from the results of inferential statistics depends upon the sampling technique and the characteristics of population data. This dependency stems from the fact that statistical analyses assume that sample(s) and population(s) meets certain conditions. These conditions are called statistical assumptions. If violations of statistical assumptions are not appropriately addressed, results may be interpreted incorrectly. In particular, when statistical assumptions are violated, the probability of a test statistic may be inaccurate, distorting Type I or Type II error rates. (Nimon, 2012).

4.5.2 Normality and Linearity Test

According to Park (2015) one common assumption is that a random variable is normally distributed. In many statistical analyses, normality is often conveniently assumed without any empirical evidence or test. But normality is critical in many statistical methods. When this assumption is violated, interpretation and inference may not be reliable or valid.

Lack of symmetry (skewness) and pointiness (kurtosis) are two main ways in which a distribution can deviate from normal. The values for these parameters should be zero in a normal distribution. (Ghasemi and Zahedias, 2012)

Kim (2013) stated that for small samples ($n < 50$), if absolute z-scores for either skewness or kurtosis are larger than 1.96, which corresponds with an alpha level 0.05, then reject the null hypothesis and conclude the distribution of the sample is non-normal.

For medium-sized samples ($50 < n < 300$), reject the null hypothesis at absolute z-value over 3.29, which corresponds with an alpha level 0.05, and conclude the distribution of the sample is non-normal.

The following table summarizes the skewness and kurtosis results of the variables that were used in the regression models.

Table 4.9 Skewness and kurtosis results for price escalation

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
PCE	67	-0.659	0.293	-0.285	0.578
IP	67	0.075	0.293	-1.343	0.578
PSC	67	-0.054	0.293	-0.529	0.578
PCM	67	-0.133	0.293	-0.849	0.578
MCI	67	-0.337	0.293	-1.034	0.578
LECI	67	0.037	0.293	-1.297	0.578
FMER	67	-0.790	0.293	-0.045	0.578
IGDM	67	-0.144	0.293	-1.082	0.578
DPC	67	-0.204	0.293	-0.996	0.578
QC	67	-0.270	0.293	-0.503	0.578
CO	67	-0.294	0.293	-0.757	0.578
CIS	67	0.247	0.293	-0.957	0.578
DBS	67	0.053	0.293	-1.051	0.578
PTNS	67	-0.223	0.293	-0.557	0.578
IROI	67	0.047	0.293	-1.129	0.578
Valid N (listwise)	67				

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials, DPC-Delay in Project Completion, QC-Quality Compromised, CO-Cost Overrun, CIS-Change In Scope, DBS-Dispute Between Stakeholders, PTNS-Project Teams not Satisfied, IRON-Effect On Return On Investment

As can be observed from the tables the results a skewness and kurtosis value in relation to standard errors is between the acceptable ranges of ±2.00. Furthermore the histogram and Normal P-P plots in the Appendix clearly indicate that the data for the variables are normally distributed.

4.5.3 Multicollinearity Test

The multicollinearity test was performed to determine if the independent variables were not highly correlated with one another. In order to detect this, pair wise and multiple variable collinearity tests of Tolerance and its inverse Variation Inflation Factor (VIF) were used. Accordingly, the table below presents these values of the two independent regression independent variables.

Table 4.10 Collinearity Statistics for Regression model

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	PCE	0.523	1.911
	IP	0.325	3.078
	PSC	0.310	3.223
	PCM	0.458	2.184
	MCI	0.357	2.802
	LECI	0.305	3.281
	FMER	0.265	3.779
	IGDM	0.553	1.809
a. Dependent Variable: Project success			
Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials			

As can be seen from tables 4.9 the tolerance values for both models are above 0.1 and the inverse VIF values are below 10. This indicates that there is no severe multicollinearity among the independent variables; hence, the assumption of multicollinearity is not violated.

4.5.4 Independence of Observations

A final test that the residuals of observations are independent from one another was performed to verify the assumption of no autocorrelation in the CLRM. The Dublin-Watson (DW) test was used to check the independence of residuals from one another. A regression analysis using the DW test statistic indicated the following values for the regression model.

Table 4.11 DW Statistic for Regression model

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.685[a]	0.469	0.396	0.44334	2.072
a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER					
b. Dependent Variable: Project success					
Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials					

As can be seen from table 4.11 the DW test statistic values for the regression model is 2.072 with a null hypothesis of no evidence of autocorrelation if these values are between the upper

and lower bounds of the critical D values. Using the DW distribution table with n=67 and k=10 at the 95% confidence interval for model 1 the boundary is (1.95, 1.98) and our DW value is close to the boundary. Therefore, we fail to reject the null hypothesis that there is no autocorrelation between the independent first order residuals. In other words, the independence of observations assumption is satisfied.

4.5.5 Regression results of price escalation variables and Delay in project completion

Table 4.12 Regression results of price escalation and Delay in project completion

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.538[a]	0.290	0.192	0.64324

a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.793	8	1.224	2.958	.008[b]
	Residual	23.998	58	0.414		
	Total	33.791	66			

a. Dependent Variable: Delay in project completion

b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.053	0.904		2.272	0.027
	PCE	0.070	0.124	0.087	0.566	0.573
	IP	-0.258	0.193	-0.259	-1.336	0.187
	PSC	0.770	0.266	0.575	2.896	0.005
	PCM	-0.460	0.198	-0.379	-2.318	0.024
	MCI	0.111	0.253	0.081	0.439	0.662
	LECI	0.302	0.215	0.282	1.405	0.165
	FMER	0.044	0.213	0.045	0.208	0.836
	IGDM	-0.013	0.174	-0.011	-0.074	0.942

a. Dependent Variable: Delay in project completion

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase,

LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials

The multiple linear regression as indicated in above Table 4.12 shows that the model is statically significant at $p<0.05$ level. The table also shows a positive relationship ($r=0.538$) between the price escalation and delay in project completion. As can be seen from the adjusted r_2 value of 0.29, 29% of the variability in the dependent variable can be explained by the independent variables.

The ANOVA analysis shows that the model indicates a linear relationship between the variables which is significant at the 99% confidence interval.

From the regression result it can be seen that Project schedule change ($\beta=0.770$) is the predominant factors that would most likely have a significant effect on the delay in project completion in the building construction projects in Addis Ababa.

4.5.6 Regression results of price escalation variables and Quality compromised

The regression result in table 4.13 below shows that the model is statically significant at the 95% confidence interval. The correlation coefficient $r=0.612$ indicates a positive relationship between the independent and dependent variables. The r_2 value of 0.374 indicates that 37.4% of the variability in quality compromised due to the effect of price escalation. The adjusted r_2 value indicates the generalizability of this model in another population.

The significant F-test in the ANOVA table shows the joint significance of the independent variables in the linear regression model. Further analysis of coefficients indicated that labor & equipment cost increase ($\beta= 0.518$) is statically significant in explaining the relationship between the two variables.

Table 4.13 Regression results of price escalation and Quality compromised

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.612[a]	0.374	0.288	0.73154		
a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						
ANOVA[a]						

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.573	8	2.322	4.338	.000[b]
	Residual	31.039	58	0.535		
	Total	49.612	66			
a. Dependent Variable: Quality compromised						
b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.347	1.028		1.311	0.195
	PCE	0.321	0.141	0.327	2.281	0.026
	IP	0.156	0.220	0.130	0.711	0.480
	PSC	-0.675	0.302	-0.416	-2.232	0.030
	PCM	-0.102	0.226	-0.069	-0.453	0.652
	MCI	0.414	0.288	0.250	1.438	0.156
	LECI	0.518	0.244	0.398	2.117	0.039
	FMER	-0.319	0.242	-0.266	-1.319	0.192
	IGDM	0.348	0.197	0.246	1.764	0.083
a. Dependent Variable: Quality compromised						
Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials						

4.5.7 Regression results of price escalation variables and cost overrun

The multiple correlation coefficient value as shown in table 4.14 below (r=0.626) indicates a positive relationship between independent and dependent variables. The adjusted r2 value of 0.308 shows that the explanatory power of the model in which 30.8% of variability of the dependent variables can be explained by the independent variables.

