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ASSESSMENT OF THE CAUSE AND IMPACT OF PRICE ESCALATION ON PUBLIC BUILDING CONSTRUCTION PERFORMANCE IN ADDIS ABABA

BY

TARIKU ASEGIDEW

ADVISOR: BELETE EJIGU (Ph.D.)

A Thesis Submitted to the School of Graduate Studies Department of Construction Technology and Management in Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Technology and Management

November 22, 2023

ADDIS ABABA, ETHIOPIA

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This is to certify that the thesis entitled "ASSESSMENT OF THE CAUSE AND IMPACT OF PRICE ESCALATION ON PUBLIC BUILDING CONSTRUCTION PERFORMANCE IN ADDIS ABABA" has been carried out by TARIKU ASEGIDEW FEKIE, ID NO. GSR/210/2013.

Approved by the Board of Examiners:

Advisor Name	Signature	Date
External Examiner	Signature	Date
Internal Examiner	Signature	Date
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Dean of Graduate Studies	Signature	Date

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I, the undersigned advisor, Belete Ejigu (PhD), certify that I have read and hereby recommend Addis College accept the thesis submitted by Ato Tariku Asegidew entitled "ASSESSMENT OF THE CAUSE AND IMPACT OF PRICE ESCALATION ON PUBLIC BUILDING CONSTRUCTION PERFORMANCE IN ADDIS ABABA" in partial fulfilment of the requirements for the award of a master's degree in construction technology and management.

Belete Ejigu (Ph.D.)	_____	November 22, 2023
Name of Advisor	Signature	Date

DECLARATION

I hereby declare that this thesis/dissertation entitled “ASSESSMENT OF THE CAUSE AND IMPACT OF PRICE ESCALATION ON PUBLIC BUILDING CONSTRUCTION PERFORMANCE IN ADDIS ABABA” in Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Technology and Management is my work, and has not been submitted to any university for similar purposes. The references used in this thesis are duly recognized by proper citations.

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Name of student	Signature	Date

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ABSTRACT

In a risky and uncertain environment, one key issue that has the potential to affect performance adversely is the significant escalation of the price of construction inputs that the public building construction projects in Addis Ababa, Ethiopia, have encountered in recent years. The challenge threatened the ability of the construction sector to perform projects within pre-set project objectives. Hence, this research aims to assess the causes and impacts of price escalation on the performance of public building projects. To address the objective, a questionnaire together with semi-structured interview questions, a desk, and a case study were used. The data were analyzed, and the results were triangulated. Accordingly, fluctuations in money exchange rates, inflation or an increase in construction input costs, and unbalanced demand and supply of construction input were identified as determinant causes of price escalation, whereas the project completion time delay, change in budget cost, dissatisfaction of stakeholders, arising disputes among involved stakeholders, and profit loss were the main impacts of price escalation. Findings also revealed that the price adjustment provision is not effective for a project with a contract period less than 18 months; a lack of a recognized price database; and the fact that the contract adjustable portion does not reflect the actual price escalation were the main obstacles that affect the implementation of price adjustments. Finaly, based on the analysis of the results, considering the price adjustment provisions that reflect actual increment rates, allowing price adjustments for projects with contract periods less than 18 months, the Ethiopian Statistics Agency ought to compile and release updated indexes frequently, the government ought to maintain stability in the macroeconomics and encourage local companies to specialize in the production of construction materials, and the employer ought to also develop contingency and risk management protocols and engage with capable construction firms are the recommendations to minimize the impact of price on the performance of public building megaprojects.

Keywords: PRICE ESCALATION, CAUSE, IMPACT, PERFORMANCE, PUBLIC BUILDING PROJECTS, ADDIS ABABA

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LIST OF ABBREVIATIONS AND ACRONYMS

AU	African Union
BSC	Balanced scorecard design
CP	Construction Project
CPA	Contract Price Adjustment
CPI	Consumer Price Indices
CSC	Central Statistical Agency
ECA	United Nations Economic Commotions for Africa
ECDSWCo	Ethiopian Construction Design and Supervision Works Corporation
ECPMi-CP	Ethiopian Construction Project Management Institute
EFQM	European Foundation for Quality Management excellence model
FIDIC	Federation International des Ingeneurs Conseils
FPPPA	Federal Public Procurement and Property Authority
GCC	General Condition of Contract
GDP	Gross Domestic Product
KII	Key Informant Interview
KPIs	Key Performance Indicators
MDB	Multilateral Development Banks
MIS	Mean Item Score
PMBOK	Project Management Body of Knowledge
Pn	Price adjustment Factor
PPA	Public Procurement and Property Administration Agency
PPI	Producer Price Index
rs	Spearman's rank,
SCC	Special Condition of Contract
SPSS	Statistical Package for the Social Sciences

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

The construction industry transforms a variety of resources into constructed economic and social infrastructure, and it is one of the major sectors that contributes significantly to the socio-economic growth of a country. According to Tadesse Borku (2022), in most countries, the construction industry accounts for a significant proportion of the gross domestic product (GDP). Globally, in most countries, the construction industry contributes 5–7% of their national gross domestic product (GDP) (Alaloul et al., 2021). In Ethiopia, the construction industry has important contributions to the economy, as demonstrated by its share in the GDP, which contributes about 19.5% (Demissew Gashahun, 2020).

Currently, the Ethiopian government is focusing on the construction of a public building project to address a community issue and is heavily investing in large-scale social and economic infrastructure projects that would improve the country's standards both domestically and abroad (Kuhil & Seifu, 2019). The development of these aforementioned infrastructures has a positive and significant impact on developing society. This positive significance is determined by the achievement of the objective of the construction projects, which is to accomplish the project within the available environment by putting together all the resources in a bounded time with an estimated project cost and specified quality (Shiferaw Belachew, 2017).

However, according to Zegeye (2019)and Soewin & Chinda (2018), there is an environment of risk and uncertainty that comes in as an obstacle to the realization of project objectives. Among the many variables, the major identified risk confronting the construction industry is price escalation (Iyer & Jha, 2005), which is an increment of the cost from the original contract budgeted cost in the monetary value of any construction inputs of a project and the base price of a project due to the passing of time (Kumar, 2020).

Construction projects have their plan and schedule, and hence a budget for the project is being developed. This project budget consists of the agreed-upon estimated cost for the project work scheduled to be executed and is made up of individual construction activities or work packages to establish an authorized CP cost baseline, which includes inputs such as labour, equipment, and raw materials, as stated in the Project Management Body of Knowledge (Edition, 2021).

As a result of price escalation in construction projects, an ‘actual cost’ comes into existence instead of the budgeted cost, particularly in long-term projects when the hazard is more prevalent, and its effect can be observed when the cost of those construction inputs is compared between two different periods (Tadesse Borku, 2022).

Moreover, due to price escalation, the cost or price of particular goods and services alters over a period of time in a given economy. The contractor incurs substantial extra costs due to escalation, which impacts the budget. Further, it increases the contractor's bid contingency and is a significant factor in the overall cost uncertainty for the employer (Kharbanda & Jain, 2018).

This leads to the fact that the budgeted cost of a construction project does not remain constant throughout the project lifecycle and is often completed at a cost higher than the initial budget, which has the potential to affect project performance (Nnadi & Obasi, 2018).

Hence, the key aim of this study was to assess the cause and impact of price escalation and the obstacles to the implementation of price adjustment on selected public building construction projects as a case study in Addis Ababa, Ethiopia.

1.2. Statement of the problem

In Addis Ababa, construction projects are a huge investment, and it is a sector that has received the largest government funding for government development programs for the last few years, allocating 58–60% of the capital budget (Demissew Gashahun, 2020).

Though they share a considerable amount of the country's scarce financial resources, they have been challenged by the fact that they are not delivered within the contract duration, do not comply with the specified quality, are not completed within the estimated budgeted cost, and do not meet other related project objectives that have become the norm for nearly all projects (Engineering et al., 2020).

One of the fundamental factors contributing to this challenge to the construction objectives is the associated market price escalation of the construction inputs (Dinkaywehu, 2019). According to Kumar(2020), it has been stated that most building construction projects in Addis Ababa, Ethiopia, have frequently experienced price escalation, and where this tendency is more pronounced, the price of construction inputs increased by more than 100% (Belay and Jain, 2023).

A significant increase in the cost of construction materials results in contractors executing the work at a loss, which ultimately hinders the project's progress, and the work does not meet the specified quality standards for public projects. Moreover, it destabilizes the policy, planning, implementation, and operation of the project, which ultimately affects the financial health of the country as a whole (Shiferaw Belachew, 2017).

Due to these facts and challenges, the federal government offices forced and announced that public projects were subject to contract amendments for price escalation adjustments. Contract amendments are made with the signed construction companies. A decision to allow price escalation adjustments for public projects awaits approval from the Ministry of Finance. The Federal Public Procurement and Property Authority (FPPPA) has allowed all federal budgetary offices whose project contracts permit price escalation adjustments without requesting permission from the authority (Yelkal, 2022).

This unsteady and inconsistent periodic project price escalation (Kharbanda & Jain, 2018), which can occur at any time during the project's design, tendering, and construction phases, has had an impact on project stakeholders, financiers, employees, and performance. Leading contracting stakeholders failed to perform building construction projects within the given planned project constraints, and it's becoming a great challenge for all involved stakeholders to secure and plan budgets for their future proposed projects (On et al., 2008).

Therefore, to mitigate these adverse effects of price escalation on public building projects, it becomes paramount to identify and know the causes of price escalation and their negative impact on public building construction projects' performance. Therefore, the research was focused on addressing and investigating the predetermined issue that affects the performance of selected public building construction projects located in Addis Ababa and making a significant contribution to the stakeholders by highlighting how the price escalation has impacted the projects' performance and giving them recommendations to overcome the projects' performance and obtain relevant remedial measures that should be taken in due time to improve the performance of their construction projects and serve as a benchmark for further studies that take on similar studies.

1.3. Objectives of the study

1.3.1. General objective

The general objective of the study is to assess the cause and impact of price escalation on the performance of public building projects in the Addis Ababa City Administration.

1.3.2. Specific objectives

1) To explore the determinant causes of price escalation in public building construction projects
2) To examine the impacts of price escalation on the performance of public building construction projects.
3) To identify the main obstacles that affect the effective implementation of price adjustments in public building construction projects.

1.4. Research Questions

1) What are the determinant causes of price escalation in public building construction projects?
2) What are the impacts of price escalation on the performance of public building construction projects?
3) What are the obstacles that affect the implementation of price adjustments in public building construction projects?

1.5. Significance of the study

Public building construction projects are crucial to a country's development because they boost economic activity, open new markets for suppliers and contractors, and produce revenue for the government. The key project stakeholders are constantly anticipating how well projects will perform to be completed on schedule, under budget, in compliance with end-product criteria, and to ensure their satisfaction (Engineering et al., 2020).

Thus, the study's findings enable stakeholders to create awareness about the main cause and impacts of price escalation, identify obstacles that affect the implementation of price adjustment, and forward measures that are supposed to be undertaken in public building construction projects to ensure the intended performance of the construction project.

As a result, getting forward measures helps to ensure proper planning, monitoring, and evaluation of building projects in terms of KPIs and budget allocation by the client and would create a good environment for all stakeholders taking part in the country's developmental endeavors. Moreover, this would allow for the existence of a fair, sound, and coherent relationship with international funding agencies and serve as a benchmark for further studies that take on similar or related development challenges.

1.6. The scope of the study

1.6.1. The spatial scope of the study

The study was conducted in Addis Ababa, Ethiopia. The specific location of the projects concerning the eleven sub-cities of Addis Ababa has been indicated on the map that shows the study area.

1.6.2. The thematic scope of the study

The study focused on price escalation and adjustment as the study's primary emphasis from a variety of project management aspects. The study focused on the causes and effects of price escalation and the identification of obstacles that affect the implementation of price adjustments on public building projects.

1.6.3. The temporal scope.

The primary and secondary data used for the study were collected from the directly contracted stakeholders involved in the ongoing construction mega projects. The questionnaires, interviews, and other secondary collection data from each were collected from April 1, 2023, up to mid-June 2023. The primary and secondary data used for the study were collected from the directly contracted stakeholders involved in the ongoing construction megaprojects. The questionnaires, interviews, and other secondary collection data from each were collected from April 1, 2023, up to mid-June 2023.

1.7. The limitation of the study

During the research process, the researcher encountered the following bottlenecks: time and budget constraints. Because of this, the study was restricted to covering only building construction projects among construction sectors: these were seven public building mega projects, which were the supervision and contract administration done by the Ethiopia Construction Design and Supervision Works Corporation (ECDSWCo).

The study focused on three projects for the desk study and one project for the case study. For the interview and questionnaires, only three groups (client, consultant, and contractor) were taken into consideration.

1.8. Organization of the document

This thesis consists of five chapters, each of which has sub-chapters based on the titles that address the objectives of the research. Each chapter is organized as shown below, with a short, brief description of the content of each chapter discussed here as follows: His thesis consists of five chapters, each of which has sub-chapters based on the titles that address the objectives of the research. Each chapter is organized as shown below, with a short, brief description of the content of each chapter discussed here as follows:

Chapter 1: In this chapter, the introduction part discusses the background of the study. The very reasons that led to conducting the study were explained. The chapter also includes a subchapter statement of the problem, the objectives of the study, the questions to be answered, the scope and limitations of the study, the significance of the study, and the organization and framework of the research.

Chapter 2: In this chapter, a comprehensive literature review was conducted to develop a better understanding of the research objective by referring to scholarly books, articles, and other sources relevant to this study. It includes mainly a conceptual literature review, a theoretical and empirical literature review on the predetermined specific research objectives, a conceptual framework described as a collation of previous studies, and finally, the research gaps.

Chapter 3: This chapter discusses the research methodology employed to address each research objective. This chapter describes the study area, the type of research design that has been used, the research approach, the research methods, and other relevant items. In this chapter, the ethical considerations that the researcher was considering were discussed.

Chapter 4: This chapter contains results and a discussion part. Data collected from the questionnaire, interview, desk, and case study were analyzed, and results were obtained. Discussion on the results comprising causes and effects of price escalation, identification of the main obstacles that affect the effective implementation of price adjustments in public building construction projects, and forward measures that can be taken to minimize the effects of price escalation on the performance of the selected public building projects.

Chapter 5: This is the last chapter of the study, in which conclusions were drawn from the research findings together with the measures recommended to be taken proactively and actively to minimize the effects of price escalation on the performance of public building projects. Recommendation It is a section believed to benefit clients, consultants, contractors, and stakeholders by serving as a guideline for future road construction endeavors.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical literature review

2.1.1. Definition of important terms and concepts

A. Construction projects

The scale, scope, and complexity of the work, the contractual arrangements between the parties, and the kinds of technology used all differ greatly in construction projects. A “Construction project" is any work done in connection with the construction of a building or structures that requires a coordinated effort in the fields of civil engineering and architecture. In other words, it refers to the process of planning, designing, and building physical structures such as buildings, roads, bridges, dams, and other infrastructure. Construction projects can range in scale from small renovations to large-scale projects such as the construction of skyscrapers or major transportation infrastructure, which entail the tangible assembly of infrastructure or buildings through alteration, conversion, fitting-out, commissioning, renovation, repair, maintenance, refurbishment, demolition, decommissioning, or dismantling (Demissew Gashahun, 2020).

Typically, almost all civil engineering constructions are undertaken in project form, with an objective that is stated in terms of the time frame for completion, the budgeted amount, and the required level of quality. It is a major undertaking that calls for the commitment of various skills and resources (Buchanan and Boody,1992). To ensure both the pre-determined objectives and the intended purpose, construction project management involves the application of various knowledge, tools, skills, and techniques through the processes of initiating, planning, executing, monitoring and evaluating, and closing various sub-processes, with the major goal of maximizing the three main process characteristics of quality, schedule, and cost (Abraham, 2008).

B. Project Cost,

The project budget consists of the agreed-upon estimated cost for the project work scheduled to be executed. This project cost can be defined as the total economic cost of construction of a given infrastructure and is made up of individual construction activities or work packages to establish an authorized CP cost baseline, which includes inputs such as labourr, equipment, and raw materials. According to the Project Management Body of Knowledge (Edition, 2021), the project cost varies due to unexpected activities related to in-scope work, known as a management reserve; plus, contingency reserves are set aside for uncertain events (risks) that can occur (Figure 2.1). The key benefit of this process is that it determines the CP cost baseline against which project performance can be monitored and controlled.