Table 4.14 Regression results of price escalation and cost overrun

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.626[a]	0.392	0.308	0.55729
a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER				

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.628	8	1.454	4.680	.000[b]
	Residual	18.013	58	0.311		
	Total	29.642	66			

a. Dependent Variable: Cost overrun

b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.275	0.783		1.629	0.109
	PCE	-0.092	0.107	-0.122	-0.862	0.392
	IP	-0.393	0.168	-0.422	-2.348	0.022
	PSC	0.410	0.230	0.327	1.778	0.081
	PCM	-0.209	0.172	-0.184	-1.218	0.228
	MCI	0.399	0.220	0.311	1.818	0.074
	LECI	0.248	0.186	0.247	1.334	0.187
	FMER	0.092	0.184	0.100	0.501	0.619
	IGDM	0.292	0.150	0.267	1.942	0.057

a. Dependent Variable: Cost overrun

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials

The significant F-test in the ANOVA table confirms that the relationship between the variables was linear at a joint significance level $p<0.05$. Coefficient analysis confirmed that only improper planning &/or improper implementation of proper planning is statically significant at the 95% confidence interval.

4.5.8 Regression results of price escalation variables and change in scope

The regression results in the table 4.15 below signal the model is statically significant at the 95% confidence interval. The multiple correlation coefficient r = 0.642 shows a positive relationship between the variables where r_2 value of 0.412 indicates the independent variables together account for 41.2% of the variability in change in scope of the project.

The ANOVA table shows that the model has a joint significance at the 99% confidence interval while Poor cost estimation, Project schedule change, fluctuation in money exchange

rate, Increase in global demand of construction materials are statistically significant at $p<0.05$ significance level. The regression result thus indicated that poor estimation, project schedule change, fluctuation in money exchange rate, increase in global demand of construction materials are the leading factors responsible for the scope creep of a project.

Table 4.15 Regression results of price escalation and change in scope

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.642[a]	0.412	0.331	0.58015

a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.673	8	1.709	5.078	.000[b]
	Residual	19.521	58	0.337		
	Total	33.194	66			

a. Dependent Variable: Change in scope

b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.307	0.815		1.603	0.114
	PCE	0.242	0.111	0.302	2.168	0.034
	IP	0.220	0.174	0.223	1.262	0.212
	PSC	-0.584	0.240	-0.440	-2.436	0.018
	PCM	0.197	0.179	0.163	1.099	0.276
	MCI	0.215	0.229	0.158	0.940	0.351
	LECI	0.299	0.194	0.281	1.541	0.129
	FMER	-0.457	0.192	-0.466	-2.379	0.021
	IGDM	0.542	0.157	0.469	3.461	0.001

a. Dependent Variable: Change in scope

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials

4.5.9 Regression results of price escalation variables and Dispute between stakeholders

Table 4.16 Regression results of price escalation and Dispute between stakeholders

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.582[a]	0.339	0.248	0.73839

a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.228	8	2.028	3.720	.001[b]
	Residual	31.623	58	0.545		
	Total	47.851	66			

a. Dependent Variable: Dispute between stakeholders

b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.606	1.038		0.584	0.561
	PCE	0.365	0.142	0.380	2.573	0.013
	IP	-0.299	0.222	-0.252	-1.347	0.183
	PSC	0.177	0.305	0.111	0.579	0.565
	PCM	-0.039	0.228	-0.027	-0.169	0.866
	MCI	0.277	0.291	0.170	0.954	0.344
	LECI	0.326	0.247	0.255	1.321	0.192
	FMER	-0.353	0.244	-0.300	-1.444	0.154
	IGDM	0.383	0.199	0.276	1.922	0.060

a. Dependent Variable: Dispute between stakeholders

Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials

The multiple correlation coefficient value as shown in the table 4.16 above (r= 0.582) indicates that there is a positive relationship between the independent and dependent variables. The r_2 value of 0.339 indicates the explanatory power of this model in which the independent variables together account for 33.9% of the variance in dispute between

stakeholders. The adjusted r_2 value of 0.248 indicates the generalizability of this model in another population.

The ANOVA table shows the joint significance of this model that confirms the model depicts a linear relationship between the independent and dependent variables. Further analysis of coefficients showed that only poor cost estimation the proposed eight variables are statically significant at the 95% significance interval.

4.5.10 Regression results of price escalation variables and project teams not satisfied

The multiple correlation coefficient value in table 4.17 below (r=.722) shows a positive relationship among the two sets of variables. The adjusted r_2 value of 0.521 shows that 52.1% of the variability in the dependent variable can be explained by this model.

The ANOVA tables indicates that there is a joint significance in the model at the 99% confidence interval, whereas from the coefficients table it can be seen that Poor contact management, Labor & equipment increase, Fluctuation in money exchange rate and Increase in global demand for construction materials are statistically significant at $p<0.05$ level.

Table 4.17 Regression results of price escalation and project teams not satisfied

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.722[a]	0.521	0.454	0.64307		
a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.044	8	3.256	7.872	.000[b]
	Residual	23.986	58	0.414		
	Total	50.030	66			
a. Dependent Variable: Project teams not satisfied						
b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	1.534	0.904		1.698	0.095
	PCE	0.182	0.124	0.186	1.476	0.145
	IP	-0.308	0.193	-0.254	-1.594	0.116
	PSC	0.384	0.266	0.236	1.444	0.154
	PCM	-0.593	0.198	-0.402	-2.989	0.004
	MCI	0.095	0.253	0.057	0.375	0.709
	LECI	0.599	0.215	0.459	2.789	0.007
	FMER	-0.487	0.213	-0.405	-2.290	0.026
	IGDM	0.779	0.174	0.549	4.488	0.000
a. Dependent Variable: Project teams not satisfied						
Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials						

4.5.11 Regression results of price escalation variables and effect on Return On Investment

Table 4.18 Regression results of price escalation and effect on Return on Investment

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.517[a]	0.267	0.166	0.67378		
a. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						
ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.610	8	1.201	2.646	.015[b]
	Residual	26.331	58	0.454		
	Total	35.940	66			
a. Dependent Variable: Effect on Return On Investment						
b. Predictors: (Constant), IGDM, IP, PCM, PCE, MCI, LECI, PSC, FMER						
Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.671	0.947		0.708	0.482
	PCE	0.213	0.129	0.256	1.648	0.105
	IP	-0.281	0.203	-0.273	-1.386	0.171
	PSC	0.405	0.279	0.293	1.454	0.151
	PCM	0.149	0.208	0.119	0.718	0.476

	MCI	0.219	0.265	0.155	0.825	0.413
	LECI	0.031	0.225	0.028	0.139	0.890
	FMER	-0.198	0.223	-0.194	-0.890	0.377
	IGDM	0.265	0.182	0.220	1.456	0.151
a. Dependent Variable: Effect on Return On Investment						
Key: PCE-Poor Cost Estimation, IP-Improper Planning &/or improper implementation of proper planning, PSC-Project Schedule Change, PCM-Poor Contract Management, MCI-Material Cost Increase, LECI-Labor & Material Cost Increase, FMER-Fluctuation in Money Exchange Rate, IGDCM-Increase in Global Demand for Construction Materials						

The multiple correlation coefficient value as shown in table 4.18 above (r=0.517) indicates a positive relationship between independent and dependent variables. The adjusted r2 value of 0.166 shows that the explanatory power of the model in which 16.6% of variability of the dependent variables can be explained by the independent variables.

The ANOVA table indicates that there is a joint significance in the model at the 99% confidence interval. From the regression result it can be seen that Project schedule change (β=0.405) is the predominant factors that would most likely have a significant effect on the delay in project completion in the building construction projects in Addis Ababa.

4.6 Summary of Correlation and Regression Analysis

4.6.1 Results of Hypothesis H1:

Hypothesis H1 dictated that price escalation is positively associated with delay in project completion. The correlation analysis showed that there is a positive relationship between delay in project completion and the causes of price escalation. Half of this relationship was significant at $p<0.05$ level. Poor cost estimation, improper planning or improper implementation of proper planning and project schedule change was found to have the highest correlation with delay in project completion.

As the same manner, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for delay in project completion and price escalation showed that poor cost estimation (β=0.770) is the predominant factors that are statistically significant at the 95% confidence interval. Therefore, we fail to reject H1.

4.6.2 Results of Hypothesis H2:

Hypothesis H1 proposed that price escalation is positively associated with quality compromised. The correlation analysis showed that there is a positive relationship between the causes of price escalation and quality compromised. Almost half of this relationship was

significant at $p<0.05$ level. Poor cost estimation and labor & equipment cost increase was found to have the highest correlation with delay in project completion.

Similarly, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis showed that labor & equipment cost increase ($\beta=0.518$) is the predominant factors that effect the quality to be compromised in the building construction projects in Addis Ababa. Therefore, we fail to reject H2.

4.6.3 Results of Hypothesis H3:

Hypothesis H1 postulated that price escalation is positively associated with cost overrun. When investigating the relationship between the cost overrun and the causes of price escalation, the strongest relationship was found to be with the fluctuation in money exchange rate($r=0.505$). This relationship was also found to be significant at 95% confidence interval.

While, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for cost overrun showed that material cost increase ($\beta=0.399$) is the predominant factors, however it is not statistically significant at the 95% confidence interval. Therefore, we reject the H3.

4.6.4 Results of Hypothesis H4:

Hypothesis H1 proposed that price escalation is positively associated with change in scope. The correlation analysis showed that there is a positive relationship between the variables of project escalation and change in scope. The strongest relationship Poor cost estimation, improper planning or improper implementation of proper planning, labor & equipment price increase and increase in global demand for construction materials. Half of this relationship was significant at $p<0.05$ level.

Similarly, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for change in scope showed that increase in global demand for construction materials ($\beta=0.542$) is the predominant factor that is statistically significant at the 95% confidence interval. Therefore, we fail to reject H4.

4.6.5 Results of Hypothesis H5:

Hypothesis H1 proposed that price escalation is positively associated with dispute between stakeholders. The correlation analysis showed that there is a positive relationship between dispute between stakeholders and price escalation variables. This relationship was significant at $p<0.05$ level. Poor cost estimation, project schedule change, labor & equipment cost increase and increase in global demand for construction materials was found to have the highest correlation with delay in project completion.

As the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for dispute between stakeholders showed that increase in global demand for construction material ($\beta=0.383$) is the predominant factor, however it is not statistically significant at the 95% confidence interval. Therefore, we reject H5.

4.6.6 Results of Hypothesis H6:

Hypothesis H1 proposed that price escalation is positively associated with project team not satisfied. When investigating the relationship between the project team not satisfied and the causes of price escalation, the strongest relationship was found to be with the project team not satisfied($r=0.535$). Half of this relationship was also found to be significant at 95% confidence interval.

The ANVOA table supports that this model has a joint significance while the adjusted r_2 value of 0.454 indicated that 45.4% of the variability of project teams not satisfied can be explained by the price escalation variables. Among the variables increase in global demand for construction materials ($\beta=0.779$) and labor & equipment material increase ($\beta=0.599$) are statistically significant at the 95% confidence interval. Thus, we fail to reject Hypothesis H6.

4.6.7 Results of Hypothesis H7:

Hypothesis H1 proposed that price escalation is positively associated with effect on Return on Investment. The correlation analysis showed that there is a positive relationship between effect on Return on Investment and price escalation variables. This relationship was found to be significant at 95% confidence interval. Poor cost estimation, improper planning or improper implementation of proper planning and project schedule change was found to have the highest correlation with delay in project completion.

While, the ANOVA table in the regression analysis indicated that there is a joint significance in the relationship. Coefficients analysis for effect on Return on Investment showed that project schedule change (β=0.405) is the predominant factor, however it is not statistically significant at the 95% confidence interval. Therefore, we reject H7.

Table 4.19 Summary of Hypothesis & Test Results

Hypothesis	Finding
H1: Price escalation is positively associated with delay in project completion	Fail to reject
H2: Price escalation is positively associated with Quality compromised	Fail to reject
H3: Price escalation is positively associated with Cost overrun	Reject
H4: Price escalation is positively associated with Change in scope	Fail to reject
H5: Price escalation is positively associated with Dispute between stakeholders	Reject
H6: Price escalation is positively associated with project teams not satisfied	Fail to reject
H7: Price escalation is positively associated with effect on Return on Investment	Reject

CHAPTER FIVE-SUMMARY OF MAJOR FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary of major findings

The study attempted to measure the effect of price escalation on the success of building projects performed by the selected Grad-1 contractors in Addis Ababa. As per the data gathered though questionnaire survey and analyzed using SPSS software summary of the findings have been outlined as follows:

- Most construction firms(62.7%) have the trend to identify the occurrence of price escalation at the planning stage
- Almost all of construction firms (94%) have encountered challenges related to price escalation in building construction projects.
- Most of the professionals (91%) involved in the building construction projects were familiar with price adjustment methodologies.
- The proactively explores alternative materials or construction methods to mitigate price escalation with a mean of 3.48 (cut off mean point is 2.5) and standard deviaton1.146.
- The application of price adjustment requires careful consideration and negotiation to ensure they are fair and reasonable for all parties involved has taken the highest score with mean and standard deviation of 4.40 (cut off mean point is 2.5) and 0.605 respectively from a total of 67 responses.
- From a comprehensive review of literatures the control variables are the internal and external causes of price escalation in building construction projects. Four parameters were identified for the internal causes of price escalation which are poor cost estimation, improper planning &/or improper implementation of proper planning, project schedule changes and poor contract management. Similarly four parameters were identified for the external cause of price escalation such as material cost increase, Labor/equipment cost increase, fluctuation in money exchange rate and increase in global demand for construction materials.
- The success criteria of projects also identified from literature review and the selected success criteria's for the study was time, quality, cost, scope, stakeholder satisfaction, project team's satisfaction and Return on Investment.

- A positive and strong relationship was observed on the independent variables of price escalation.
- Highest correlation was observed between improper planning &/or improper implementation of proper planning and project schedule change (r=0.677) and poor cost estimation and labor & Equipment cost increase (r=0.665).
- Highest correlation was observed between increase in global demand in construction materials and project teams not satisfied (r=0.535) followed by fluctuation in money exchange rate & cost overrun (r=0.759).
- Most price escalation variables are positively related with project success variables.
- The correlation analysis showed that there is a positive relationship between delay in project completion and the causes of price escalation.
- From the regression result it can be seen that Project schedule change has a significant effect on the delay in project completion in the building construction projects in Addis Ababa. Similarly poor estimation, project schedule change, fluctuation in money exchange rate, increase in global demand of construction materials are the leading factors responsible for the scope creep of a project. From the regression analysis it was also identified that project schedule change has a significant effect on the delay in project completion in the building construction projects in Addis Ababa.
- Poor cost estimation, improper planning or improper implementation of proper planning and project schedule change was found to have the highest correlation with delay in project completion.

5.2 Conclusion

After a thorough analysis using different descriptive, correlation and regression tools the following are the conclusions of the research.

The study found that price escalation is a significant challenge faced by most construction firms, with 94% of firms encountering issues related to price escalation in their building construction projects. The findings indicate that construction professionals are generally familiar with price adjustment methodologies, and firms often proactively explore alternative materials or construction methods to mitigate price escalation.

The internal causes of price escalation identified were poor cost estimation, improper planning/implementation, project schedule changes, and poor contract management. The

external causes included material cost increases, labor/equipment cost increases, currency exchange rate fluctuations, and increases in global demand for construction materials.