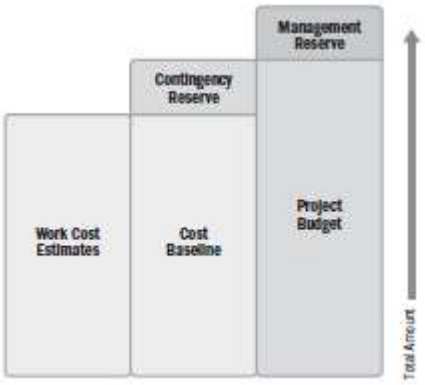

Figure 2.1 Project Management Body of Knowledge (Edition, 2021)

C. Cost estimation

Planning for the construction project entails developing an estimate for work effort, duration, costs, people, and physical conditions. According to the Project Management Body of Knowledge (Edition, 2021), estimating is used to develop cost estimates for project costs that use a quantitative assessment of the likely amount or outcome of project costs based on what is known today or existing information and circumstances. According to ECPMi-CP Cost Management. Pdf, n.d., it can be defined as the iterative process of developing an approximation of the monetary resources needed to complete construction project activities by using a variety of cost-estimating techniques.

Reliable project cost estimates at every stage of construction are necessary for responsible project management. According to DINSA (2015), an unreliable project cost estimate results in a risk to the construction projects' programming, budgeting, and planning processes, which results in an ultimate budgetary decision that impairs an effective allocation of budgets. The cost estimates are provided by a professional estimating firm, either as part of the design team or by the contractors at the tender stage. Furthermore, as stated in the Ethiopian construction project cost management working manual, estimates are very important because decisions about whether to proceed with a project are based on them (ECPMi-CP Cost Management', (no date).

D. Project Pricing

There is a distinct difference between cost estimation and pricing. A cost estimate is the cost of the resources required to complete the project. Pricing, however, includes a profit margin. According to Zegeye (2019), "pricing of work" is a submitted offer to carry out project work. In other words, a contracting company working on a project for a client attempts to calculate the expenditure of resources such as materials, manpower, machinery, finance, and time required to realize the intended project and complete the project. Then, with this cost information, a profit will be added to the project's work. This specified sum of money for a construction project is called the "tender sum." Pricing construction projects is a critical step that must be undertaken very carefully. As a result, pricing has two major components: the cost component and the profit component (On et al., 2008).

However, due to different factors such as the inflation of building material prices, labor wages, and machinery hire rates changing every year, the project work is not completed within the bounds of the planned budget or the estimated bid price value (Tadesse Borku, 2022). When the actual costs of the construction projects exceed the previously estimated bid price, then cost escalation will occur. Cost inflation is considered a major problem that hinders a project's progress since it decreases the contractor's profit, leading to huge losses that leave the project in deep trouble (Kanchana & Sukumaran, 2018).

E. Price Inflation

The term "inflation" refers to an increase in prices, which over time results in a loss of purchasing power. The average price increase of a basket of chosen goods and services over time can be used to determine the rate at which buying power is decreasing. A unit of currency now effectively has less purchasing power than it had in earlier periods due to the increase in prices, which is frequently stated as a percentage. Deflation, on the other hand, is characterized by a drop in prices and an increase in purchasing power (Oner, 2012). One of the main factors that significantly affects a nation's economy is inflation. Every industry is affected by inflation, either favorably unfavorably. The repercussions of inflation are felt throughout the construction industry. The construction project's initial budget and the final budget differed as a result of annual variations in building material prices, labor wages, and machinery hire rates (Tadesse Borku, 2022). According to Musarat et al. (2021), the rate of inflation has an impact on the construction sector as well as the project's estimated budget, which causes a revision and results in cost overruns. The annual cost increase is causing significant concern among stakeholders in the construction industry.

Contractors must deal with a great deal of uncertainty when submitting bids and funding work on projects. Due to the unpredictability of inflation and its repercussions, owners are now paying premiums on building prices in addition to the rising costs of facilities and capital. Contractors' inability to predict long-term returns on their investments and the need to redirect cash to cover resource expenditures have a negative impact on productivity. Long-term costs should be reduced in particular by properly allocating economic risks in contracting, although this would necessitate significant changes in how the construction sector operates (On et al., 2008).

To evaluate and track the effects of inflation levels, several variables should be taken into account, including the interest rate, potential output, exchange rate, money supply, wage rate, trade openness, and expectations. At the same time, inflation is significant in the economic world since it never results in a stagnation of the purchasing power of money. Furthermore, according to Musarat et al. (2021), the price of products or services at a particular time, typically once a year, might grow or drop by a given percentage. This is referred to as the inflation rate. Workers will also want a raise in pay to offset the higher living costs in response to an increase in the inflation rate, which is correlated with an increase in material costs. Companies desire low inflation rates since they can invest more money and make more money because they don't have to pay more to cover price increases.

F. Price Escalation

On the other hand, price escalation refers to a persistent rise in the price of specific commodities, goods, or services due to a combination of inflation, supply and demand, and other effects such as environmental and engineering changes. Therefore, inflation is one of the factors that cause escalations (Farid Tayari, 2023). Price escalation in construction projects is a rise in a project's base cost or the cost of any construction components from the initial contract because of time. According to Nazif et al. (2021), price escalation is the increase in the amount of money required to construct a given project above the initially budgeted sum. It also arises if the actual cost of construction is greater than the originally estimated amount. Furthermore, according to Kharbanda & Jain (2018), it is the fluctuation in the price of particular goods or services over time in a particular economy. As unit prices rise, inflationary trends in the economy are mirrored, and the price escalation has an impact on the budget and results in a significant financial overrun for construction projects. One of the major reasons for cost overruns is price escalation, which is an increment in the monetary value of any construction elements of the original contract and the base price of a project due to the passage of time (Engineering et al., 2020). Additionally, it increases the contractor's bid's contingency and is the main cause of the employer's tender rates' overall cost uncertainty. As a result, it is important to have control provisions in the building contract document to deal with the sudden price increase.

G. Relationship Between Inflation and Escalation

Inflation and escalation, though related, are not interchangeable. While escalation can be driven by general inflation related to the money supply, it is also driven by changes in technology, practices, and particularly supply-demand imbalances that are specific to a good or service in a given economy (Mohammed Gashaw, 2013).

H. Construction Contract

A construction contract is a legally binding agreement that specifies the terms and conditions under which a facility will be built. According to Mohammed Gashaw (2013), the general type of contract chosen may be influenced by the element of risk, the parties' willingness, the parties' competition, the complexity of the construction, and the parties' sense of urgency, and this project's contract type directly affects the compensation in the event of a price change.

I. Methods of Price Adjustment

Price adjustment is a technique for shifting the contractor's risk of increasing material prices to the other construction stakeholders involved, and it also enables material prices to change without endangering the agency or the contractor (Mohammed Gashaw, 2013). According to FIDIC (1999), the fundamental idea behind contract price adjustment is to provide compensation to the contractor or employer in the event of an increase or decrease in labor costs, the cost of materials, or any modification to the legislation that enables the contractor or owner to be protected from price fluctuations that may occur between contract signing and contract execution. Whenever there is a price fluctuation due to the aforementioned factors or other factors such as legislation changes, the contract prices need to be adjusted if the contract has a provision.

As a result of ongoing and unforeseen changes in the macroeconomic climate, the construction sector has been confronted with an increase in build delivery costs that, in some circumstances, do not match the budgeted ones. In light of this circumstance, contractual provisions have been created to account for the best possible recovery of price increases. There are several ways to determine the CPA. Whatever method is employed, it usually provides for both price increases and decreases, which can, in turn, lead to either an increase or a decrease in the contract price. The two commonly used alternatives in the local context to determine such variations practiced in the construction industry are "basic prices," or the proven cost method, and "price indices," or the adjustment method (Mohammed Gashaw, 2013).

2.1.2. Construction Price and performance

A. Construction Price Indices

Construction price indices are used as a basis for indexation for insurance purposes, as well as in promised value provisions in rental, leasing, and other contracts, as well as in the adjustment of sales contracts for buildings that are still under construction, and they are also used to lower estimates of construction activity output (‘Sources and Methods’, 2016). According to Mohammed Gashaw (2013), the countries' statistical directorates calculate construction price indices to satisfy the demand resulting from the need to evaluate actual changes in the output from these activities, which cannot be derived solely through reference to regular building and construction statistics. It is required to employ proxy indices from vendors or the government in Ethiopia because the country does not produce the indices needed for use in such a calculation. In the absence of trustworthy indices, a simplified version of the method using the published consumer price index may be employed. Sources and types of proxy indices could include a cement mill for cement, a minimum wage for local workers, a government-reported fuel price for fuel, etc. In conclusion, construction price indices are used to track changes or trends in construction cost (or price).

B. Price change measurement tools

To measure price changes occurring in an economy, a variety of tools are utilized. These include GDP deflators, producer price indices, pricing indices for particular items and/or services, and consumer price indices (CPIs) (Zegeye, 2019). The Consumer Price Index (CPI) is the most commonly utilized indicator of inflation. Government, business, labor, and private citizens can use it as a resource to help them make economic decisions by giving them information about price changes in the country's economy. A more suitable general index for heavy construction is thought to be the Producer Price Index (PPI), which tracks inflation at the wholesale level and the average change in prices that producers of goods received. The whole marketed output of producers in one country constitutes the target set of products and services covered in the PPI. The group includes both the goods and services that customers buy directly from service providers or through retailers, as well as the goods and services that other producers buy as inputs for their processes or as capital investments. Imports are not considered because the PPI's aim is the production of domestic producers.

C. Construction Project Performance

Construction performance refers to the ability of a construction project to meet its objectives. According to Ingle & Mahesh (2022), the success of a project is typically described as fulfilling stakeholder expectations and accomplishing its intended goal. A construction project is considered to have good performance if it is completed within the specified budget and schedule while also meeting the required quality standards and safety regulations. Traditionally, the construction industry evaluates its performance using three key indicators: time, cost, and quality (Atkinson, 1999). However, there is no consensus among scholars regarding the most important aspects of success factors, that should be taken into account when evaluating a project's success. Identification of acceptable performance areas is the first stage in measuring the performance of building projects. Finding performance measures for performance areas that help gauge performance in construction projects is the next stage (Ingle & Mahesh, 2022). This supports the argument for developing performance areas for specific countries when required.

Construction projects have inherent characteristics and are complex in nature as they involve different stakeholders, such as contractors, clients, and consultants. Due to rising environmental consciousness and shifting client demands, project success is not always straightforward to achieve. There are numerous other elements besides those three crucial ones that have a direct or indirect impact on building performance in real-world settings (Soewin & Chinda, 2018). These are the factors that can affect the performance of a construction project, including the quality of the materials, a scarcity of skilled team members, the weather, the availability of resources, the overall project management, global market conditions, a tight budget, and fierce competition in the construction industry. Additionally, the complexity of the project, the size of the project, and the timeline can all have an impact on the performance of the project. It is important to consider all these factors when evaluating the performance of a construction project (J. Yang et al., 2015).

Even though, according to numerous publications, the measurement of construction project success has recently been refined to include non-financial performance areas and environmental factors for improved construction performance such as customer relations, stakeholder satisfaction, and employee motivation, traditional financial performance areas that consider the relevance of financial factors for a construction company's profitability and viability, such as profit, turnover, return on investment, and so on, are still the most common criteria for measuring project performance to manage the performance of construction projects. The models of performance measurement that are most used in the finance and non-finance sectors are also used in the building industry. These performance models' descriptions are displayed in Table 2.1 (Ingle & Mahesh, 2022).

Table 2:1 Literature summary for performance metrics affecting project performance.

S.N	Performance areas	Performance metrics
1	Cost	Unit cost, cost growth, budget factor
2	Schedule	Construction speed, delivery speed, schedule growth, schedule factor
3	Safety	OSHA recordable, lost time injuries, fatalities
4	Productivity	Productivity factor, labour factor
5	Communication/Modifications	RFIs, submittals, modification, material waste, Modifications
6	Finance	Profit
7	Customer relations	Return business, claims, feedback
8	Quality	Systems, punch list items, warranty costs, defect costs, defect liability cost
9	Stakeholder satisfaction	Satisfaction
10	Environment	Political, economic, technical, social
11	Operations and maintenance	Service cost, maintenance

Note: performance metrics affecting project performance (Source: (Ingle & Mahesh, 2022).

D. Performance Measurement

In a time of globalization and an increasingly competitive environment, measuring performance has become critical to business success. An organization determines the parameters within which its programs, investments, and acquisitions are producing the expected results through the process of performance measurement. According to H. Yang et al. (2010), a "performance measure" is a metric that is used to quantify the efficiency and/or effectiveness of previous acts.

A construction project is considered successful when it is completed on time, without cost overruns, and within specifications. A performance measurement framework is a complete set of performance measures and indicators that have been developed consistently in accordance with a set of predetermined rules or guidelines. As performance measurement has progressed, frameworks have grown in scope and utility (H. Yang et al., 2010). Although there are other frameworks for performance measurement implemented within the construction industry, the EFQM excellence model, the BSC model, and the KPIs model are the most frequently used models for performance measurement in construction and are discussed as follows:

E. European foundation for quality management excellence model

The EFQM business excellence concept was created by 14 multinationals in 1989 to raise the standard of management in Western Europe. They formed the EFQM. It is utilized to evaluate and raise an organization's overall standard of excellence. Project, internal stakeholder, external stakeholder, and organizational business results were among the results criteria. The organizational level is typically where the EFQM excellence model is used.

F. Balanced scorecard design

The BSC, a management method that was first developed by Kaplan and Norton in 1992, allows firms to "transform their vision and strategy into action." Most businesses may evaluate their performance using the BSC framework. considering four angles:

a) Financial: "How do we appear to our shareholders?"

b) customers: "How do our customers see us?";

c) Improvement and innovation: "How can we continue to improve our processes?"

d) internal process: "What must we excel at?

Compared to the EFQM excellence models, the BSC framework is thought to be clearer and more thorough because it covers a variety of "leading and lagging indicators." It is also the model that construction businesses most use to measure their success. When the Balanced Scorecard appeared, there was a lot of dependence on financial indicators (Kaplan and Norton, 1992; Norton, 1993), as well as an outstanding contribution to performance evaluation. What is not implied is that it is exhaustive, as was mentioned before. Nevertheless, it was the peak of a performance measurement wave. frameworks that evolved organically and gradually for determining performance (Wegelius-Lehtonen, 2001).

G. Key performance indicators model

The construction sector has made extensive use of the KPIs model, which was generally established in the late 1990s. created a KPI framework. To measure project and organizational performance across the construction sector, the KPI framework was created. The project level and organizational level are the two levels at which the KPI is established as an indicator. The project-level KPIs include defects, customer satisfaction with the product and service, as well as construction cost, construction time, predictability cost, and predictability time. Safety, financial success, and productivity are the company-level measures(H. Yang et al., 2010).

The recommended KPIs' computation techniques are often divided into two groups. The first group, known as the objective measures, calculates the relevant values using mathematical formulas. The opposing group relies on the stakeholders in the project's subjective assessments and judgments.

2.1.3. Determinant causes of price escalation

Price escalation is a significant issue in both developed and developing nations. According to Shane et al. (2009), in construction projects, cost growth often manifests itself during construction. To manage this cost growth, it is essential to understand the variables that led to its occurrence. These variables in construction projects are varied, and some of them are not only hard to predict but also difficult to manage. It is also established that a poor contract could be attributed to the way it was awarded. In some cases, projects are awarded to the lowest bidder, which results in various degrees of problems. Some of these low bidders may have inadequate management skills and have less regard for contract plans, cost control, and allocation (Nazif et al., 2021).

Moreover, according to Tadesse Borku (2022), the factors contributing to the rise in building material prices are transportation; political interference; local taxes and fees; variations in the price of raw materials; financial costs; inflation; and exchange rate fluctuations. In addition, there are a few macroeconomic variables that affect the price of building supplies, such as the rate at which the local currency is exchanged for other currencies worldwide, the rate of inflation, and the interest rate charged on loans. Besides, according to Shiferaw Belachew (2017), some of the reputable factors that cause the project's cost, according to different researchers, are scope creep, an inadequate review of the contract document, poor site management, contingencies, and project size inaccuracies in cost estimation. The variables are categorized as internal and external factors.

2.1.4. Impacts of price escalation on the performance

Modern construction projects, even those of a modest scale, are typically multidisciplinary in nature and involve the participation of designers, contractors, subcontractors, specialists, construction managers, and consultants. For the industry, price escalation could bring about project abandonment, a drop in building activities, a bad reputation, and an inability to secure project finance or secure projects at higher costs due to added risks. All these consequences undermine the viability and sustainability of the building construction industry. The price escalation can account for a substantial part of the construction costs, affect the budget, and cause severe financial overruns in the construction projects. For instance, according to Baloi & Price (2003), the cost performance of a single project is frequently evaluated in terms of cost growth, or the percentage difference between the contract award amount and the final contract amount.

The costs incurred by clients and the profits made by contractors are the economic foundations of the conflicting interests that result in adversarial relationships between clients and contractors. According to Amoa-abban & Allotey (2014), price escalation has obvious effects on key stakeholders in particular and building construction in general. To the client, price escalation implies added costs over and above those initially agreed upon at the pre-contract phase, resulting in lower returns on investment. To the end user, the added costs are passed on as higher rental or lease costs. For professionals, cost overruns imply an inability to deliver value for money and could well tarnish their reputations, leading to a 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 future contracts if at fault.

In other words, in some circumstances, according to Nazif et al. (2021), it has been proven that additional costs will clearly have a negative impact on the important stakeholders in particular and the industry as a whole. Additionally, these extra expenses will prevent consultants from providing value for money, which could damage their reputation and cause clients to lose faith in them. If the contractor is at fault, there could be a loss of profit due to penalties for non-compliance and unfavorable remarks that could endanger future job opportunities (Nazif et al., 2021).

The cascade effect of this dramatic price increase has had considerable impacts outside the scope of the approved contract amounts, in addition to lost fees and harmed or destroyed construction businesses. The choice then falls to public bodies as to whether to delay projects while additional funding is sought, cancel the project if additional funding is not available, or try to reduce the project scope and threaten disputes among involved stakeholders, which results in the construction project failing to achieve its intended purpose or predetermined objectives (By- et al., 2015).

Achieving project success in the construction industry has been a daunting task. The failure of a project to perform according to the planned objectives usually results in losses for the parties involved. The project suffers from overruns in time and cost; this comes at a huge cost to the parties. However, the construction team is most often helpless because the project is influenced by different factors, which can be internal or external. Thus, most times, there are factors beyond the control of the project team (external factors)(Vacanas et al., 2020).

2.1.5. Obstacles that affect the implementation of price adjustment

The fundamental purpose of contract price adjustments is to provide compensation to the employer or contractor if labor or material costs increase or decrease, or if laws change (FIDIC, 1999a). This gives the contractor or owner protection from price changes that might happen between contract signing and contract execution. If the contract contains a provision requiring price adjustments, it must be applied whenever prices change because of the aforementioned reasons or others, such as a change in legislation.

In a typical price escalation clause, the conditions, procedures, and terms of the price adjustment should be specified. These are the timing, trigger, cap, or amount of work that will be adjusted, as well as the calculation technique. Contracting authorities choose a standard to use for calculating adjusted construction amounts as well as a formula to compute price changes. The contracting parties may specify a single formula for escalating the total cost of all completed work over a specified period or different formulas for the various work packages. Following formula selection, contracting parties should decide the formula's parameters, such as the formula's non-adjustable portion, cost element coefficients, indices, or reference prices (Mohammed Gashaw, 2013).

Methods for price adjustment have inherent limitations due to: clients who refuse to honor escalation clauses; insufficient contract provisions; and an uncompensated increase in the cost of construction materials; Price indices may overestimate or underestimate the market conditions as to how prices have risen and the selection of the most suitable index in using inflation indices, which makes the situation worse while price adjustment is taking place or being practiced and ultimately creates disputes among involved construction project stakeholders that affect construction project work progress (On et al., 2008).

2.2. Empirical Literature Review

2.2.1. Determinant causes of price escalation

According to many scholars, numerous studies of significant projects demonstrate that price escalation is common. As a result, the following discussions present the findings of various scholars on the factors causing price increases in construction projects. Therefore, according to Nazif et al. (2021), study findings, the main causes of cost increases reported by experts in the construction industry are insufficient supervision, different site conditions, a lack of cost control, design error, extensive variation, incorrect estimation methodology, fluctuation in material prices, irregular payments, government policy, contract management, transportation costs, additional works, and fraudulent and kickbacks.

Furthermore, according to Mohammed Gashaw (2013), the causes of price escalation are an increase in material cost (material price fluctuation); an increase in global demand for construction materials; fluctuation in money exchange rates; limited capacity of material producers; shortage of labor or skilled workers; change in legislation; force majeure; local concerns and requirements; and local or municipal regulations. According to Ahmed (2018), the factors contributing to price escalations are cash flow and financial difficulties; slow payments; inflation; fluctuations in material prices; number of change orders or extra work orders; frequent design changes; shortage of materials; incorrect planning and scheduling; poor contract management; government policies and political instability; and a lack of timely decision-making. According to Cunningham (2017), factors causing the price escalation are the complexity and scale of the project, the quality of the tender documentation, poor design and project specifications, the need for variations, and the nature of the site.

Moreover, according to State et al. (2017), cost overruns are attributed to several variables that are either uncontrollable or, to varying degrees, unmanageable. These factors include the accuracy of the initial cost estimate, the extent of governmental oversight and control, the number of design revisions, the length of time it takes to complete the building, and labor-related issues including employee availability, skill levels, and increases in fringe benefits.

According to Engineering et al. (2020), the internal factor that causes price escalation Long periods between design and tendering time, inadequate planning and scheduling, poor estimation or insufficient initial analysis of costs, poor contract management, poor site and project management, project schedule changes, contracts awarded before site adaptation, unclear specifications, poor technical performance, and insufficient bidding data concerning the project were the most significant factors ranked relative to other factors that cause price escalation on public building projects. high effect on price escalation.

These factors, including market conditions, inflation or increase in material cost, change in the foreign exchange rate, which goes up due to worldwide demand for construction material, change in economic conditions, fluctuation in money exchange rates, and limited capacity of material producers, were the top seven most influential external factors that cause price escalation on public building projects from the perspective of all stakeholders' relative to other factors. Price escalation in public projects in Addis Ababa, in addition to internal factors, is caused by external factors such as shortages of supply, inflation, and an increase in the foreign exchange rate. Therefore, market uncertainty became a reason for price escalation.

Table 2.2: Summary for internal and external contributing factors for price escalation.

No.	Internal Factors	External Factors
1	Delivery/procurement approach	Local concerns and requirements
2	Insufficient bidding data concerning the project	Increase in material cost
3	Project schedule changes	Force Majeure
4	Projects are awarded to the least bidder	Limited capacity of material producers
5	Engineering and construction complexities	Change in Legislation
6	Untimely payment	Maximization of profit by construction material manufacturers
7	Poor estimating	Fluctuation in money exchange rates
8	Inconsistent application of contingencies	Increase in global demand for construction materials
9	Lack of timely decision-making.	Political instability
10	Ambiguous contract provisions	Limited capacity of material producers
11	Poor design and Unclear/vague specification	Shortage of labors / skilled workers
12	Over-dependence on imported building materials	Demand and supply of construction materials
13	Unforeseen site conditions	Inflation
14	Improper planning and/or improper implementation of proper planning	Local or municipal regulations
15		Shortage of laborers / skilled workers

Note: Internal and external factors (Source: established findings from the empirical literature review by the researcher)

2.2.2. Impacts of price escalation on the performance

The building industry has been impacted by the recent, unprecedented price increase in several ways. The community of contractors and subcontractors has undoubtedly voiced concerns about reduced or abolished profit restrictions as well as major project losses. The consequences of this sudden price increase include missed payments, damaged or destroyed construction trades, as well as other issues (Belay & Jain, 2023a).

The effects of price increases on each building project have been identified in their research works as follows:

Increasing Conflict Between Contracting Parties: Conflicts frequently result in project abandonment in its entirety, cost increases, time delays, and legal action, according to Belay and Jain (2023b), there are several construction disputes as a result of disparities in suffering and expense during the time of the building project. Any one of several unfavorable causes, either alone or in combination, can lead to a construction conflict. Issues including exaggerated contract duration and rates, delays' repercussions and collateral effects, estimates of the scope and quality of work, changes to plans, explanations, and specifications, discouraging obligations, insufficiency, and interruption are the main causes of frequent conflicts.

Project delays, scope reductions, and cancellations: Due to the widespread increase in the price of private building materials, project delays, scope reductions, and cancellations are frequent. This has compelled many designers to reconsider the "quantities" necessary to justify a private advancement. As a result, projects have been postponed, cancelled, or had their scopes decreased. For public projects supported by bond issues, significant price increases raise particular challenges. When the electors approved a bond and the term for construction project tenders was formed, material values rapidly increased, and tenders began to arrive at values significantly higher than the agreed-upon contract amounts. When further funding is not forthcoming, organizations must decide whether to abandon the project, keep it on hold (keeping it delayed), or try to narrow the project's scope ((Belay and Jain, 2023b),

Increased construction project cost: Construction projects that haven't been abandoned or aren't running notably behind schedule (very late) because of price increase issues usually have higher project costs. Larger contract pricing and project costs are frequently the result of concerns about price rises from suppliers and contractors, as well as the absence of price escalation clauses in most construction contracts (Kumar, 2020).

Projects' Cash Flow (Financing) Issue: Pricing adjustments may affect both clients and contractors in addition to the project itself. Price changes significantly harm contractors' cash flow (project funding) when they are not properly compensated.

Furthermore, as stated by Dinkaywehu (2019), the recent, unprecedented price increase has had a variety of effects on the building business. Undoubtedly, claims of degraded or reduced profit margins as well as significant project losses have been made by the contractor and subcontractor communities. The knock-on effects of this sharp price increase have not only resulted in lost revenue but also in damaged or destroyed building firms, among other effects. Price changes may affect owners, clients, contractors, and the project itself. If contractors are not adequately rewarded, the main impact of price variation on them is the projects' cash flow (project financing) issues.

As recognized and summarized by Literate and Indonesia (2020), price hikes are a big problem, and it happens frequently that in a building project, the budgetary estimate is higher than the estimation, the budget is more than the budgetary estimate, and the settlement is higher than the budget. Uncontrolled construction expenses put more pressure on investors, boost construction prices, affect how investments are made, waste national resources, and may even encourage corruption or criminal activity." Cost is a major consideration throughout the project management life cycle and can be regarded as one of the most important project parameters and the project's primary determinant of success (Literate & Indonesia, 2020).

Moreover, according to Kumar (2020), the effects of price escalation identified from the literature review and the overall responses received from clients, consultants, and contractors indicate that the top 5 most influential impacts of cost escalation on public building projects were project delay, variation order, cost overrun, quality degradation, and project financing problems (budget shortfall), respectively. Price escalation in public projects in Addis Ababa is resulting in delayed completion, higher costs, lower quality, and budget shortages.

2.2.3. Obstacles that affect the implementation of price adjustment

Although the idea may seem straightforward, price adjustment is not an easily resolvable problem because prices are not being adjusted for most public building projects. Subsequently, this will lead to many disputes and claims between the various construction parties, which will ultimately hinder the success of construction projects due to the following: lack of a recognized source or price database for the history of construction materials prices that periodically produces cost indexes to establish and measure the price increase or decrease, lack of use of the methods of construction input prices for forecasting, and lack of contractual treatment of the construction inflation during the construction period.

Moreover, according to Gebremedhin (2021), the most prominent challenges in price adjustment practices are constant weighting coefficients throughout the project lifetime; different estimators producing different weighing coefficients; failure to consider actual labour work time; changes in project cost; constant input material amounts; computation time; only considering extreme prices; the complications of the price adjustment formula; adjustable amounts; adjustments for non-used items; or failure to make periodic payments. These could be the reasons and factors that contribute to the failure of any construction project and failure in performance (Merhaba, 2019).

2.3. Minimizing the effects of price escalation

Measures that regulate price escalation on construction projects must be adopted to reduce the effects of escalating prices. Understanding and identifying the factors that underlie the causes is crucial to accomplishing this. Based on the identified root causes of the price escalation, strategies will have been developed for approaches to construction design and procurement as well as a redistribution of risk allocation in projects, as the cost escalation in the construction market is a cumulative effect of several factors.

To manage price escalation and minimize the impact of future cost increases or other factors that will surely arise to put additional pressure on the market, project owners need to change how they think about and handle projects. Perhaps the most important thing project owners can do to minimize the impact of the volatile construction market is to understand and become partners in the risk. This takes the burden of handling market volatility off the shoulders of the contractors and vendors and, in turn, reduces the pressure on bidders to charge premiums (Gashaw Mossa & Ababa, 2013).

The first step is for project owners to take on more accountability for the risk associated with fluctuations in material prices. The owner is more knowledgeable about managing the risk because they are considerably more diversified. There are various ways to accomplish this at each stage of the planning and construction process. Use fluctuation clauses, which allow for changes in material costs; in other words, the owner agrees to pay for the cost of materials and does not require the contractor to submit a fixed price for something they may not be able to purchase for some time.

These measures can help project owners reduce risk for the contractors. Partnerships with suppliers and pre-purchased items mitigate the impact of future prices. Consider locally available materials in the design. To help absorb the risk for architects and engineers, project owners can develop program-wide contingencies and risk management protocols.

This requires first recognizing the types of risks that exist and then ensuring that all members of the project team understand and are trained on how to deal with them. At all levels of the project, the key thing for the project owner to do is actively manage design and cost by ensuring that all participants in the design process are fully aware of budgetary constraints as well as the impact of any changes or delays on the overall project cost (Gashaw Mossa & Ababa, 2013).

Moreover, the escalation of construction costs can be held to a manageable level. During the construction phase, a detailed and clear client brief should be taken at the inception of the project to minimize unnecessary variance. Others include hiring qualified consultants and contractors and paying certificates on time.

To prevent any wrong estimations, estimates must constantly be cross-checked using the most recent price information. Before a project, it is also important to conduct a proper assessment of the details. Price escalation in building construction projects can be solved or minimized when the factors causing price escalation have been addressed. This will go a long way in minimizing cost escalation in building construction projects (Nazif et al., 2021).

2.4. Price Escalation in Construction Contract

2.4.1. Condition of contracts

A construction contract is a binding agreement, enforceable by law, that contains the conditions under which the construction of a facility will take place. Construction projects are typically quite time-consuming, lasting anything from several months to several years. Additionally, these building projects are carried out essentially in accordance with a preconfigured contract sum and contract agreement. Consequently, there is a high likelihood that the price of labor and materials will rise and fall, either more or less, over the course of the project (Choi et al., 2006).

2.4.2. Price Escalation Clauses

Lacking is the price escalation clause, which permits an adjustment to the contract price in the event that the market prices for essential construction materials increase more than anticipated. Hence, to cope with the sudden price escalation, regulated provisions are necessary in construction contract documents (Dinkaywehu, 2019).

The price escalation clauses ensure that the price will change if a specific circumstance that is outside the control of either party causes the contractor's costs to rise or fall. It is also known as "rise and fall," which means the contract price will be changed in the client's favor if the cost of some expenses decreases, giving the parties the chance to make plans for the unknown and decide how and to what degree the extra costs will be covered (Mohammed Gashaw, 2013).

A. FPPA 2006 Contract Form

Clause 47: Price Adjustments

Prices shall be adjusted for fluctuations in the cost of construction inputs only if provided for in the Special Conditions of Contract. If so provided, the amounts certified in each payment certificate, after deducting for advance payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency. A separate formula of the type indicated below applies to each contract currency:

$$\text{Pn} = A + b\frac{Ln}{Ln} + c\frac{Mn}{Mo} + d\frac{En}{Eo} + etc$$

Where:

- Pn is a price adjustment factor to be applied to the amount in each specific currency for each payment certificate.
- "A" is a constant specified in the contractor's bid, representing the non-adjustable portion of contractual payments;
- b, c, d, etc., are weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) in the works or sections thereof, net of provisional sums, as specified in the contractor's bid; the sum of A, b, c, d, etc., shall be one;
- Ln, Mn, En, etc., are the current cost indices or reference prices of the cost elements in the specific currency of origin at the date 28 days prior to the deadline for bid submission; and Lo, Mo, Eo, etc., are the base cost indices or reference prices corresponding to the above cost elements at the date 28 days prior to the last day of the period to which a particular Interim Payment Certificate is related.
- If a price adjustment factor is applied to payments made in a currency other than the currency of the source of the index for a particular indexed input, a correction factor of Zo/Zn will be applied to the respective component factor of Pn for the formula of the relevant currency.
- Zo is the number of units of currency of the country of the index, equivalent to one unit of the currency of payment on the date of the base index, and Zn is the corresponding number of such currency units on the date of the current index.

The sources of indices shall be those listed in the contractor's bid, as approved by the engineer. Indices shall be appropriate for their purpose and shall relate to the contractor's proposed source of supply of inputs on the basis of which his contract price and expected foreign currency requirements shall have been computed.

Price adjustment is recommended for contracts that provide for a time of completion exceeding 18 months. Bidders are required to propose the weightings for each cost element (labor, materials, equipment, etc.) and the sources of indices.

B. FPPA-2011 Contract form

According to clause 62, "When it is confirmed that the contract's performance will take longer than 18 months, adjustments to contract prices must be made after twelve (12) months from the contract's effective date." The adjusted price becomes the new contract price in relation to that work item at the end of 30 days from the date on which the public body is notified of that adjusted price.

Clause 62: Price Adjustments

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.

Request for price adjustment in relation to 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 the notification of that adjusted price from the Contractor unless another date is agreed in writing between the Parties.

Price Adjustment shall be applicable as payable in full for the originally scheduled completion period. In the event, that the completion of the contract exceeds the originally scheduled period:

In case of default on the part of the Contractor causing a delay in the 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.

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.