Both the correlation and regression analysis showed strong positive relationships between these price escalation variables and various project success criteria, such as time, cost, and stakeholder satisfaction. Specifically, the regression analysis found that project schedule changes, poor cost estimation, and fluctuations in exchange rates and global demand had significant contribution to the delays in project completion and scope creep.

Overall, the results suggest that construction firms need to focus on improving cost estimation, planning and scheduling processes, and managing external factors like material costs and exchange rates in order to mitigate the negative effects of price escalation on project success. Careful consideration and negotiation of price adjustment mechanisms is also crucial.

5.3 Recommendation

Based on the findings and conclusions the following are the recommendations provided by the researcher so as to improve price escalation management as well as the success rate of building constructions projects in Addis Ababa.

1. Building construction companies shall improve cost estimation processes by implementing more robust cost estimation techniques to better account for potential price escalation factors. By conducting a thorough market research on material and labor costs to inform more accurate budgeting. And it is better regularly reviewed and update cost estimates throughout the project planning and execution phases.
2. Building construction companies shall enhance project planning and scheduling by developing a detailed project plans that incorporate contingencies for potential price escalation events. Improving coordination between design, procurement, and construction teams have a positive effect on the companies to minimize schedule changes.
3. Managing external price factors shall be done by closely monitor global market conditions, exchange rates, and demand for key construction materials. And also the companies shall explore alternative material options or construction methods that can provide cost savings.

4. The Building construction companies shall negotiate fair Price adjustment mechanisms by working closely with clients and contractors to develop clear, equitable price adjustment clauses in contracts. The companies also ensure that the price adjustment methodologies account for the legitimate interests of all parties involved.
5. The Building construction companies shall enhance their organizational capabilities by providing training to project teams on price escalation management techniques and tools. In addition to this developing data-driven analytics to better understand and forecast price escalation trends. Implementing these recommendations can help construction firms better anticipate, mitigate, and manage the effects of price escalation on their building projects.

5.4 Limitations of the study

The results must be viewed in the context of some restrictions, as the current study's findings illuminate the effects of price escalation on the success of building construction projects performed by particular Grades 1 contractors. The first restriction relates to the research's scope. Only Addis Ababa building construction projects were taken into consideration in the study.

The second limitation of this study was that the sample size considered only 10 Grade-1 construction companies and collected 67 valid responses due to various researcher related constraints as time limitations and resource capacity. However, because the stated standard deviations are not statistically significant, it was determined that the sample size had no effect on or prejudiced the research's findings. On the other hand, a larger sample size would probably result in a higher confidence range for the correlation and regression models' variable coefficients.

Distance has been prevented from affecting the study's data and findings in order to prevent conflicts that could result from prejudice brought on by the researcher's similar professional background. To ensure that the data collected matched the goals and study questions, a rigorous and ethical process was followed. It has been challenging to collect the surveys on time due to the need to obtain permission before collecting the necessary data. Another factor

affecting the timely gathering of replies was the respondents' requests for availability and the respondents' hectic work schedule.

5.5 Future research directions

The study's conclusions significantly add to the growing body of knowledge about and emphasis on the significance of price escalation management in building construction firms. Furthermore, it has broadened the existing knowledge by connecting the price escalation to the critical success factors of building projects in Addis Ababa. Additionally, it was recommended that the price adjustment clauses in the contract be applied in order to lessen the price escalation.

Future research can be conducted by expanding on the leads from this study and changing its context. Future research could be done on various construction sectors, such as the construction of roads, bridges, or water works, as the focus of this study was the building construction industry. A further modification in context would be to relocate the study and contrast Addis Ababa with other Ethiopian cities' price escalation management strategies for new construction.

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Appendix I: Questionnaire

Addis Ababa University

School of Commerce

Department of Project Management

MA. Project on Price Escalation

Dear Respondents,

My name is Brook Beksissa and I am a Master's student in Project management at Addis Ababa University School of Commerce. This is a questionnaire survey I have developed to gather the necessary data for fulfillment of my Master's project on the effect of Price escalation on the success of Building Construction Projects in Addis Ababa.

First of all, I want to express my gratitude for giving up some of your time to complete this survey. Please note that your replies to this survey will remain secret as it will only be used for academic reasons to investigate the impact of price escalation in various building construction companies in Ethiopia.

Moreover, your sincere answer will be really important in achieving a clear comprehension of the construction practices in relation to price escalation. To this purpose, I sincerely request that you kindly supply the necessary data in a genuine manner so that it is possible to advance the knowledge of and mitigation of price escalation in Ethiopia.

Part I. General Profile

Please place a "✔" mark to all your responses in the box provided besides each statement

1. Gender
   - ☐ Male
   - ☐ Female
2. Age

   - ☐ 18-24 years
   - ☐ 25-34 years
   - ☐ 35-44 years
   - ☐ 45-54 years
   - ☐ 55-64 years

☐ 65 years and above

3. Educational Background
   ☐ Master's degree or above
   ☐ Bachelor's degree
   ☐ College Diploma
   ☐ High school Completed
   ☐ Other (Please specify_____)

4. Role in the Construction Project
   ☐ Project Manager
   ☐ Construction Engineer
   ☐ Contract Admin/Site/Office Engineer
   ☐ Other (Please specify_____)

5. Years of Experience
   ☐ Less than 5 years
   ☐ 5 to 10 Years
   ☐ 10 to 15 Years
   ☐ Over 15 Years

Part II. Research Related Questions

Please tick on the box for a response you feel is appropriate for the following questions of the section.

A. Price escalation Awareness and Its mitigation mechanism

1. Is there a separate department that handles cost management in your organization?

   ☐ Yes
   ☐ No

2. How would you rate the importance of cost management in building construction projects?

   ☐ Very important
   ☐ Important
   ☐ Neutral
   ☐ Not important

3. Does your company have a mechanism to identify the occurrence of price escalation at the planning stage of the project?

   ☐ Yes
   ☐ No
   ☐ Other (Please specify_____)

4. How often do you conduct price escalation reviews and updates during the project lifecycle?

- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Other (Please specify_____)

5. How do you track and monitor project costs during construction?

- ☐ Cost tracking software
- ☐ Manual records
- ☐ Other (Please specify_____)

6. Have you encountered any challenges related to price escalation in building construction projects?

- ☐ Yes
- ☐ No

7. Are you satisfied with the current price escalation management practices implemented in your building construction projects?

- ☐ Satisfied
- ☐ Dissatisfied

8. Do you involve all stakeholders (clients, contractors, suppliers) in the price escalation management discussions and decisions?

- ☐ Yes
- ☐ No

9. Which Party do you believe is the most affected by price escalation?

- ☐ Contractor
- ☐ Client
- ☐ Engineer
- ☐ Other (Please specify_____)

10. Are you familiar with price adjustment methodologies?

- ☐ Yes
- ☐ No

11. Does the Client/owner of the project allow adopting price adjustment in the Contract document?

- □ Yes
- □ No

12. If your answer to question 11 is "No", please describe the reason.

_____

Part III. Rating Scale Questions:

A. Existing Price Escalation Management Practices

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Existing Price Escalation Management Practices	Rate				
		5	4	3	2	1
1	There is a clear strategy to control price escalation in projects					
2	Regularly updates cost estimation and forecasting processes to address price escalations					
3	Actively collaborates with contractors and suppliers to tackle price escalation concerns					
4	There is a contingency plan in place to address unexpected cost increases during construction projects					
5	Proactively explores alternative materials or construction methods to mitigate price escalation					
6	There is effective communication channels in place to promptly address and resolve price escalation issues					
7	Resilient in managing and mitigating price escalation					