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

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

Where:

- PA = The amount of the Price adjustment to be paid to, or recovered from, the contractor, in the currency specified in SCC;
- NV=The fraction which represents the 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: at the bid closing date, or 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 affect 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: at the bid closing date, or 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 affect the current Contract Price;
- C=The fraction of the Contract Price subject to adjustment in accordance with movements of the selected Equipment Price Index
- ME =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: at the bid closing date, or 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 affect 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: at the bid closing date, or 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 affect the current Contract Price;
- BC= Current Contract Price applicable to the Works
- Q= Quantity;

And where: NV+A+B+C+D are equal to 1.00

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

C. 2010 MDB FIDIC and FIDIC,1999 Contract Form

Class 13 of (International Federation of Consulting Engineers, 2010), stated that:

Clause 13: Variations and Adjustments, Subclause 13.8: Adjustment for Changes in Cost

If this sub-clause applies, the amounts due to the contractor must be adjusted for increases or decreases in the cost of labor, goods, and other inputs into the work by adding or deducting the amounts determined by the formulae established in this sub-clause. The accepted contract amount shall be deemed to have included sums to cover the contingency of additional rises and falls in costs. To the extent that complete compensation for any rise or fall in costs is not met by the provisions of this or other clauses, the accepted contract amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

According to International Federation of Consulting Engineers (2010),Adjustments for Changes in Cost apply the following terms and conditions in general:

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices.

The formulae shall be of the following general type:

Pn = a + b Ln/ Lo + c En/Eo + d Mn/Mo + ...

where:

“Pn” is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period “n”, this period being a month unless otherwise stated in the Contract Data;

“a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“b”, “c”, “d”, … are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labor, equipment and materials;

“Ln”, “En”, “Mn”, … are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“Lo”, “Eo”, “Mo”, … are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the "currency of index" is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favorable to the Employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced, or inapplicable as a result of variations.

Table 2.3: Summary of Contract Forms

Issues	Condition of contract			
	FPPA 2006	**FPPA 2011**	**FIDIC 1999**	**MDB2010**
	On Clause 47	**On Clause 62**	**On Clause 13.8**	**On Clause 13.8**
Prices shall be adjusted.	Changes in cost and legislation and only for fluctuations in the cost of the input if provided in the SCC.	Changes in cost and legislation, change in the cost of inputs, only those categories of inputs that are specifically in the SCC.	Changes in cost and legislation and changing the cost of labor, Goods and other inputs to the Works determined by the formulae prescribed in this Sub-Clause	Changes in cost and legislation and changing the cost of labor, Goods and other inputs to the Works determined by the formulae prescribed in this Sub-Clause
Base pricing or indexing date	28 days prior to the latest bid submission	28 days prior to the latest bid submission	28 days prior to the latest bid submission	28 days prior to the latest bid submission
A price adjustment is applied if	contracts with a contract period exceeding 18 months and if the contract is subjected to price adjustment as shown in SCC	contracts with a contract period exceeding 18 months if the contract is subjected to price adjustment as shown in SCC.	the contract is subjected to price adjustment as shown in SCC	the contract is subjected to price adjustment as shown in SCC
Starting date of price adjustment	after twelve months from the effective date of the contract.	after twelve months from the effective date of the contract	not explicitly stated	not explicitly stated
Method(s) of adjustment	Index formula	Index formula	The index formula is the same as that of the FPPA 2006	The index formula is the same as that of the PPA 2006

Source of indices	listed in the contractor's bid and approved by the engineer.	The contractor shall submit to the public body for review and approval all calculations and supporting information necessary to determine the price.	The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer.	The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the engineer.
Overhead and profit in price adjustment	not explicitly stated	not explicitly stated	Overhead and profit are excluded.	not explicitly stated

Note: Price escalation clauses in the contract form (source: established findings from the contract form review by the researcher)

2.5. Policy and Strategy

According to the Ministry of Urban Development and Construction's construction industry policy, the construction sector intends to have a comprehensive policy to ensure compliance with the objectives and goals of national, social, and economic development. The Construction Industry Policy takes into account the fact that the realization of the objectives and goals of the identified priority construction sectors, land, and good governance operates on the availability of a reliable, strong, and competitive local construction industry that is capable of delivering quality services to its stakeholders (MUDC, 2012).

As a policy directive, the provision is that the government and the private sector shall adhere to established appropriate procurement practices to ensure quality and cost-effectiveness in the delivery process. Among the main objectives of the construction industry policy, the policy directives are as follows:

1. To ensure efficient and cost-effective performance in the construction industry that will guarantee value for money on constructed facilities in line with best practices.
2. To promote the application of cost-effective and innovative technologies and practices to support socio-economic development activities.
3. To improve the coordination, collaboration, and performance of the institutions supporting the development and performance of the construction industry.
4. The government shall develop the capacity of its staff in project management and contract administration.
5. The government, in collaboration with the private sector, shall formulate standard guidelines for procurement and project delivery arrangements.
6. Promote strategic alliances with regional and international players.
7. The government and the private sector shall continue to mobilize resources for physical infrastructure for the purpose of the economic and social development of the whole country.
8. The government shall ensure proper utilization of all dedicated funds, loans and grants.

2.6. Conceptual frame works.

According to Allahaim & Liu (2012), a conceptual framework is described as a collection of overarching ideas and principles drawn from literature studies and used to organize a subsequent presentation. In this study, groups of factors that exhibit similar patterns and display various variables have been presented. Therefore, this conceptual framework demonstrates the cause and impact of price escalation on the performance of the project.

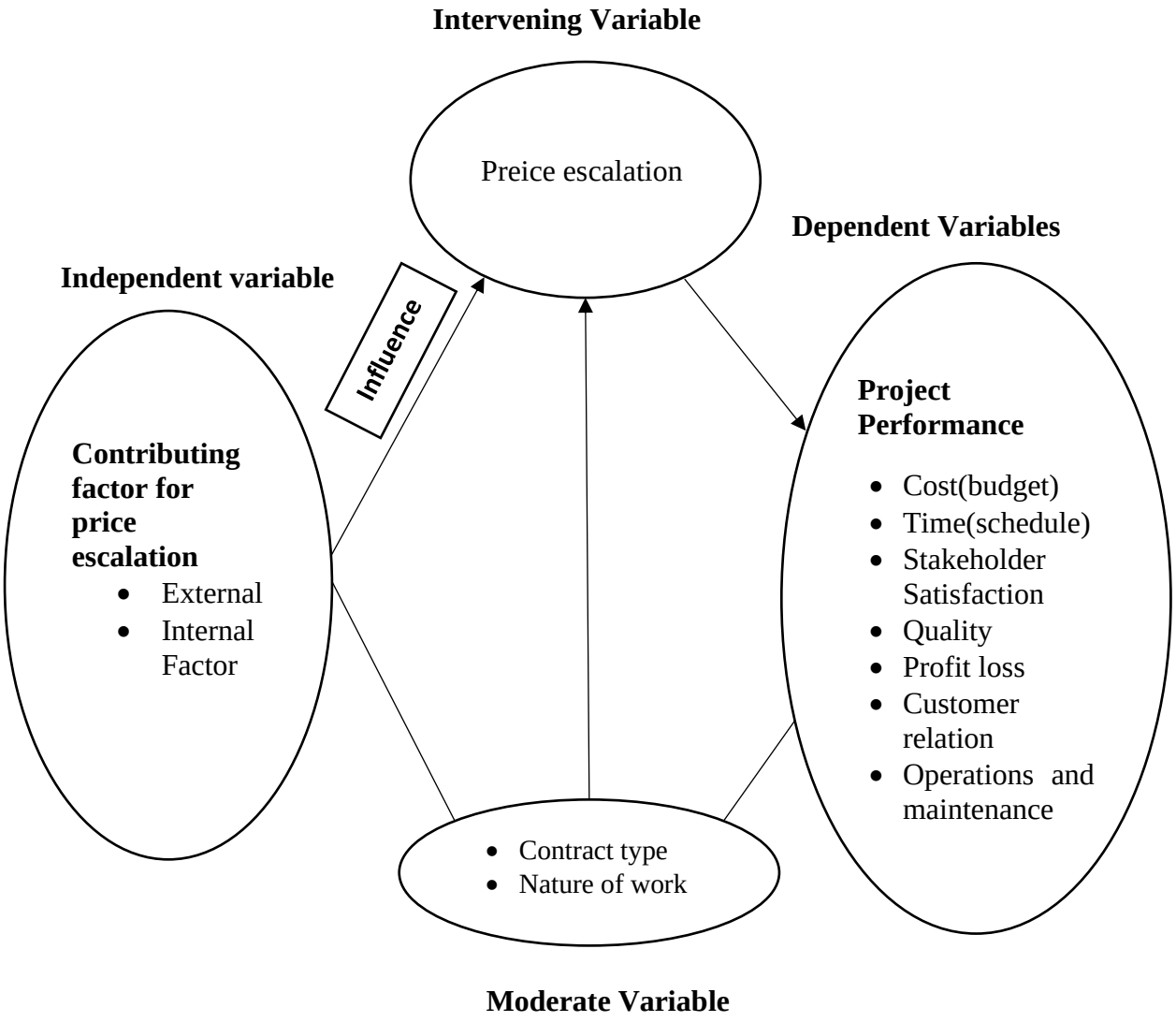

Figure 2.2 Conceptual Framework (Source: established using theoretical and empirical literature by the researcher)

2.7. Research gap

The overall literature review indicates that there is research trying to study the cause and effects of price escalation in different spatial scopes and construction categories. Here in Ethiopia, the research that the researcher reviewed has been conducted mostly on both building and road projects.

According to Mohammed Gashaw (2013), he has conducted research under the title Assessment of Price Escalation and Adjustment Problems on Federal Road Construction Projects in Addis Ababa, Ethiopia, with the purpose of academic research. Furthermore, he has studied this area to assess the causes and effects of price escalation on federal road construction projects, identify problems of price escalation and adjustment on federal road construction projects, assess the present price escalation administration practices on federal road construction projects, and identify methods to improve the administration of price escalation on federal road construction projects.

Furthermore, according to DINSA (2015), he has conducted research under the title "Assessment of the Causes and Effects of Price Escalation of Federal Road Contracts in Ethiopia" in Addis Ababa, Ethiopia, for the purpose of academic research. Moreover, he has studied this area to get the following answers: "Road clients are facing construction price escalation of contracts in Ethiopia," to identify the possible root causes and effects of price escalation and mitigate problems facing clients with regard to planning, programming, and road clients, contractors, consultants, and stakeholder groups in the construction industry.

Moreover, Gebremedhin sebsibe (2019), he has conducted research under the title "Factors Affecting the Performance of Construction Projects: The Case of the Defense Construction Enterprise" in Addis Ababa, Ethiopia, for the purpose of academic research. Moreover, he has studied this area to examine and rank the resource, determine, and rank procurement management, assess, and rank quality, and look at and rank stakeholder management-related factors that affect project performance.

Besides, according toBeza (2020) has conducted research under the title Effect of Construction Material Price Escalation on Public Building Construction Project Performance in Hawassa City, Ethiopia, with the purpose of academic research. The study was focused on identifying the factors causing the escalation in the price of construction materials, identifying the effects of the escalation in the price of construction materials on building construction project performance, and identifying the challenges in price adjustment application and administration practice. In this study, under the second research objective, the study focused on the performance measures of a project; it considered only the three components of project performance, the ‘iron triangle': time, cost, and quality.

Thus, in light of the review and the identification of the research gap, it can be said that almost no studies were conducted in Addis Ababa, Ethiopia, on those public building mega projects that have now recently received funding by allocating large capital budgets for government development programs. Therefore, the researcher aims to bridge this gap, including the impact of price escalation on mega-public building projects' performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Study Area

This study was conducted in Addis Ababa, the capital city of Ethiopia and the seat of the headquarters of major international organizations such as the African Union (AU) and the United Nations Economic Commission for Africa (ECA). which has eleven sub-cities, namely Addis Ketema, Akaki kality, Arada, Bole, Guillele, Yeka sub-city, Kirkos, Lemikura, Kolfe keranio, Lideta, and Nifassilk Lafto sub-city. The city of Addis Ababa is located a few kilometers west of the East African Rift Valley, which divides Ethiopia in two. Based on the 2007 Census conducted by the CSA, Addis Ababa has a total population of 2,739551 with an area of 527 square kilometers; Addis Ababa has a population density of 5,165.1/km2.

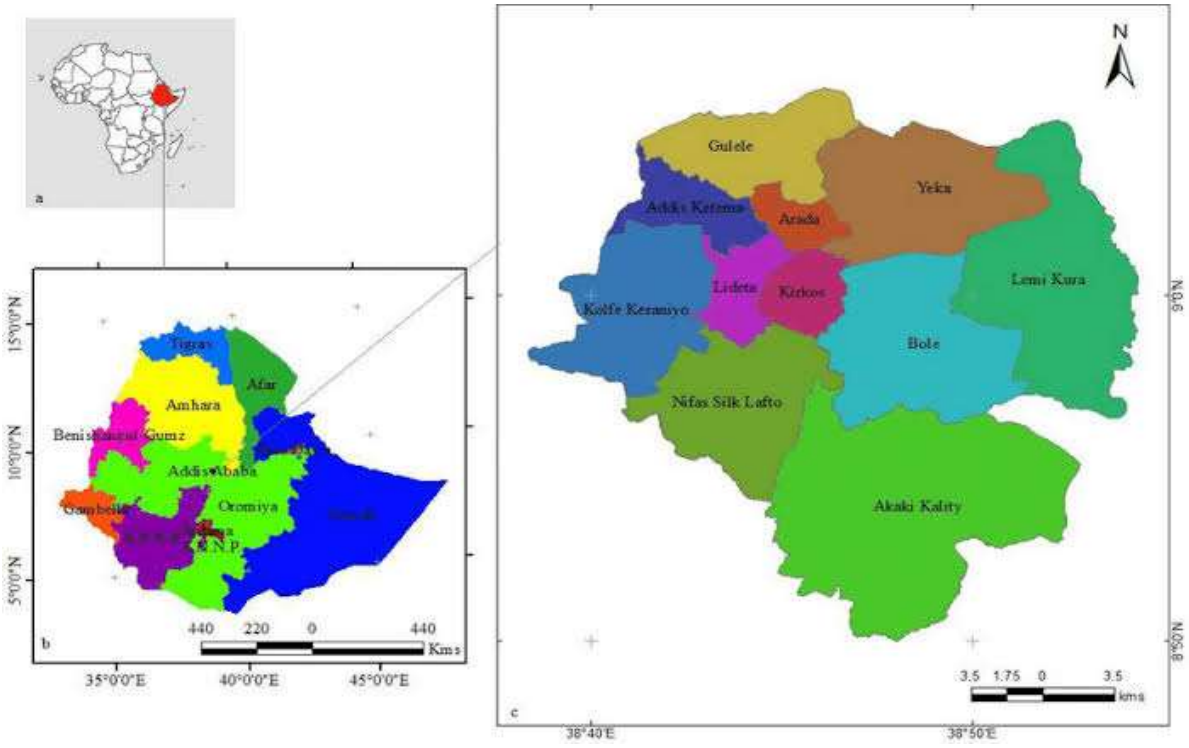

Figure 3.1: Location map of the study area (source: Ethiopia GIS-2022)

3.2. Research Design

In this study, the methodology was developed after identifying the research problem through an unstructured literature review, an archival study, and informal discussions with colleagues and professionals in the construction industry sector, and then the research design was developed. Therefore, an explanatory and descriptive survey design was employed in this study. This research design was focused on the pragmatism school of thought because it dealt with facts, claimed that the choice of research philosophy was primarily determined by the researcher, and also employed a mixed approach, both qualitative and quantitative. Using both qualitative and quantitative research approaches, ultimately used to analyses the data numerically, statistics using closed questionnaires and narration, the data were analyzed non-numerically and perceived using interviews and open-ended questionnaires or documents that illustrate, respectively.

3.3. Research Approach

This research applied a mixed approach, both quantitative and qualitative, as explained in the section on research design. A quantitative approach was used to collect factual data and find the concepts using a closed questionnaire through focused measurement on a 5-point Likert scale of the variables that were identified from the literature assessed, discussions with professionals, and obtained from a pilot test survey.

Qualitative methods because they focused on obtaining the perceptions of the selected public building construction projects' stakeholders about the research questions. In the qualitative research approach, the researcher used interviews, document reviews, and open-ended questionnaires on the selected public building projects to obtain a thorough understanding of the research problems. Mixed approaches were employed while conducting the case study.

3.4. Research Type

This research was applied based on its goal, which was initiated by practical problems. This research also employed explanatory research to conduct an in-depth investigation of the selected project among the public building projects as a case study, whereas descriptive research uses a mean-score method of analysis to rank variables, describing how frequently they occur.

3.5. Source of Data

The data sources for this study were primary and secondary sources to assess the cause and impact of price escalation on the performance of public building projects in the Addis Ababa City Administration. Questionnaires, interviews, and case studies were used as primary data sources, whereas data gathered from books, journals, desk studies, and other publications on the topic were used as secondary data sources.

3.5.1. Primary Data Sources

In this research, to achieve its intended objectives, the researcher used primary source data to get original, first-hand information in the form of questionnaires and interviews with Clients (Project managers), Contractors (Project managers, Construction engineers, Site engineers, and Office engineers), and Consultant representatives (Project managers, Resident engineers, Contract administrators, and others) from the selected seven public building projects for the study.

3.5.2. Secondary Data Sources

The secondary data include referred approved price escalation documents, work progress reports, approved payment certificates and approved extensions of time, archival documents, correspondences, and other relevant documents. The secondary data helped supplement other specific information that was obtained from the primary data sources and gave a general understanding of the predetermined research questions.

3.6. Sample Design

3.6.1. Sample population

The public building construction projects selected for this study were those 7 public building mega projects found in Addis Ababa (see Appendix 2). Those construction projects were under construction supervision and contract administration services provided by the Construction Design and Supervision Works Corporation (ECDSWCo).

The public building construction projects were ongoing megaprojects, and the main stakeholders who directly participated in the projects were project owners, contractors, and consultants.

3.6.2. Sample technique

In this research, the researcher employed nonprobability sampling techniques. From non-probability, the purposive sampling technique was used because it involved a deliberate selection of sample units that conformed to some predetermined criteria and involved the selection of cases that the researcher judged to be the most appropriate for his study. As a result, research was conducted on all of the mega projects that were under construction and invested with high budgeted costs, resulting in a high impact due to price escalation. Therefore, among the public building construction projects that were supervised by BUDSWS, the seven mega projects were selected for this research. Based on what the researcher judged, the interviewees for this study were selected among qualified professionals who were thought to be senior in their experience in public building construction work. Using the same technique, three megaprojects were selected for the desk study among seven megaprojects that had the most progress. One megaproject for the case study was selected, which was subjected to a price adjustment but was adjustable nonadjustable portions were not set in their contract, and disputes were raised between the contractor and contractor because a price adjustment was not effective; see Appendices 4 and 5, respectively.

3.6.3. Sample Size

From the public building projects that were under construction supervision and contract administration services provided by the BUDSWS, all mega projects were considered the scope of the study, of which there were seven megaprojects in total. These megaprojects consist of a group of clients, contractors, and consultants. The respondents were selected by the purposive sampling technique based on their professions, have relevant experience, and can provide the necessary information.

Table 3.1: Target population in the respective selected public building construction projects.

No	Project	Respondent in Group			Number of Respondents	Proportionated (%)
		Client	Contractor	Consultant		
1	A	3	7	4	14	14.89
2	B	4	6	5	15	15.96
3	C	2	6	4	12	12.77
4	D	4	7	4	15	15.96
5	E	4	6	3	13	13.83
6	F	3	5	4	12	12.77
7	G	4	6	3	13	13.83
Total		**24**	**43**	**27**	**94**	**100.00**

3.7. Method of data collection

To proceed with the findings of the study in line with the research objectives, which demand identifying causes and assessing the impact of price escalation on the performance of public building projects, the required data were collected using a questionnaire, interviews, and desk study of the 7 selected megaprojects.

3.7.1. Questionnaire

In this research, the researcher employed questionnaires as a data collection technique for primary sources, particularly closed and open-ended questionnaires that were issue-focused and acted as a survey to understand the primary concerns and attitudes of respondents towards the research questions. Respondents were given a prompt for the question and a blank space to write their response when a question was open-ended, which helped them specify missing information that was not provided. Closed-ended questions, on the other hand, presented a question prompt and asked respondents to select from a range of potential answers. Hence, a total of 94 questionnaires have been distributed to the three direct contracting parties that were involved in the selected projects; specifically, 43 have been given to respondents on behalf of the contractor, 24 to those of the client, and 27 to those of the consultant.

To get a high response rate from respondents, the questionnaires were carefully designed. As shown in the following sections, the responses to the structured portion of the questionnaire were based on a Likert scale of five ordinal measures of agreement with each statement.

Understanding the level of measurement is necessary to be able to choose the best method of analysis. Ordinal scales were used in this study. Ordinal scales, as depicted in the tables, are a type of ranking or rating data that typically employs integers in either ascending or descending order. The assigned numbers (1, 2, 3, 4, and 5) neither denote absolute quantities nor suggest that the distance between scales is equal. They are merely labels with numbers. The tables below are based on the Linker scale.

The researcher prepared a questionnaire, which was structured in five parts as follows:
Part 1: was related to the respondent's general information;
Part 2: To explore the determinants that cause price escalation in public building construction projects, the agreement of the respondents about these factors of price escalation on public building construction projects in Addis Ababa was then explored.

Part 3: After expressing their agreement and/or disagreement on the first research question, respondents were asked about the major impact of price escalation on the performance of public building construction projects by employing an ordinal scale for the measurement of the degree of significance.

Part 4: The respondents, after expressing their opinions about the major impact of price escalation on the performance of public building construction projects, were asked to identify the main obstacles that affect the effective implementation of price adjustments in public building construction mega projects.

3.7.2. Key Informant Interview (KII)

In addition to the questionnaire, this research identified appropriate, key experts for KII. In this study, a semi-structured interview was conducted because, using this type of interview, participants were asked a series of open-ended questions before being asked follow-up questions to delve deeper into their responses to each respective research question. In general, it has a set of predetermined questions (a generalized form of questionnaire) with a flexible order depending on how the interviewer views the subject matter after assessing the respondent's aptitude and experience (see Appendix 2).

Table 3.2: Interviewees for the selected public building construction mega projects.

No.	Key Experts	Number of interviewees
1	Head of the construction department	1
2	Project manager	1
3	Senior Contract Administrator	1
4	Resident Engineer	1
5	Project Coordinator	1
Total		5

3.7.3. Desk study

In this study, the researcher selected three public building construction mega projects that were under construction phase projects, supervised by the BUDSWS, and had a contract period exceeding 18 months but were not subjected to a price adjustment. Its purpose was to support or add to the arguments and responses discovered through the questionnaire and interview. As data sources for the case, archival records, including completion reports, progress reports, payment certificates, and contract documents, were used. The selected public building projects were labelled as Projects A, B, and C for the sake of privacy; the real names of the projects and the involved stakeholders cannot be mentioned by name. The general information about the selected projects (desk study) is shown in Appendix 4.

3.7.4. Case Study

The data from the case study was organized into tables for this research to produce a comprehensive understanding of price escalation and its impact on construction project performance in its actual context. In this study, the researcher selected one project as a case study among selected public building projects that had disputes due to price escalation, as shown in Appendix 5.

3.8. Methods of Data Analysis

A descriptive statistical method was used to analyzes the data collected from various sources for this study. To compile the data and determine how many responses fell into each category, frequency tables and charts were used. It was then necessary to thoroughly analyses, interpret, and compare the results that were obtained using various research tools. In general, all analysis has been carried out using software for computer statistics as the analysis's tools (SPSS, Excel, etc.).

3.8.1. Qualitative method data analysis

It is the process of organizing, analyzing, and interpreting non-numeric, conceptual information by referring to the selected public building project's completion reports, progress reports, contract documents, and payment certificates thoroughly. Thus, the causes, impacts, and main obstacles that affect the effective implementation of price adjustments in public building construction mega projects were analyzed by employing a narrative analysis. The narrative analysis was used to interpret research for case studies, desk studies, interviews, and other in-depth examinations of the impact of price escalation on the performance of selected public building projects, which were supervised by the BUDSWS.

3.8.2. Quantitative method data analysis (Statistical Tools of Data Analysis)

A. Descriptive Statistical Analysis

This approach can also be used to identify characteristics, frequencies, trends, correlations, and categories. Moreover, it was helpful to assess the perspectives of various stakeholders on the issues of price escalation, the causes, impacts, and main obstacles that affect the effective implementation of price adjustments in public building construction projects.

In the analysis, the “mean item score (MIS)" methods were adopted to determine the ranking of variables for the respective research questions. The five-point scale (1, 2, 3, 4, and 5) was used to calculate the mean item score (MIS) for each variable, which was then used to determine the relative ranking of different factors by assigning ranks to the mean scores, with high mean scores assigned high ranks and vice versa. The mean item score (MIS) for each factor was computed by the following formula:

$$rs = \frac{\sum_{i=1}^{5} (Si \times fi)}{N}$$ ----------Equation 3.1

where i = response category (scaling) index = 1, 2, 3, 4, and 5 for "strongly disagree," "disagree," "neutral," "agree," and finally "strongly agree," respectively; Si is the score assigned to each factor by the respondents and ranges from 1 to 5. fi = frequency of responses to each rating (1–5) for each factor; and N = total number of responses concerning that factor. To determine the most important causes, the "weighted average" of the mean item scores for each of the causes from each group was evaluated. The analysis of variance was carried out to determine the significant differences among the various professions.

B. Inferential Data Analysis

Spearman's rank correlation coefficient (rs) was used to test the agreement, strength, and direction of the relationship between different respondents’ groups. The degree of agreement between the different respondent groups involved in the questionnaire was checked using this correlation coefficient.

$$rs = 1 - \frac{6\sum d^2}{n(n^2-1)}$$ ----------Equation 3.2

Where

rs = Spearman's rank,

d = rank difference,

n = number of ranks.

Correlation coefficients “rs” might be between -1.0 and +1.0. The relationship between the two variables is stronger the closer rs is to +1 or -1. rs close to 1 indicates a strong linear positive link between the two variables, whereas rs close to -1 indicates a strong linear negative correlation between the two variables. If the connection exists, the coefficient value is said to have a strong degree of correlation if it is between 0.5 and 1. Values of the correlation coefficient The correlation has a moderate degree, falling between 0.3 and 0.5. When the correlation coefficient is between 0.1 and 0.3, there is a low correlation. Meanwhile, 0 The coefficient value shows that there is no correlation (Shiferaw Belachew, 2017).

3.9. Mode of data presentation

In this study, the analyzed data was presented using text, tabular form, and graphical form (a bar graph and a pie chart). Text is the principal method for explaining findings, outlining trends, and providing contextual information. A table was best suited for representing both quantitative and qualitative information. A graph is a very effective visual tool as it displays data briefly, facilitates comparison, and can reveal trends and relationships within the data.

3.10. Reliability and Validity

The technique used to acquire the data was one of the key elements that determined a research project's strengths and weaknesses. These data-gathering techniques must meet certain criteria, and the researcher was required to have them awarded to provide research findings that accurately reflect the issue that inspired the study's conduct. Validity and reliability tests were frequently used to satisfy these criteria.

3.10.1. Validity

Validity tests were conducted on each question on the questionnaire to select and assess if, accurately or not, they were supposed to measure as expected, without misinterpretation, and in a meaningful manner as planned concerning the objective of the research. The validity of the data collected by conducting a pilot test survey was checked. Pilot tests have been conducted using carefully selected professionals and well-experienced respondents for the instrument, similar to the population of the study. The purpose of pre-testing was to refine questions and assess the validity of measures. Based on the pre-testing and the unnecessarily item-based feedback and comments, the questionnaire has been refined, and paraphrased, and a few were deleted.

3.10.2. Reliability

To gather useful information, the data gathered from the questionnaire must be reliable and consistent. Therefore, the questionnaire that was prepared for the pilot survey was analyzed to check the consistency of the measurements listed on the questionnaire. To assess reliability, Cronbach's alpha test was used to demonstrate reliability and display how measurement error affects each respondent's observed score using the statistical software SPSS, version 27. Thus, respondents' replies on the Likert scale were analyzed, and the internal consistency of the measurements was checked. The analysis showed a result of 0.908, which is considered to be "excellent." Since the reliability test and validity test, both indicate that the findings from the respondents can address the research issue, the questionnaire designed for the pilot test survey was used for data collection.

Table 3.3: Reliability reports for the questionnaire data

Considered	No of Items	Cronbach alpha
All	50	88.8

3.10.3. Triangulation

Finally, to increase the validity of the research findings, triangulation of the closed-ended data outputs, open-ended questions, interviews, and data from desks and case studies (secondary data sources) was made.

3.11. Ethical Consideration

A guarantee of confidentiality was given to the voluntary respondents. This research was regarded as neutral and independent, and it was taken into account that it did not in any way harm respondents. To create positive attitudes towards it among its redacted counterparts, the study was accompanied by a one-page statement summarizing the goal and expected benefits, and the researcher provided a letter of support and recommendation to the respondent. Respondents were also informed about the advantages of the study by the data collector. The study reserved the possibility for respondents to withdraw entirely.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Analysis of Data and Result Obtained from the Questionnaires

4.1.1. Response Rate

A total of **94** self-administered questionnaires were distributed to the three groups or organizations of respondents: clients, contractors, and consultants, and 86 were returned and used, which comprise (**91.67**%) client's representatives, **25 (92.59%)** consultants' representatives, and **39 (90.70%)** contractors' representatives. This gives a response rate of **91.49**% of the total target population of **94**. The return of questionnaires from the three groups of respondents is tabulated as shown in Table 4.1 below.

Table 4.1: Response Rate by Type of Organization

Groups	Total Questionnaires distributed (No.)	Questionnaires Returned (No.)	Response Rate (%)
Client	24	22	**91.67**
Consultant	27	25	**92.59**
Contractor	43	39	**90.70**
Total	**94**	**86**	**91.49**

According to the analysis result obtained, out of the 86 questionnaire responses, 22 (25.58%) were client representatives, 25 (29.07%) were consultant representatives, and 39 (45.35%) were contractor representatives. As a result, contractors were the majority of the participants.

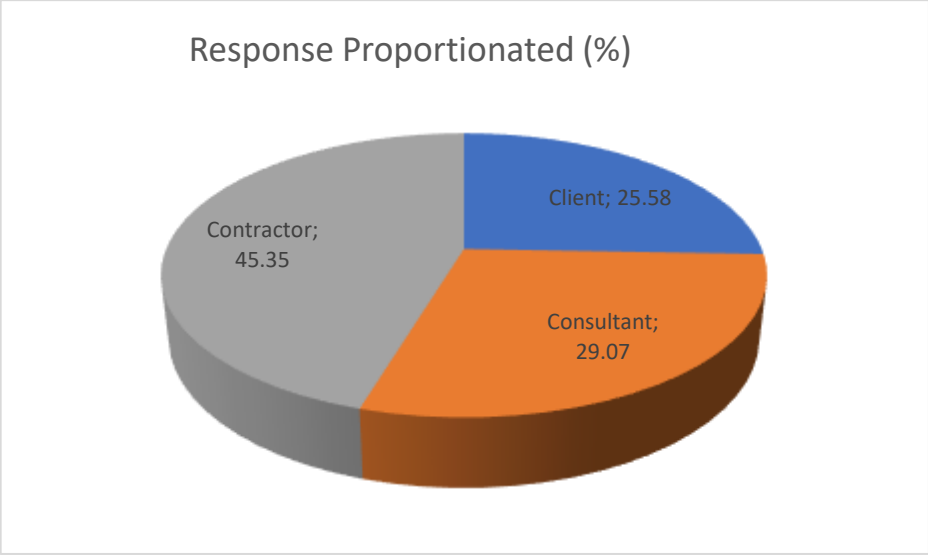

Figure 4.1 Analysis result response proportionated (source: by the researcher)

4.1.2. Demography Based on the Respondents

A. Level of Education Respondent

The purpose of this section is to determine the educational and professional competencies of respondents as related to this study, which helped in predicting the general accuracy and reliability of the information gathered from the respondents. As shown in the analysis tabulated in Table 4.2 below, among the client's respondents, 81.82% have a B.Sc. degree and 18.18% have a M.Sc. degree. On the other hand, from the consultant side, 24.00% of the respondents have a B.Sc. degree 76.00% of the respondents have an M.Sc. degree, while from the contractor side, 56.41% of the respondents have a B.Sc. degree and 43.59% of them have a M.Sc. degree, and from the cumulative sum of respondents to all organizations, **53.49%** of the respondents have a B.Sc. degree and **46.51%** of them have a M.Sc. degree. These figures show that the respondents from the three group types were well-represented by better-qualified professionals.

Table 4.2: Academic Qualification of the Respondents Concerning Organization

Educational status of the respondent									
		Type or origin of your organization:						**Total**	
		Client		**Consultant**		**Contractor**		**No.**	**%**
Educational status of the respondent:	**B.Sc.**	18	81.82%	6	24.00%	22	56.41%	**46**	**53.49%**
	M.Sc.	4	18.18%	19	76.00%	17	43.59%	**40**	**46.51%**
Total		**22**	**100%**	**25**	**100%**	**39**	**100%**	**86**	**100%**

B. Work Experience of Respondents

Various experienced professionals were targeted to fill out the questionnaire. As a result, the researcher selected respondents who were considered mostly appropriate to the subject under consideration; those who would ultimately benefit and have work experience in years in the field were generally believed to respond with very good knowledge of the subject matter; and those who were thought to have the necessary information and were most appropriate for the study. The analysis result in Table 4.3 below shows that **39.53%** have 6 to 10 years of experience, **26.74%** have 11 to 15 years of experience, and the remaining **33.72%** of respondents have more than 16 years of working experience.