B. Internal causes of Price Escalation

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	Internal causes of Price Escalation	Rate				
		5	4	3	2	1
Poor Cost Estimation						
1	It is a significant cause of price escalation					
2	Leads to unexpected price escalations during the construction process					
3	Can result in higher costs for materials, labor, and other construction-related expenses					
4	Contributes to price escalations that impact the overall financial viability of construction projects					
Improper Planning and/or improper implementation of proper planning						
5	It is a significant cause of price escalation					
6	Leads to unexpected price escalations during the construction process					
7	Can result in higher costs for materials, labor, and other construction-related expenses					
8	Impact the overall financial viability of construction projects					
Project schedule changes						
9	It is a major cause of price escalation					
10	Result in increased project costs					
11	Directly correlates with the likelihood of price escalation					
12	Effective project management can help minimize the impact of schedule changes					
13	It is important for stakeholders to anticipate and plan for potential schedule changes to avoid price escalation					
Poor Contract management						
14	It is a significant cause of price escalation					

15	Lead to increased project costs					
16	Lack of clarity and specificity in contracts often results in disputes and additional expenses					

C. External causes of Price Escalation

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

S No.	External causes of Price Escalation	Rate				
		5	4	3	2	1
Material cost increase						
1	It is significantly contribute to price escalation					
2	Fluctuations in material prices can lead to unexpected cost escalations					
3	Effective management of material costs is crucial for controlling overall expenses					
4	Proactive measures to mitigate material cost increases are essential for managing price escalation					
Labor and Equipment cost increase						
5	It is a significant cause of price escalation					
6	Directly impact the overall project budget					
7	Affect the profitability of construction companies					
8	It is beyond the control of construction companies					
9	Affects the affordability of construction projects					
10	Result in higher prices for end-users or clients					
Fluctuation in money exchange rate						
11	It is a significant cause of price escalation					
12	Directly impact the overall project budget					
13	Affect the profitability of construction companies					
14	It is beyond the control of construction companies					
15	Money exchange rate fluctuations affect the affordability of construction projects					
16	Result in higher prices for end-users or clients					

17	Create uncertainty and risk					
Increase in global demand for construction materials						
18	It is a significant cause of price escalation					
19	Leads to supply shortages and driving up prices					
20	Effective sourcing and procurement strategies can mitigate the impact					
21	Construction companies have limited control over global demand for construction materials					
22	Affects the affordability of construction projects					
23	Construction companies should explore alternative materials or suppliers to manage price escalation caused by global demand					
24	The fluctuation of global demand for construction materials introduces uncertainty and risk into construction projects					

D. Applying Price adjustment in Contract clauses

Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

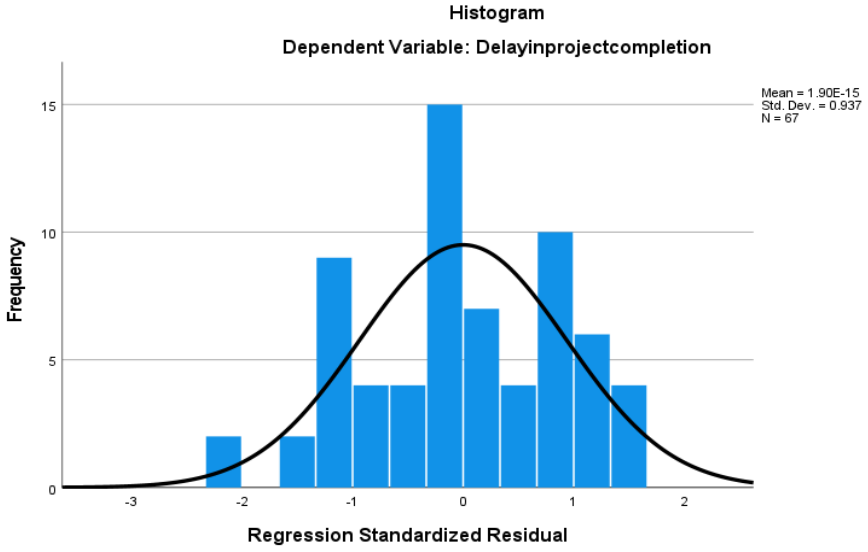
S No.	Applying Price adjustment in Contract clauses	Rate				
		5	4	3	2	1
1	Can help mitigate the impact of material cost increases					
2	Should be included in all building construction contracts to account for fluctuations in material prices					
3	Price adjustment clauses can provide a fair and equitable solution for both contractors and clients when material costs change during the project					
4	Can help maintain project profitability and prevent cost overruns due to material price increases					
5	It requires careful consideration and negotiation to ensure they are fair and reasonable for all parties involved					

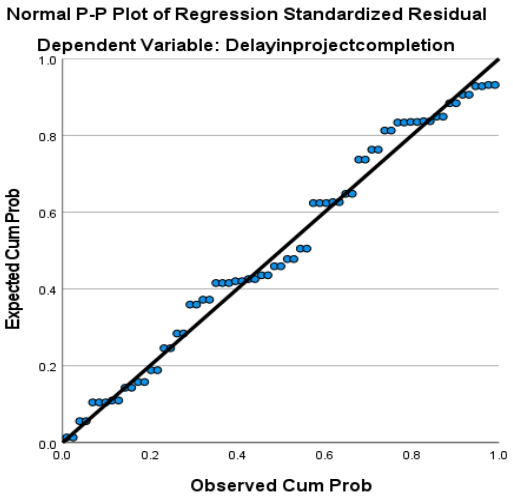
E. Evaluation of project success criteria

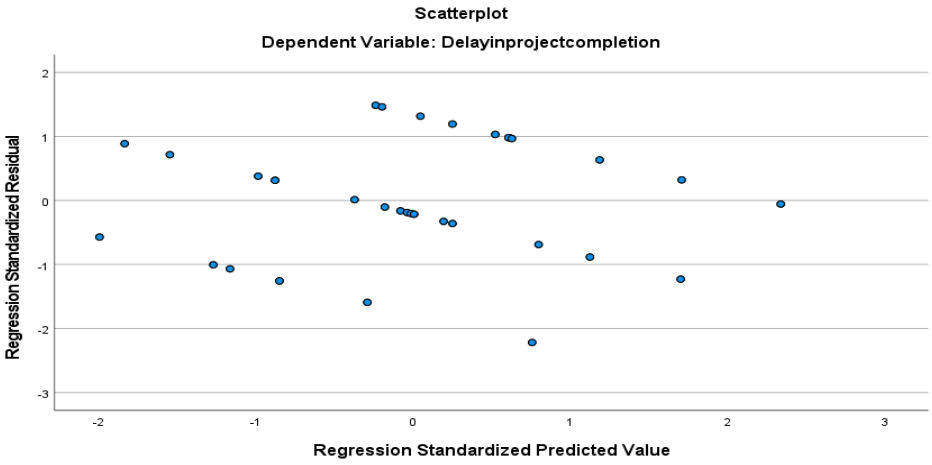
Please tick on the space you feel is appropriate for the following. Scale rating description: 5= Very Strongly Agree, 4= Strongly Agree, 3= Agree, 2= Strongly Disagree, 1= Very Strongly Disagree.

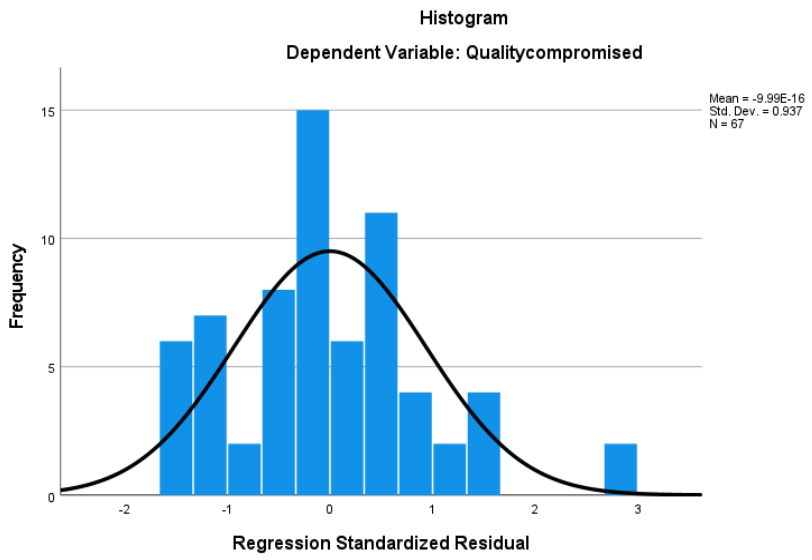
S No.	Evaluation of project success criteria	Rate				
		5	4	3	2	1
1	Delay in project completion					
2	Quality compromised					
3	Cost overrun					
4	Change in scope					
5	Dispute between stakeholders					
6	Project teams not satisfied					
7	Impact on Return on Investment(ROI)					