Table 4.3: Respondents Work Experience in the Construction Industry

Years of experience of the respondent									
		Type or origin of organization:						Total	
		Client		Consultant		Contractor			
	from 6 to 10 years	14	63.64%	4	16.00%	16	41.03%	**34**	**39.53%**
	from 11 to 15 years	5	22.73%	6	24.00%	12	30.77%	**23**	**26.74%**
	Over 16 years	3	13.64%	15	60.00%	11	28.21%	**29**	**33.72%**
Total		**22**	**100%**	**25**	**100%**	**39**	**100%**	**86**	**100%**

As shown in Table 4.3 above, professionals who have over 11 years of experience make up over 50% of the respondents. The majority of respondents were from the client, consultant, and contractor groups, which was **60.46%** of the respondents.

4.1.3. Contributing Factors for Price Escalation

This section deals with analysis and ranking according to its occurrences and influence, causing price escalation. The top five variables were identified based on the combined perceptions of the three groups of respondents, namely clients, consultants, and contractors, as shown in Table 4.4 below.

Table 4.4: The factors that contribute to price escalation.

CODE	Variable Descriptions	CLIENT		CONSULTANT		CONTRACTOR		COMBINED	
		MIS	Rank	MIS	Rank	MIS	Rank	MIS	Rank
SF1	Poor design and Unclear/vague specification	3.77	21	3.84	**16**	4.10	**12**	3.94	**16**
SF2	Untimely payment	3.86	17	3.76	**21**	3.90	**19**	3.85	**19**
SF3	Frequent design changes at the project	4.05	13	3.88	**13**	4.36	**5**	4.14	**11**
SF4	Poor contract management	4.14	**11**	4.00	**11**	4.23	**8**	4.14	**9**
SF5	Number of change/ extensive variation	3.95	**15**	3.88	**13**	4.18	**10**	4.03	**14**
SF6	Cash flow and financial difficulties;	4.23	**8**	4.00	**11**	3.95	**18**	4.03	**13**
SF7	Lack of timely decision-making.	4.45	**3**	4.16	**7**	4.08	**13**	4.20	**5**
SF8	Force Majeure	3.77	**21**	3.60	**23**	4.00	**17**	3.83	**20**
SF9	The quality of the tender documentation/Inappropriate or insufficient time given to tender document	4.00	**14**	3.76	**20**	3.72	**22**	3.80	**22**
SF10	Political instability	3.77	**23**	4.32	**3**	4.33	**6**	4.19	**6**
SF11	Unforeseen site conditions/not indicated or anticipated in the bidding document excessive change orders	3.82	**19**	4.04	**10**	4.38	**4**	4.14	**9**
SF12	Fluctuations in money exchange rates	4.41	**4**	4.60	**2**	4.62	**2**	4.56	**2**
SF13	Increase in global demand for construction materials	4.09	**12**	4.12	**8**	4.28	**7**	4.19	**6**
SF14	Limited capacity of material producers	4.23	**7**	4.16	**6**	4.05	**14**	4.13	**12**
SF15	Inflation/Increase in material costs (material cost fluctuation)	4.77	**1**	4.80	**1**	4.87	**1**	4.83	**1**

SF16	Maximization of profit by construction material manufacturers	3.82	**20**	3.88	**15**	4.00	**16**	3.92	**17**
SF17	Over-dependence on imported building materials /Difficulty in obtaining construction materials in the local market	4.55	**2**	4.20	**5**	4.21	**9**	4.29	**4**
SF18	Unbalanced demand and supply of construction input	4.27	**6**	4.24	**4**	4.46	**3**	4.35	**3**
SF19	Poor technical performance of those involved in the projects	4.14	**10**	3.80	**18**	3.74	**21**	3.86	**18**
SF20	Change of schedule/suspension of work	4.23	**8**	3.80	**18**	4.00	**15**	4.00	**15**
SF21	Delivery/procurement approach	3.91	**16**	3.72	**22**	3.82	**20**	3.81	**21**
SF22	Insufficient bidding data concerning the project	3.86	**18**	3.80	**17**	3.41	**23**	3.64	**23**
SF23	Poor estimation	4.32	**5**	4.08	**9**	4.10	**11**	4.15	**8**

According to the combined result, the first most determinate factor to the price escalation is inflation / an increase in material costs (material cost fluctuation), with the mean item score (MIS = 4.83). Fluctuations in money exchange rates are the second most important cause of price escalation, with an MIS value of 4.56. Unbalanced demand and supply of construction input are the third important cause of price escalation, with an MIS value of 4.35. Over-dependence on imported building materials or difficulty in obtaining construction materials in the local market is the fourth important cause of price escalation, with an MIS value of 4.29. Lack of timely decision-making is the fifth important cause of price escalation, with an MIS value of 4.20.

Delivery/procurement approach, the quality of the tender documentation, inappropriate or insufficient time given to the tender document, and insufficient bidding data concerning the project are ranked as the three most least likely causes of price escalation, with the same mean item score (MIS) value of 3.80, 3.56, and 3.64, respectively.

Correlation of Respondents: Between Their Rankings

In Section 4.1.3, the aggregate weights of the three responder groups were used to rank the factors of price escalation overall. Nonetheless, clients, contractors, and consultants rank different factors. As a result, it is necessary to verify if respondents' rankings of the elements in each category correspond.

The extent to which the rankings of the questions indicated on the questionnaires that were answered by the respondents were checked was what their relationships looked like. The Spearman's rank correlation coefficient (r’s) is a measure of strength and direction between two sets of ranks obtained from a possible combination of respondent groups (i.e., between client-consultants, client-contractors, and contractor-consultants).

Thus, the existence of a significant agreement between the three sets of rankings (consultants vs. contractors, consultants vs. clients, and contractors vs. clients') was checked, as shown in below table 4.5.

Table 4.5: Correlations among groups in ranking cuase of price escalation

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1.00	0.57	0.32
Consultants	0.57	1.00	0.79
Contractors	0.32	0.79	1.00

Table 4.6: Summary of the correlation test on the ranking of causes of price escalations

Respondents	Spearman's rank correlation coefficient (r's)	Relation of the respondents
Client Vs Consultant	0.57	Moderate correlation
Consultant Vs Contractor	0.79	Strong correlation
Client Vs Contractor	0.32	Weak correlation

Note: The interpretation of correlation (Schober & Schwarte, 2018)

The Spearman's rank correlation coefficient in the table above (Table 4.6) reveals that relatively, there was a moderate correlation between client and consultant and a weak correlation between client and contractor, but there was a strong correlation between consultant and contractor in ranking contributing factors causing price escalation on public building megaprojects found in Addis Ababa, Ethiopia.

It can be concluded that there was a strong correlation between consultant and contractor, which means these respondents share more of the same perspective or attitude regarding contributing to price escalation.

The relationship between client and consultant indicates that they have an averagely similar response rank on some contributing causes of price escalation compared to consultant-contractor relationships.

However, in contradiction to the above two relationships between respondents, in the correlation between client and contractor, there was a weak correlation, which means these respondents did not share the same perspective or attitude regarding contributing to price escalation.

4.1.4. The Impact of Price Escalation

The degree of effect of price escalation varies among the stakeholders in the construction industry.

Table 4.7: The result of the effects of price escalation

CODE	Variable Descriptions	CLIENT		CONSULTANT		CONTRACTOR		COMBINED	
		MIS	Rank	MIS	Rank	MIS	Rank	MIS	Rank
S2F1	The project completion time is not complying with the agreed schedule.	4.23	**2**	4.72	**1**	4.44	**1**	4.47	**1**
S2F2	affects the project budget cost	3.68	**6**	4.16	**4**	4.18	**3**	4.05	**4**
S2F3	Profit, turnover, and return on investment	3.55	**7**	4.08	**5**	3.95	**5**	3.88	**6**
S2F4	Unemployment among construction workers/reduced productivity	3.73	**5**	3.76	**7**	3.64	**7**	3.70	**7**
S2F5	Dissatisfaction by project owners and consequently by end users,	4.00	**4**	4.28	**3**	4.15	**4**	4.15	**3**
S2F6	Poor quality of project work	4.32	**1**	3.92	**6**	3.82	**6**	3.98	**5**
S2F7	Disputes among involved stakeholders (customer relations)	4.18	**3**	4.28	**2**	4.28	**2**	4.26	**2**

From the ranking assigned to each effect, the five most important effects of price escalation on the performance of public building construction mega projects were identified. Table 4.7 shows the arithmetical rank of effects that were ranked by the respondents to the combined result (clients, consultants, and contractors). Thus, according to the statistical analysis shown, the project completion time is not comply with the agreed schedule (MIS = 4.47), there are disputes among involved stakeholders (customer relations) (MIS = 4.26), there is dissatisfaction among project owners and consequently by end users (MIS = 4.15), it affects the project budget cost (MIS = 4.05) and poor quality project work (MIS = 3.98) were listed from high to low according to their degree of significance effect on the performance of public building mega projects, respectively.

The effect of price escalation on unemployment among construction workers and reduced productivity ranked as the least viable variables by respondents, as shown in the table, with a mean item score (MIS) of 3.70.

Correlation of Respondents: Between Their Rankings

The agreements between the respondents (i.e., client-consultant, client-contractors, and contractor-consultants) in ranking the factors were calculated through Spearman's rank correlation coefficient.

Table 4.8: Correlations among respondents in ranking the effects of price escalation

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1.00	0.29	0.21
Consultants	0.29	1.00	0.96
Contractors	0.21	0.96	1.00

Table 4.9: Summary of correlation test on the ranking of effects of price escalation

Respondents	Spearman's rank correlation coefficient (r's)	Relation of the respondents
Client Vs Consultant	0.29	Weak correlation
Consultant Vs Contractor	0.96	Very Strong correlation
Client Vs Contractor	0.21	Weak correlation

Note: The interpretation of correlation from (Schober & Schwarte, 2018)

The Spearman's rank correlation coefficient in the above table (Table 4.9) reveals that there was generally a very strong correlation regarding the effects of price increases on public building construction mega projects between contractors and consultants, a weak correlation or agreement between clients and contractors, and a weak correlation between client and consultant.

The significant association between consultants and contractors suggests that they share the same perspective or attitude regarding the effect of price increases on the performance of public building construction mega projects, which means a higher variable increase in one group tends to be similar for the other groups. That means most of the respondents have the same perception about the effect of price escalation.

However, the relationship between clients and contractors and clients and consultants is weak. One of the reasons for the weak agreement could be resentment as a result of miscommunication that exists between the parties, which means these respondents did not share the same perspective or attitude regarding contributing to price escalation.

4.1.5. Obstacles that Affect the Effective Implementation of Price Adjustment

Table 4.10: The result of Obstacles that Affect the Effective Implementation of Price Adjustment

CODE	Variable Descriptions	CLIENT		CONSULTANT		CONTRACTOR		COMBINED	
		MIS	Rank	MIS	Rank	MIS	Rank	MIS	Rank
S3F1	Lack of a recognized price database for recording and updating the price of construction materials for contractual.	4.05	**5**	3.72	**5**	3.85	**6**	3.86	**5**
S3F2	Not applying price adjustment clauses for materials or items whose price significantly changes within time frames less than 18 months.	4.14	**2**	4.20	**1**	4.08	**2**	4.13	**1**
S3F3	Lack of use of the methods of construction input prices for forecasting	3.86	**9**	3.72	**3**	3.95	**5**	3.86	**6**
S3F4	In the application of price adjustment clauses, the contracted adjustable portion does not reflect the actual price escalation that occurs	4.09	**3**	4.04	**2**	4.05	**3**	4.06	**2**
S3F5	Contractors do not follow the proper contractual procedures for requesting price adjustments.	3.95	**7**	3.20	**9**	3.33	**9**	3.45	**9**
S3F6	Failure to make periodic payments (i.e., if price adjustments are not made periodically (preferably monthly), the adjustment will no longer reflect the true value)	3.95	**6**	3.60	**6**	4.00	**4**	3.87	**4**
S3F7	Constant weighting coefficients throughout the project's lifetime	3.95	**7**	3.44	**7**	3.49	**8**	3.59	**8**
S3F8	Client’s resist honoring the escalation clauses	4.09	**3**	3.72	**3**	4.13	**1**	4.00	**3**
S3F9	Contractors do not provide the necessary basis cost index in their bidding document for approval by the Engineer.	4.45	**1**	3.40	**8**	3.79	**7**	3.85	**7**

From the ranking assigned to each challenge, the five most important potential challenges that affect the current price adjustment provisions in public building construction mega projects were identified. Table 4.10 shows the arithmetical rank of effects that were ranked by the respondents to the combined result (clients, consultants, and contractors).

Thus, according to the statistical analysis, not applying price adjustment clauses for materials or items whose price significantly changes within time frames less than 18 months (MIS = 4.13), the application of price adjustment clauses, the contracted adjustable portion does not reflect the actual price escalation that occurs (RMIS = 4.06), and clients resisting the escalation clauses (MIS = 4.00) were listed from high to low according to their degree of significance as obstacles to the implementation of price adjustment, respectively.

Contractors do not provide the necessary basis cost index in their bidding document for approval by the Engineer, Constant weighting coefficients throughout the project's lifetime and Contractors do not follow the proper contractual procedures for requesting price adjustments are ranked ninth, tenth, and eleventh, respectively, with MIS scores of 3.85, 3.59, and 3.45 as shown in Table 4.10.

Correlation of Respondents: Between Their Rankings

For the obstacles that affect the effective implementation of price adjustments, the agreements between the respondents (i.e., client-consultants, client-contractors, and contractor-consultants) were calculated through Spearman's rank correlation coefficient.

Table 4.11: Correlations among respondents in ranking obstacles that affect the effective implementation of price adjustments.

	Spearman’s rank correlation coefficient (r’s)		
Respondents	Clients	Consultants	Contractors
Clients	1.00	0.34	0.45
Consultants	0.24	1.00	0.86
Contractors	0.45	0.86	1.00

Table 4.12: Summary of correlation test on the ranking of obstacles that affect the effective implementation of price adjustments.

Respondents	Spearman's rank correlation coefficient (r's)	Relation of the respondents
Client Vs Consultant	0.34	Weak correlation
Consultant Vs Contractor	0.86	Strong correlation
Client Vs Contractor	0.45	Moderate correlation

Note: The interpretation of correlation from (Schober & Schwarte, 2018)

The Spearman's rank correlation coefficient in the table above (Table 4.12) reveals that relatively, there was a moderate correlation between client and contractor and a weak correlation between client and consultant, but there was a strong correlation between consultant and contractor in ranking obstacles variables that affect the effective implementation of price adjustments on public building megaprojects found in Addis Ababa, Ethiopia.

It can be concluded that there was a strong correlation between consultant and contractor, which means these respondents share more of the same perspective or attitude regarding contributing to price escalation and in such a way that a higher variable increase in one group tends to be similar for the other groups.

The relationship between client and contractor indicates that they have a moderately similar response rank on some contributing causes of price escalation compared to consultant-contractor relationships.

However, in contradiction to the above two relationships between respondents, in the correlation between client and contractor, there was a weak correlation, which means these respondents did not share the same perspective or attitude regarding contributing to price escalation.

4.2. Results obtained from the interview

4.2.1. Analysis of Data from the Interview

The interviews were conducted between selected construction industry practitioners who were currently involved in public building mega projects, focusing on their perceptions of price escalation. In total, in the three groups, semi-structured interviews were conducted with the selected interviewees and summarized in a way that can easily be categorized in line with the research objectives listed in Table 4.13 below.

Namely, a senior project manager and the head of the follow-up team from the clients' group (A), a senior contract administrator from the consultants' group (B), and a senior project manager from the contractors' group (C) were interviewed. The interview was summarized in a way that can easily be categorized by the interviewee's point of view in line with the research objectives, as shown in Table 4.13 below.

Table 4.13: Results of a summary of a semi-structured interview

S. N	Questions	Interviewee A	Interviewee B	Interviewee C
1	What are the most determinant factors leading to price escalation in public building construction mega projects?	➢ Exchange rates ➢ Unbalanced demand and supply of construction input Inflation ➢ an increase in material cost	➢ Change of schedule ➢ exchange rates ➢ unavailable material in the local ➢ Unavailability of skilled labor ➢ Inflation/Increase material cost. ➢ Unbalanced demand	➢ exchange rates ➢ the capacity of material producers ➢ Inflation/an increase in material costs ➢ Poor design or specification ➢ Unbalanced demand
2	What are the major impacts of price escalation on the performance of building construction projects?	➢ Affect budget costs ➢ Time delay ➢ Poor quality ➢ Dissatisfaction stakeholders ➢ Disputes among involved stakeholders (customer relations) ➢ Profit loss	➢ Affect budget costs ➢ Time delay ➢ Poor quality ➢ Dissatisfaction stakeholders ➢ Loss of the profit ➢ Disputes among involved stakeholders (customer relations)	➢ Affect budget costs ➢ Time delay ➢ Poor quality ➢ Dissatisfaction stakeholders ➢ Loss of the profit ➢ Disputes among involved stakeholders (customer relations)
3	According to your experience, what are the Obstacles that Affect the Effective Implementation of Price Adjustment provisions to address the price escalation encountered in public building construction mega projects?	➢ formula, not simple ➢ Contractors do not follow contractual procedures. ➢ Lack of a recognized price database ➢ Not effective for a time frame of less than 18 months ➢ the contracted adjustable portion does not reflect the actual price escalation that occurs	➢ Lack of a recognized price database ➢ the contracted adjustable portion does not reflect the actual price escalation that occurs ➢ Not reached on the agreed adjustable fraction ➢ Not effective for a contract time frame of less than 18 months.	➢ Not effective for a time frame of less than 18 months. ➢ Client's resist honoring the escalation clauses ➢ the contracted adjustable portion does not reflect the actual price escalation that occurs ➢ Lack of a recognized price database

4.2.2. Findings from the Interview

From the interview, numerous causes of price escalation were identified in the first question, the impacts of price escalation in the second question, and obstacles that affect effective implementation in answering the third question. These variables were merged and checked to see if they were out of the literature to include them in the questionnaire. However, more of them had the same meaning as the domain of the variables identified in the literature.

From the summary of the interview, the common answer was sorted, and the factors that cause price escalation were listed as shown in Table 4.14 below. It was revealed that exchange rates, unbalanced demand and supply of construction input, and inflation or an increase in material costs were the common answers that contributed to price escalation on public building construction mega projects.

Table 4.14: Result of the interview as a contribution factor for price escalation

S. N	Causes of price escalation
1	Fluctuations in money exchange rates
2	Inflation/ Increase in material costs
3	Unbalanced demand and supply of construction input

As identified from the interview, the sorted summary of a semi-structured interview that frequently answers questions on public building projects revealed that project budget, time delay, poor quality, dissatisfaction of stakeholders, and profit loss were identified, as shown in Table 4.15 below.

Table 4.15: Results of the interview on the impacts of price escalation

S. N	Impact of price escalation
1	Affect budget costs
2	Time delay
3	Poor quality
4	Dissatisfaction stakeholders
5	Profit loss
6	Disputes among involved stakeholders (customer relations)

Finally, for the third objective, with the subject of obstacles that affect the effective implementation of price adjustment, the interviews of the three groups and the common answer were listed, as shown in Table 4.16 below.

Table 4.16: Result of the interview on Obstacles that Affect Effective Implementation

S. N	Obstacles that Affect the Effective Implementation of Price Adjustment
1	The price adjustment is not effective for a time frame of less than 18 months.
2	Lack of a recognized price database
3	With the application of price adjustment clauses, the contracted adjustable portion does not reflect the actual price escalation that occurs.

4.3. Desk Study Analysis

The desk study was conducted from three projects selected from the population that were carried out in public building construction mega projects, designated as Projects A, C, and D for this study purpose only. The three selected projects had a contract period greater than 18 months. However, projects A and D, even though they exceed a contract period greater than 18 months, have an SCC that restricts price adjustment, whereas project C has a contract period exceeding 18 months and price adjustment is allowed in its contract conditions of the SCC.

4.3.1. Project A

The tender sum for Project A was 1,575,236,702.75 Birr, and its contract signing date was April 5, 2020. The contract duration was 1330 calendar days. There were numerous additional costs associated with the construction inputs due to price escalation occurring at the construction stages. During the observation of the project, it was noted that the contractor spent additional costs on purchasing construction goods such as cement, finishing material, electrical fittings, and reinforcement while perusing these goods compared to the basic cost of the material at the tender stages. The work progress and time elapsed for this selected project were 70.86% and 98.57%, respectively, at the time this research was conducted, as shown in Appendix 4.

In collecting all the relevant data, archival records like completion reports, progress reports, payment certificates, and contract documents were used as sources of data. A detailed description of selected desk study projects is found in Appendix 4. The documents used were signed, stamped, and legal documents at law, including price adjustment clauses in the GCC and SCC of the contracts, price adjustment requests for escalation in the price of construction input, claims by contractors, and other relevant correspondence letters between consultants, clients, and contractors.

4.3.2. Project C

The tender sum for project C was 1,736,144,224.41 Birr, the project contract signed date was January 30, 2020, and the contract construction duration was 1305 calendar days. The project had progressed to 54.89% of the work planned. On the subject project, it was observed that numerous additional costs were associated with the construction inputs due to the price escalation. The price adjustment reached until this research was conducted was 1,838,211,144.17 Ethiopian birr, which was more than 100% of the contract price. As a result, the contractor was notified that he was to suspend the project site operations temporarily, as per GCC Cause 20 Subclause 20.1, due to the tremendous challenge that he had faced. Among the challenges are insufficient cash flow and severe losses on the performance of the contract caused by external factors while perusing these goods compared to the basic cost of the material at the tender stages. As the contractor could not make progress on the works as per the agreement, the completion date was elapsed by 105.9% over the schedule of works.

The same as Project A and Project C, during the desk study, the information included site handover dates, prices quoted by contractors in the contracts, percentage time elapsed, physical progress, financial progress, price adjustment clauses in the GCC and SCC of the contracts, price adjustment requests for escalation in the price of construction input, claims by contractors, and other relevant correspondence letters between consultants, clients, and contractors.

4.3.3. Project D

The tender sum for Project D was 4,623,829,150.00 Birr, and the contract duration was 1522 days. The project contract signed date was July 17, 2019. The project progress was 91.40%, and the project had a time elapsed of 99.47% over the schedule of work. The price adjustment made to the project was 784,025,464.52 birr.

During the desk study, the information included the contract signed date of July 17, 2019, site handover dates, percentage time elapsed, financial progress, price adjustment clauses in the GCC and SCC of the contracts, price adjustment requests for escalation in the price of construction input, claims by contractors, and other relevant correspondence letters between consultants, clients, and contractors.

4.3.4. Findings from the Desk Study

Accordingly, from the desk study results for the selected three public megaprojects, the most common factors leading to an escalation in the price of construction input were tabulated and shown in Table 4.17. These were fluctuations in money exchange rates, unbalanced demand and supply of construction input, inflation, and an increase in material costs (material cost fluctuation). The sum of the causes of price escalation is shown in Table 4.17.

Table 4.17: Results of the Desk Study on Causes of Price Escalation

S. N	Causes of price escalation
1	Fluctuations in money exchange rates
2	Unbalanced demand and supply of construction input
3	Inflation/ Increase in material costs (material cost fluctuation)

After finding the cause of price escalation from the project document review, it was started to examine the effect of price escalation on the project's performance, and then there was an increase in project costs, which created dissatisfaction among stakeholders, caused project abandonment, and caused profit loss. The completion of the projects was further extended. In addition to the three projects studied, on two of the projects, there was a dispute between the client and contractor. As a result, the client is unable to pay for the increased cost of construction materials. This had an impact on the progress of the work, which in turn influenced the project's completion time.

Table 4.18: Results of the desk study on the effects of price escalation

S. N	Effects of price escalation
1	Project completion time delay
2	Affects the project budget cost
3	Dissatisfaction by project stakeholders
4	Profit loss
5	Disputes among involved stakeholders (customer relations)

Finally, from the desk study, it was found that there were obstacles that affected the effective implementation of price adjustment and administration practices. According to the desk studies, all three projects encountered challenges due to construction input price escalation.

However, price adjustments were not allowed for Project A and Project D as per the SCC of the contracts they have. Even though price adjustment was allowed for Project C, it was not applied yet due to a lack of market price data for construction input and poor price adjustment administration practices. The project work for the three projects has completely ceased after the contractors submitted their request for price adjustments for construction input, and the projects suffered significant delays, which increased their vulnerability to the increasing price escalation. This caused friction between consultants and contractors, as well as between clients and contractors. (Details of the desk study analysis are presented in Appendix 4).

Table 4.19: Results of the Desk Study for Obstacles that Affect the Effective Implementation of Price Adjustment

S. N	**Obstacles that Affect the Effective Implementation of Price Adjustment**
1	The price adjustment is not effective for a time frame of less than 18 months.
2	Lack of a recognized price database
3	With the application of price adjustment clauses, the contracted adjustable portion does not reflect the actual price escalation that occurs.

4.4. Case Study Analysis

This section deals with the study of the actual context of the one selected megaproject as case studies from the seven identified projects as population for this research. In this study, to investigate the extent and produce a comprehensive understanding of price escalation and its impact on construction project performance, archival records like progress reports, payment certificates, contract documents, material delivery reports, and the basic price indices of the project were used as sources of data. A detailed description of selected case studies of projects is found in Appendix 5.

There was difficulty obtaining information on actual labor, equipment (for building), subcontractor expenses, and indirect costs, which was considered a limitation of this case study.

Table 4.20: Grouping materials for a selected public building construction project

Item no	Project amount		1,434,323,142.49	Weighting Factor (%)
	Basic Element	Unit	Total cost of material	
1	Cement	ETB	52,820,509.08	3.68%
2	Reinforcement Bar	ETB	339,227,854.78	23.65%
3	Ceramics (All Finishing Material)	ETB	483,223,466.70	33.69%
4	Diesel & Benzene	ETB	57,088,316.21	3.98%
	Total Adjustable portion		**932,360,146.78**	**65.00%**
	Non-Adjustable Portion		**501,962,995.70**	**35.00%**

Note that the non-adjustable portion is, in the context of public body contract provisions, the portion of the unit rate excluding the adjustable portions that were stated in the contract document of the project. Thus, cement, reinforcement bars, ceramics (all finishing materials), and diesel and benzene were described at the SCC in the contract document of the project.

Accordingly, the contractor claimed the price adjustment for each interim payment using the weighted average method, which was calculated for the billing group as shown in the following tables.

Table 4.21: Adjustable portions are considered in construction inputs at the IPC-03.

FEBRUARY 18,2022 Applied for PAYMENT-03					
Item no	**Basic Element**	**Weighting Factor (%)**	**Base Material Price**	**Current Material Price**	**M(Mn/Mo)**
1	Cement	3.68%	208.83	450.00	0.079
2	Reinforcement Bar	39.05%	38.00	110.00	1.130
3	Ceramics (All Finishing Material)	14.44%	330.89	475.03	0.207
4	Diesel & Benzene	3.98%	18.75	28.94	0.061
Total Adjustable portion		**61.15%**			
Non Adjustable Portion		**38.85%**			**0.389**
Pn=A+B+C= A+B(Mn/Mo)+C(Ln/Lo)					**1.867**

Table 4.22: Adjustable portions are considered in construction inputs at the IPC-04.

OCTOBER 09,2022 Applied for PAYMENT-04					
Item no	**Basic Element**	**Weighting Factor (%)**	**Base Material Price**	**Current Material Price**	**M(Mn/Mo)**
1	Cement	3.68%	208.83	814.70	0.144
2	Reinforcement Bar	39.05%	38.00	85.00	0.873
3	Ceramics (All Finishing Material)	14.44%	330.89	575.03	0.251
4	Diesel & Benzene	3.98%	18.75	59.90	0.127
	Total Adjustable portion	**61.15%**			
	Non Adjustable Portion	**38.85%**			**0.389**
	Pn=A+B+C= A+B(Mn/Mo)+C(Ln/Lo)				**1.784**

Table 4.23: Adjustable portions are considered in construction inputs at the IPC-05.

MARCH 02,2023 Applied for PAYMENT-05					
Item no	**Basic Element**	**Weighting Factor (%)**	**Base Material Price**	**Current Material Price**	**M(Mn/Mo)**
1	Cement	3.68%	208.83	900.00	0.159
2	Reinforcement Bar	39.05%	38.00	108.00	1.110
3	Ceramics (All Finishing Material)	14.44%	330.89	652.17	0.285
4	Diesel & Benzene	3.98%	18.75	67.30	0.143
	Total Adjustable portion	**61.15%**			
	Non Adjustable Portion	**38.85%**			**0.389**
		Pn=A+B+C= A+B(Mn/Mo)+C(Ln/Lo)			**2.084**

Table 4.24: Adjustable portions that were included were considered at IPC-03, 04, and 5.

Item no	**Description**	**Payment Amount with VAT**	**Index (Pn)**	**Adjusted Amount**	**Total With Adjusted Amount**
		A	**B**	**C=(B-1)*A**	**D=C+A**
1	IPC-03	28,760,321.26	1.867	24,933,661.19	53,693,982.454
2	IPC-04	76,211,964.56	1.784	59,727,438.91	135,939,403.467
3	IPC-05	30,917,592.45	2.084	33,529,045.65	64,446,638.096

The amount of the price adjustment to be paid to or recovered from was 1.867, 1.784, and 2.084 of the interim payment of IPC-03, 04, and 05, respectively. This result shows that as time goes on, the PN is going up. At ICP 5, the factor was 2.084, which means that the construction material cost was rising by more than 100%. (Details of the case study analysis are presented in Appendix 5.)

Accordingly, the contractor claimed an estimated amount of price adjustment at each interim payment (IPC-03, 04, and 05) for compensation price change from the base material price, as shown above in Table 4.24. However, due to the adjustable and non-adjustable portion elements and the fact that the exact combination of elements was not specified on the SCC, the determination of the Pn value, which was calculated and submitted by the contractor and then determined by the consultant, did not get approval from the client. As a result, the agreement between the client and contractor was not reached. Hence, the contractor noticed in official letters that they were continuing to lose profit from the project.

While conducting this research, disputes among the involved stakeholders arose, and consequently, the project's work activities were abandoned. A fatigued and exhausted formal communication and meetings held with higher officials (government offices) for the resolution of the issue arose to make contact amendments to compensate the contractor’s claim of a price adjustment amount that was not found to be acceptable from the client's point of view. Unfortunately, even though there were constructive meetings among involved stakeholder groups, amending the contract was not reached on the agreement due to interest conflicts that arose from the attendee, and consequently, while the researcher was finalizing his case study, the contractor gave a notice of termination official letter to the concerned stakeholder.

Table 4.25: Results of the findings from the case studies were summarized as follows:

Investigation of a case study	**Results of the findings**
Causes of price Escalation	Inflation/ Increase in material costs (material cost fluctuation)
	Monopoly and unethical practices of suppliers (Cement, steel, and other construction materials in the country) artificial material shortage
	Fluctuations in money exchange rates
Effects of price escalation	Project completion time delay
	Delivery of low-quality construction materials
	Disputes among the stakeholders/ Customer relation
	Dissatisfaction by project owners and consequently by end users,
	Profit loss of the contractor
	Affects the project budget cost
Obstacles that affect the effective implementation of price adjustments	Escalation occurs in projects with a contract period not exceeding 18 months. The SCC limits or restricts the application of price adjustments.
	Special Conditions of Contract: Application of Price Adjustment Clauses (The contracted adjustable portion and fraction for each specified element and the exact combination of elements that will be applied in the formula for price adjustment do not reflect.
	Lack of a public database for recording and updating the monthly market price of construction input.

4.5. Discussion on the results of the study

This section presents the discussion of the study findings from the questionnaires, the desk study, the interview and the case study. The cause of price escalation, impact of price escalation and Obstacles that affect the effective implementation of price adjustments are discussed.

4.5.1. Causes of Price Escalation Public Building Megaprojects

According to the questionnaire, the first major cause of price escalation that was ranked first by all respondents (clients, consultants, and contractors), as shown in Table 4.4, was inflation or an increase in material costs (material cost fluctuation). All respondents, client, consultant, and contractor, share the same viewpoint as the overall rank.

Moreover, based on the results obtained from the interview, as shown in Table 4.14, indicates that inflation and an increase in material costs were also causes of price escalation. Furthermore, from the observations, which were supported by the results obtained from the desk study as shown in Table 4.17, also agreed. Finally, this result also aligned with the case study finding, as shown in Section 4.4, that inflation and an increase in material costs were the major causes of price escalation.

As Nazif et al. (2021) identified, inflation, or an increase in material costs (material cost fluctuation), was the major cause of price escalation, which agreed with research findings. Furthermore, according to Mohammed Gashaw (2013), inflation, or an increase in material costs (material cost fluctuation), is also one of the most common causes of price escalation.

Inflation occurs due to an increase in the prices of construction raw materials and services on construction projects, which over time results in a loss of purchasing power. One of the most obvious causes of project price escalation was a rise in material costs (material price fluctuation). The public building construction mega project were struggling as a result of the price increases in construction materials brought on by this inflationary tendency. A unit of currency now effectively has less purchasing power than it had in earlier periods due to the increase in prices; this result coincides with the study (Kumar, 2020a).