Appendix II - Normal and Linear Distribution Figures





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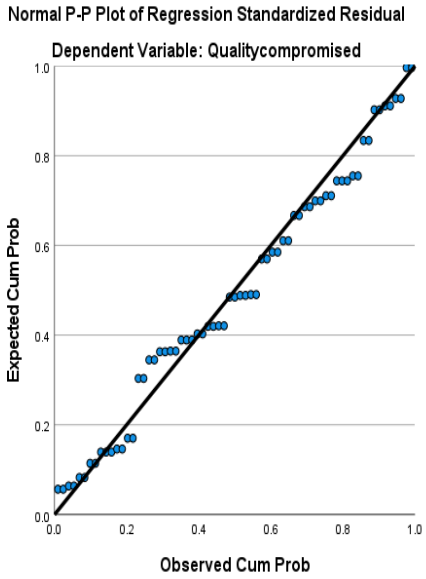
Frequency
Regression Standardized Residual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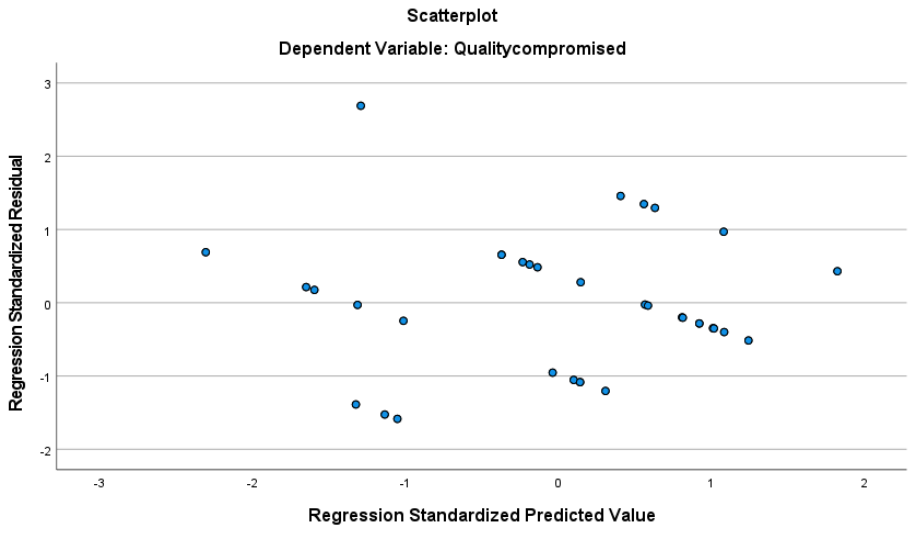
Expected Cum Prob
Observed Cum Prob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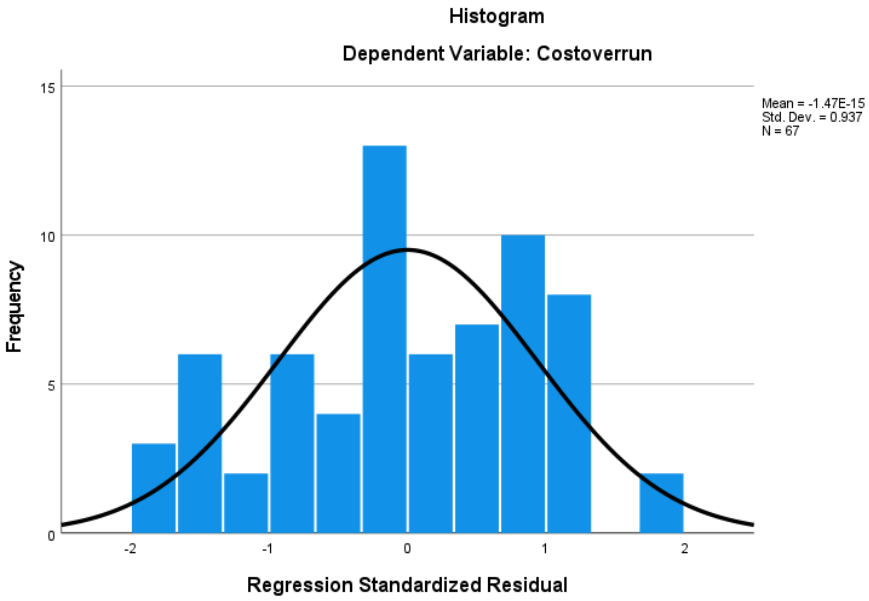
Regression Standardized Predicted Value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Frequency
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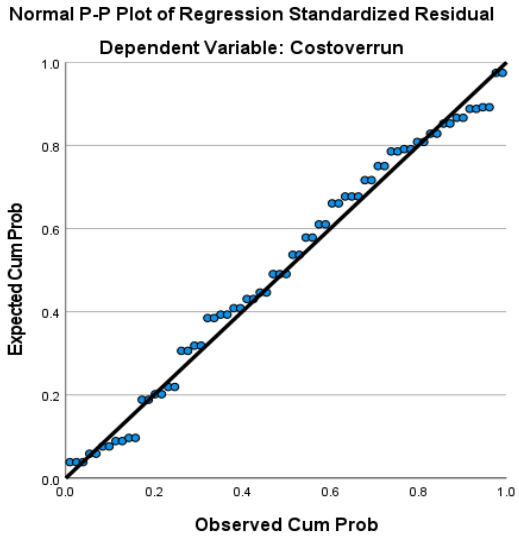
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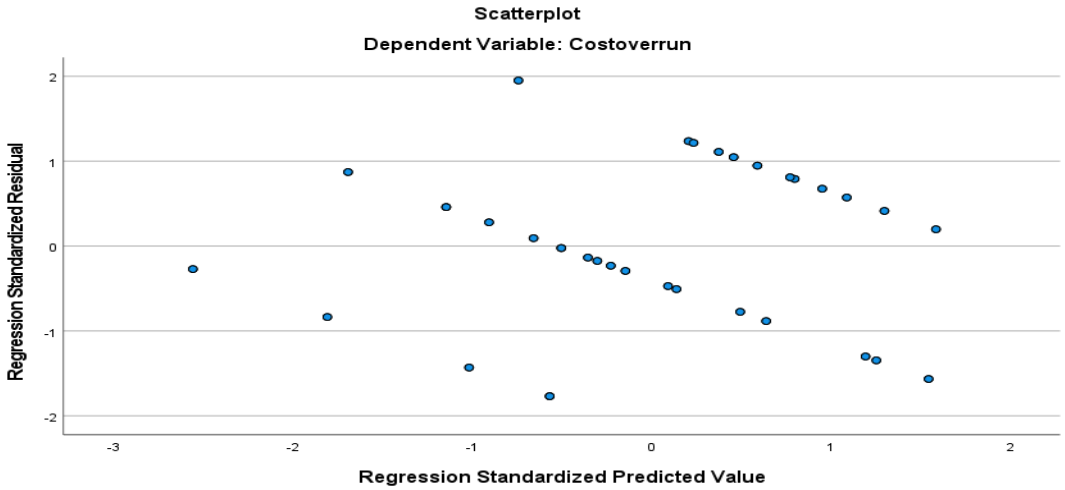
Dependent Variable: Costoverrun
Expected Cum Prob
Observed Cum Prob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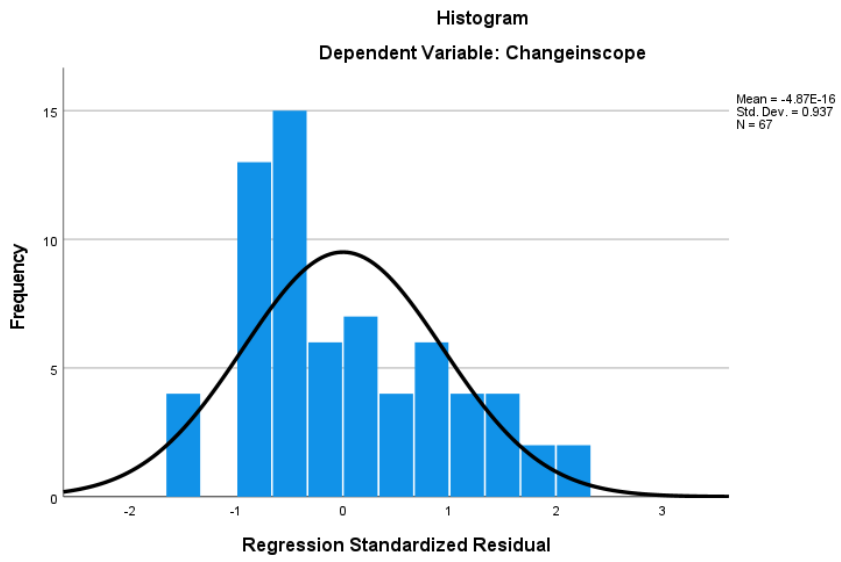
Regression Standardized Predicted Value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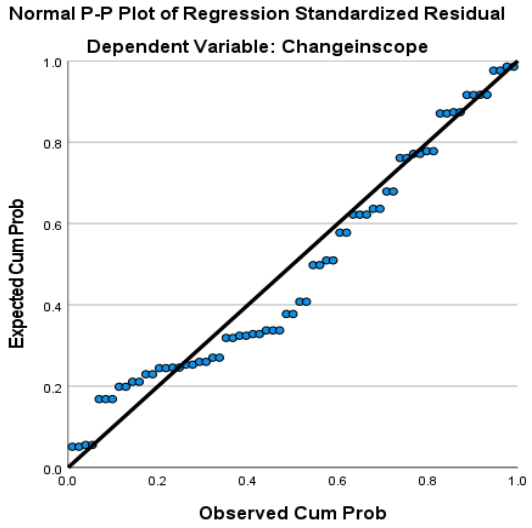
Regression Standardized Residual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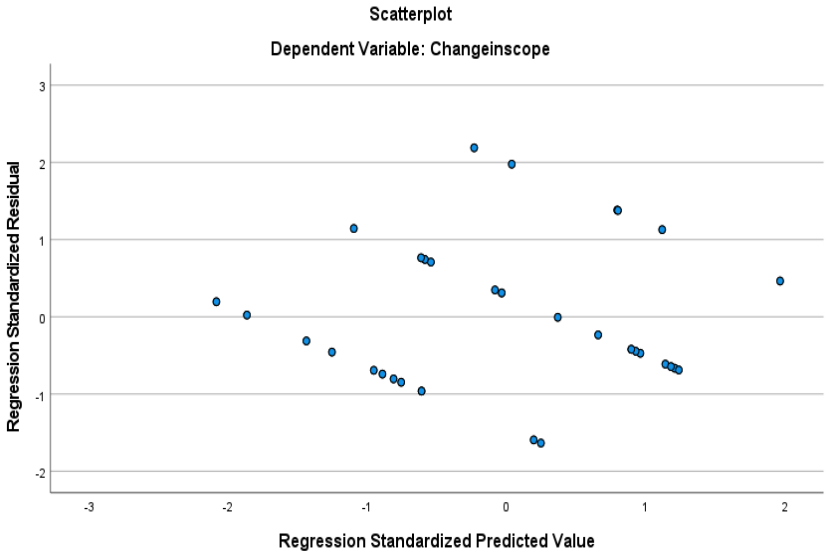
Expected Cum Prob
Observed Cum Prob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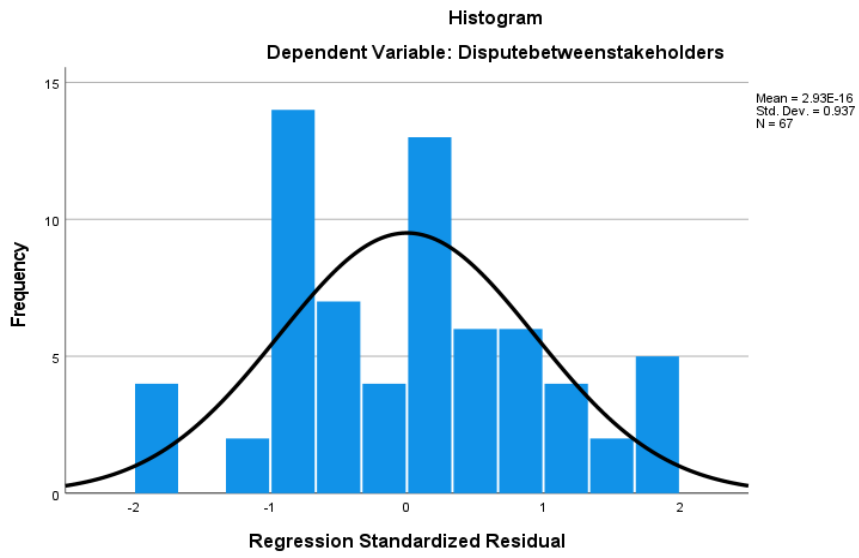
Regression Standardized Residual
Regression Standardized Predicted Value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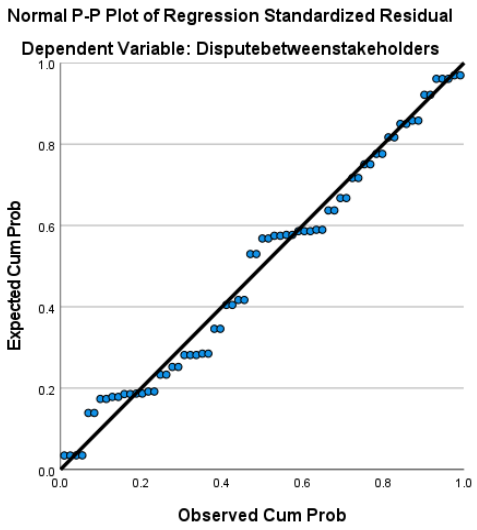
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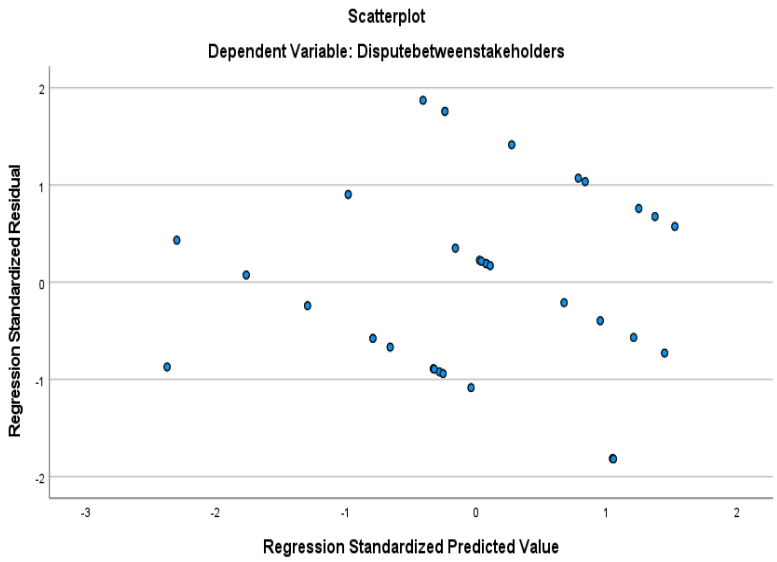
Expected Cum Prob
Observed Cum Prob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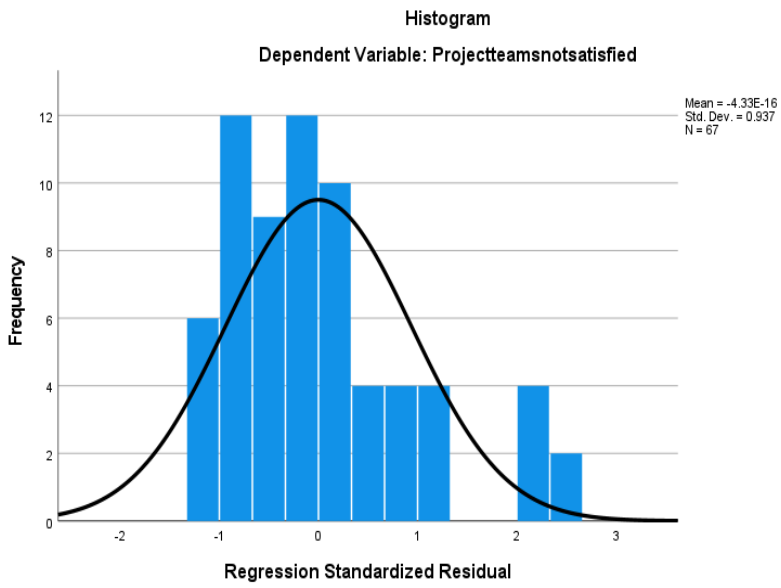
Regression Standardized Residual
Regression Standardized Predicted Value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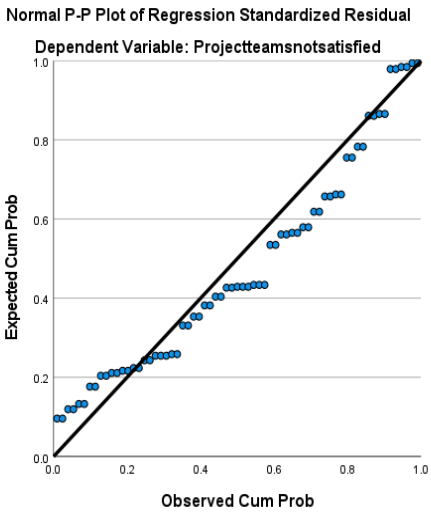
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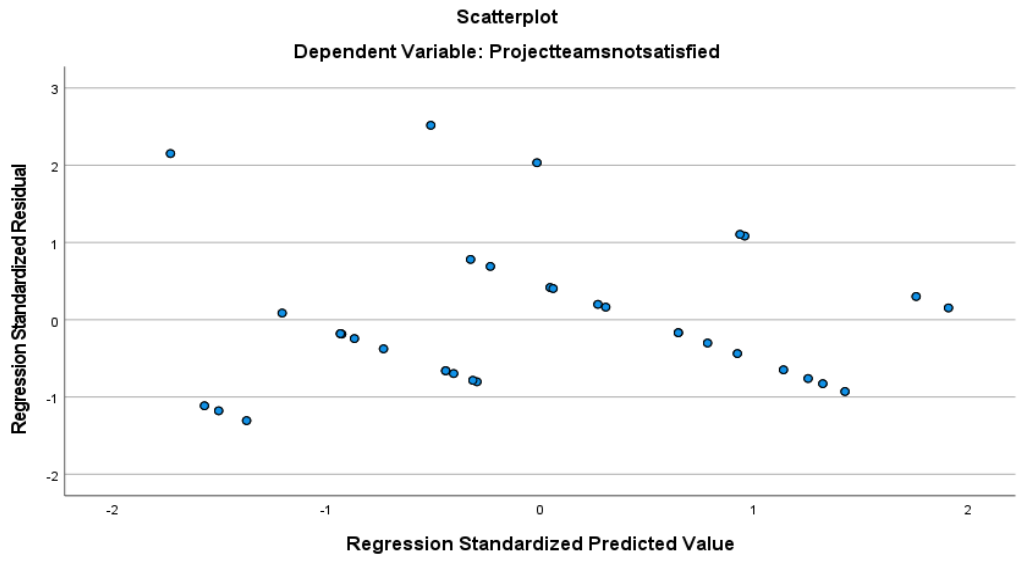
Expected Cum Prob
Observed Cum Prob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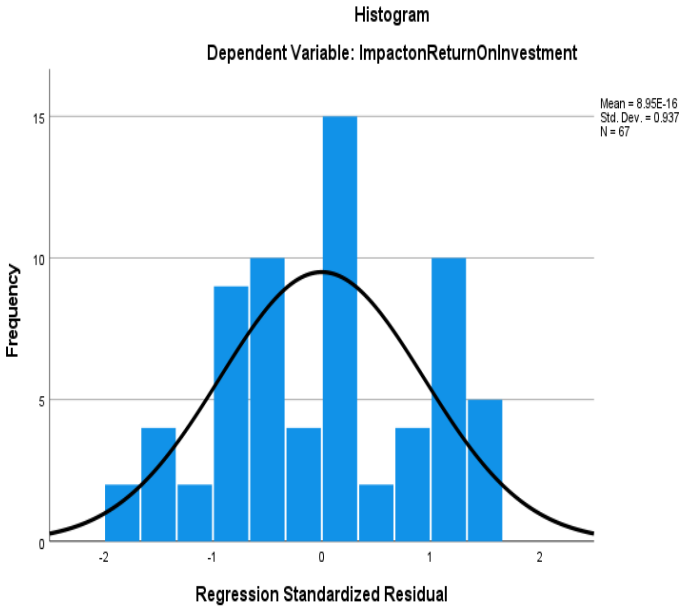
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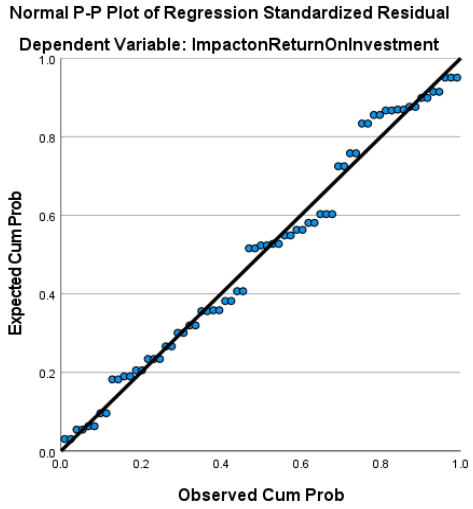
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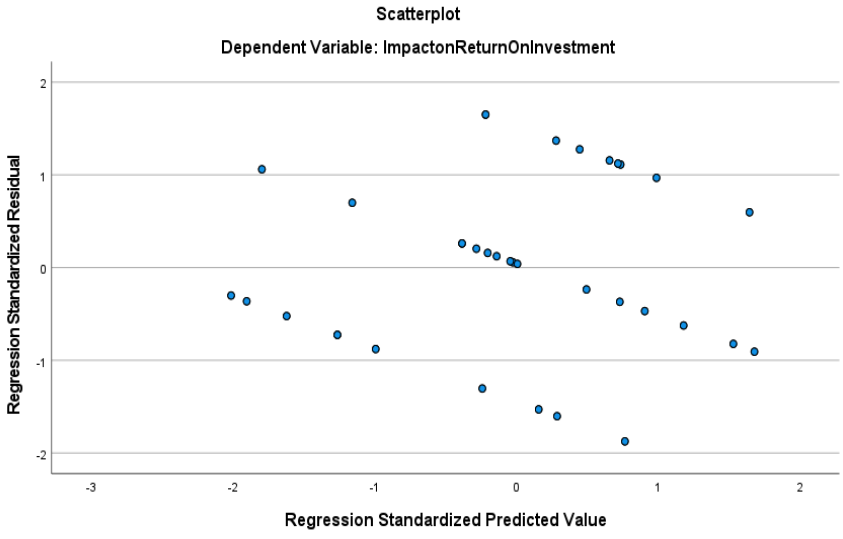
Expected Cum Prob
Observed Cum Prob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Regression Standardized Residual
Regression Standardized Predicted Value