Based on the questionnaire, fluctuation in the money exchange rate was the second most common cause of price escalation, which was ranked by the respondent's combined group (client, consultant, and contractor), as shown in Table 4.4.

Moreover, it can be observed that fluctuation in the money exchange rate was ranked by both contractors and consultants as a secondary contributing factor to price escalation; however, it was ranked by the client as the 4th most common cause of price escalation, which shows that the consultant and contractor gave more priority consideration to the exchange rate than the client. On the other hand, this result shows that fluctuation in the money exchange rate is the most important factor from the standpoint of the consultant and contractor.

Fluctuations in money exchange rates: it can be seen that changes in currency exchange rates were pointed out as the most determinant cause of price escalation, as shown in Table 4.4. This confirmed that since the exchange rate has been deregulated, the prices of all construction raw materials and services have been increasing. This volatility of the foreign exchange rate impacts global trade patterns and thus affects a country’s balance of payments position.

Moreover, this result agreed with the interviewee; the desk study and case study, as shown in Tables 4.14, 4.17, and 4.25, respectively, also identified the fluctuation in the money exchange rate as the most important determinant cause of the price escalation. This finding was in agreement with the study of (Gashaw Mossa & Ababa, 2013).

Unbalanced demand and supply of construction input were the third most common cause of price escalation, which was ranked by the respondent's combined group (client, consultant, and contractor), as shown in Table 4.4. The group ranking result shows the client, consultant, and contractor groups as the 6th, 4th, and 3rd most common causes of price escalation, respectively. This implies that unbalanced demand and supply of construction input for the contractor were the most important factors from his standpoint, with an immediate effect compared to the other two respondent groups, client and consultant, and that could probably be the reason why he rated it higher.

The result obtained from the questionnaire that unbalanced demand and supply of construction input were causes of price escalation agreed with the findings of the interviewee, the desk, and the case study, as shown in Tables 4.14, 4.17, and 4.25, respectively.

This finding, aligned with (Musarat et al., 2021), shows that an unbalanced demand and supply of construction input, which keeps prices high and inhibits output, greatly contributes to price escalation.

Over-dependence on imported building materials or difficulty in obtaining construction materials in the local market was the 4th most common cause of price escalation, which was ranked by the respondent's combined group (client, consultant, and contractor), as shown in Table 4.4; however, it was ranked by the client, consultant, and contractor groups as the 2nd, 5th, and 9th most common cause of price escalation, respectively. The client group was most concerned by the overdependence on imported building materials or difficulty in obtaining construction materials in the local market compared to the other two respondent groups. Findings from the interview, desk, and case study coincide with the questionnaire that overdependence on imported building materials or difficulty in obtaining construction materials in the local market was the main cause of price escalation, as shown in Appendix 2.

Moreover, to this effect, as the construction industry continues to expand, so does the demand for building supplies; therefore, for the market to remain stable, the local supply must be adequate to meet the increasing consumer demand. Contrary to this, there is an excessive reliance on imported building supplies, which will cause prices to increase as a result of the increased import costs linked to a depreciated country's currency, according to the respondents, which also affirms the findings by (Beza, 2020).

Lack of timely decision-making was the fifth most common cause of price escalation, which was ranked by the respondent's combined group (client, consultant, and contractor), as shown in Table 4.4. It was also ranked by the client, consultant, and contractor groups as the 3rd, 7th, and 13th most common causes of price escalation, respectively. The client and consultant groups gave more weight to the lack of timely decision-making compared to the contractor, and they probably understood that a stakeholder's inability to decide in a timely manner could be the reason for the price escalation to occur. This result aligned with one interviewee as it was the main cause of price escalation, as shown in Appendix 2.

The duration and cost of the project were significantly impacted by certain decision-makers (involved stakeholders) leaving the paper on their desks for an extended period without making a decision spontaneously. In other instances, if the contractors do not have approvals or orders to continue working from the consultant, it results in significant time and financial costs. As a result of the decision-making process being delayed, more time and money were spent. The contractors were unable to receive a fast response to their requests due to the consultant staff's inability to give fast approval of the submittals or work orders. Due to these severe effects, a significant amount of time would be lost, which would have an impact on the cost of the project (‘Tadele’, 2018).

Results obtained from the questionnaire, interview, desk, and case study were triangulated. Similar findings were **fluctuations in money exchange rates, inflation or an increase in material costs, and unbalanced demand and supply of construction input**.

4.5.2. Impact of Price Escalation on Public Building Megaprojects

According to the findings from the questionnaire, the variables that determine the performance of the public building construction megaprojects that were impacted by the price escalation were ranked using the combined group of clients, consultants, and contractors, from high to low, according to their degree of impact.

This result indicates the significance of this influence on public building construction megaprojects in Addis Ababa City because it is in the same position in terms of clients, consultants, and contractors. Delays are one of the frequent results of price escalation, which then has an impact on construction projects. In the event of a delay, the price of the necessary goods or machines may rise, or these products may become scarce in the domestic markets, leading to value increases. Longer delays also result in significant costs. inflation for projects, which agreed with the finding (Belay & Jain, 2023).

Thus, the completion time is not complied with the determined schedule, causing disputes among involved stakeholders (customer relations), creating dissatisfaction to owners and consequently coming to the end users, creating a poor quality of project work, and finally affecting the project budget cost were examined as effects of price escalation on the performance of the public building construction mega projects, as shown in Table 4.7.

Therefore, the following discussion is based on the first five rankings that were examined for the impacts of price escalation using a questionnaire, and results obtained from the interviewee, desk, and case study were also discussed where necessary.

Accordingly, the first major impact of price escalation that was ranked first by all respondents (clients, consultants, and contractors), as shown in Table 4.7, was the project completion time not complying with the agreed schedule. It was also ranked by the respondents of the client groups as the second major impact of price escalation, whereas the consultant and contractor agreed and ranked it as the first major impact of price escalation.

This result was also complemented by the results of the interview, desk, and case study presented in tables 4.15, 4.18, and 4.25, respectively. Therefore, the results of the desk study, the questionnaire survey, the interview, the case study, and the previous study findings (Dawit Tarekegne, 2022) make it evident that the project completion time not complying with the agreed schedule was the primary impact that the escalation has on the projects.

Excessive price increases necessitate extra funding, which depletes the country's scarce financial resources and creates further budget gaps for building projects. and finally bring the effect that there was dissatisfaction by project owners and consequently by end users, and this impact was agreed upon with the findings of Belay and Jain 2023b).

Then, the public body is forced to decide whether to cancel the project if extra funding is not available at the construction stage, put projects on hold while additional funding is sought, or try to reduce the project's scope, which would then affect the project contract's duration significantly, which affirms the findings (Gashaw Mossa & Ababa, 2013).

Disputes among the involved stakeholders (customer relations) were the second most common impact of the price escalation on the public building construction project, which was ranked by respondent groups (clients, consultants, and contractors), as shown in Table 4.9. Furthermore, disputes among the stakeholders involved (customer relations) were ranked by the consultant and the contractor, who agreed that they ranked the same as those ranked by respondent groups (combined); however, clients ranked it as the third major common impact of price escalation; this perception shows that the consultant and contractor gave more weight to that, as shown in Table 4.7.

Thus, a source of dispute among stakeholders was also created by price inflation, which resulted in adversarial relationships between stakeholders in public building construction megaprojects. It took more time to resolve these conflicts, which eventually affected the project timeline and, consequently, the project's overall duration. This finding coincides with (Gashaw Mossa & Ababa, 2013).

Large-scale projects frequently included intricate finance, planning, and designing for phasing, as well as legal considerations. There was much overlap and interaction between the parties. As a consequence, there were more and more disagreements between the contractor and the client. The additional time needed to resolve these issues affects the project timeline, which in turn affects the project's overall duration and associated expenses (Belay & Jain, 2023).

Dissatisfaction by project owners and, consequently, by end users was another major impact of price escalation. It was ranked as the 3rd major impact of price escalation by combined respondents (client, consultant, and contractor), whereas both client and contractor respondent groups ranked it as the 4th; however, the consultant ranked as the third major impact of price escalation. This ranking difference may be because the contractor and client respondents may not have had the chance to see the effect as closely as the consultant and respondent groups, who have more exposure to contract management.

This result was supplemented by the fact that interviewees mentioned dissatisfaction by project owners and, consequently, by end users as a major impact of price escalation. Moreover, this finding also agreed with the desk study and case study, as shown in Tables 4.18 and 4.25, respectively. Therefore, it can be said that this performance area was highly influenced by the price escalation. This result coincides with the finding (Ingle & Mahesh, 2022), who thoroughly discussed the performance area as it plays a pivotal role in the success of a project. Hence, the significant stakeholder satisfaction with the performance areas captured by this research was one of the key indicators for construction professionals for better project success, and they are categorized as non-financial measures that have emerged as important measures in this study.

The project budget cost affected was ranked in 6th, 4th, and 3rd place by the client, consultant, and contractor group respondents, respectively, whereas the respondent's group combined ranked it in 4th place. There was a small disagreement on the ranking between client respondents on one side and consultant and contractor respondents on the other side.

Moreover, this finding was supplemented by an interview, as per Table 4.13, and based on the results of the interview, the common answer has been sorted and can be taken as a price escalation impact on the budget cost of public building projects. This result was in agreement with the finding of (Kumar, 2020) that price escalation affects the project's initial budgeted cost.

It also received the highest ranking from the contractor as a result of the excessive cost growth that necessitates an extra financial plan. This, in turn, depletes the nation's limited monetary resources and leads to further budget shortfalls for building projects. This hinders the planned increase in the production of goods and services, and as a result, this phenomenon has a detrimental impact on the rate of national growth.

Furthermore, the impacts of price escalation, based on the findings of the desk and case study Tables 4.18 and 4.25, respectively, demonstrated that excessive price increases necessitate extra funding. This depletes the public building construction project’s scarce financial resources, creates further budget gaps for public building mega projects, and finally brings the effect that there was dissatisfaction by project owners and consequently by end users. This finding coincides with satisfaction (Ingle & Mahesh, 2022).

Thus, it can be generalized that, from the above detailed discussion, excessive cost growth necessitates additional funding for each public building construction project, which consumes the project's limited financial resources, creates financial scarcity, and causes additional budget gaps for construction projects. If not found, additional budget would finally lead to an abundance of the project as a result of the serious suffering caused by the increase in cost among the stakeholders. This prevents the planned increase in property and service production from taking place, and this phenomenon in turn affects, in a negative way, the rate of national growth.

This finding agreed with the finding of Dinkaywehu (2019), as he stated that the unprecedented price increase has had a variety of effects on the building business. Undoubtedly, claims of degraded or reduced profit margins as well as significant project losses have been made by the contractor and subcontractor communities. The knock-on effects of this sharp price increase have not only resulted in lost revenue but also in damaged or destroyed building firms, among other effects. Price changes may affect owners, clients, contractors, and the project itself. If contractors are not adequately rewarded, the main impact of price variation on them is the projects' cash flow (project financing) issues.

Poor-quality project work was the fifth most significant impact of price escalation, ranked by combined respondents (client, consultant, and contractor), whereas client, consultant, and contractor respondent groups ranked 1st, 6th, and 6th major impacts of price escalation, respectively. This ranking difference shows that the respondent group has a different perception of the impact of price escalation on quality. This result was noted by the interviewees as poor quality to be created and as a major impact of price escalation.

The cost of quality in construction was the cost incurred by the involved stakeholders in attaining and maintaining good quality throughout the public building's operational life to achieve the highest level of customer satisfaction. Every time rework is undertaken, the cost of quality increases.

In general, quality costs were maintained by adhering to the cost of conformance and the cost of non-conformance. The cost of conformance, better known as the cost of good quality, can be further subdivided into prevention costs and appraisal costs. However, whenever the construction projects were affected by price escalation, it would be difficult to comply. Since the cost conformance used was the amount of money spent to avoid failures during the project, in a public building construction project, there was a budgeted cost for training, testing, audits, calibration, and maintenance; however, in reality, keeping the preference limited due to price escalation created a financial scarcity, which, in turn, affected the health of the financial flow of the project and finally created the cost of non-conformance, which was the cost of poor quality.

On the other hand, the amount of money spent due to failures during and after the public building construction project forms the cost of non-conformance due to price escalation, which resulted in rework, repairs, scrap, and complaint handling in the construction projects.

Results obtained from the questionnaire, interview, desk, and case study were triangulated. Similar findings were that **project completion time delay, affects the project budget cost, dissatisfaction by project stakeholders, arising disputes among involved stakeholders (customer relations), and profit loss** were the major findings on the effects of price escalation.

4.5.3. Obstacles that Affect the Effective Implementation of Price Adjustment

From the questionnaire, the respondents ranked not applying price adjustment clauses for materials or items whose price significantly changes for the contract duration of the project, less than 18 months, as the first most significant effect. Moreover, this result was agreed upon by the interview, desk, and case study. This result also coincides with the previous study findings (Beza, 2020). According to Subclause 62.1 of the PPA (2011 version), the price adjustment is only allowed where it is confirmed that the performance of the contract requires more than 18 months. The adjustment of contract prices shall be undertaken after twelve (12) months from the date of the contract's effective date. This limitation on the implementation of price adjustment was first considered by respondents as the main difficulty with price adjustment.

Furthermore, the implementation of price adjustment clauses was limited by the application of price adjustment clauses; the contracted adjustable portion does not reflect the actual price escalation that occurs. According to the interview, desk, and case study for the identified projects, the SCC doesn’t specify the categories of inputs, the fractions for each specified element, or the exact combination of elements that will be applied in the formula for price adjustment as specified in sub-clauses 62.7 and 62.13 on the GCC of the PPA. These circumstances create a substantial obstacle to the implementation of price adjustment; this finding also coincides with the research findings (Dinkaywehu, 2019).

Clients' resistance to honoring the escalation clauses was one of the most significant effects. As shown in Table 4.10, respondents ranked the statement that declares clients don't honor escalation clauses as the third challenge to the application of price adjustment, with an MIS score of 3.98. Clause 62: Sub-clause 62.4 gives the power to increase or decrease the contract price amount to the public body, i.e., the client, laying the fate of approving the price adjustment in the hands of the client, which makes it difficult for application. Moreover, approval and compensation events might take a long time while projects remain idle. Hence, problems with honoring escalation clauses pose a practical challenge to the application of price adjustment. This finding coincides with (Gashaw Mossa & Ababa, 2013)

The lack of a recognized price database for recording and updating the price of construction materials for contractual purposes was the most significant obstacle; this result also aligned with findings from the interview, desk, and case study. This finding agreed with the study (Beza, 2020), which found the absence of a database for keeping track of and updating building material prices for contact or other purposes. The benchmark price index and the monthly price index are the necessary material price indices at distinct points in time for price adjustment under PPA contract terms. The Ethiopian Central Statistical Agency, or the Public Procurement and Property Administration Agency, is the primary source for these pricing indices: the benchmark price index and the monthly price index. However, this is still a serious issue: agencies shall provide pricing indices, particularly for building materials.

Finally, results obtained from the questionnaire, interview, desk, and case study showed that **the price adjustment was not effective for a time frame of less than 18 months due to a lack of a recognized price database, the application of price adjustment clauses, and the fact that the contracted adjustable portion does not reflect the actual price escalation that occurs.** These were the obstacles that affected the effective implementation of price adjustments in public building construction mega projects.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The complex and dynamic nature of the construction industry brings uncertainties to construction projects, which do have lots of variables that come into play during implementation. The development of the aforementioned construction projects has a positive and significant impact on developing society, and this positive significance is determined by the achievement of the objectives of the construction projects, which are to accomplish the project within the available environment by putting together all the resources in a bounded time with an estimated project cost and specified quality. However, there is an environment of risk and uncertainty that comes in as an obstacle to the realization of project objectives. Among the many variables, one of the major identified risks confronting the construction industry is price escalation, which is an increment of the cost from the original contract budgeted cost in the monetary value of any construction inputs of a project and the base price of a project due to the passing of time.

To minimize the negative effects of price escalation, it is imperative to know the causes and effects of them so that a proactive measure can be taken. As to this effect, this research was made on public building mega projects supervised and administered by BUDSWS.

The preceding provided a detailed discussion of the results, which were obtained through the use of desk studies, interviews, questionnaires, and a case study to address the research objectives. The study's key findings are presented in this chapter, and conclusions are drawn in line with the objectives that were established.

According to the obtained results from the questionnaire, interview, desk, and case study that was being triangulated, **fluctuations in money exchange rates, inflation/an increase in material costs, and unbalanced demand and supply of construction input** were identified as the most determinant contributing factors for price escalation in public building construction megaprojects.

Results obtained from the questionnaire, interview, desk, and case study show that **completion time delay, change in budget cost, dissatisfaction of stakeholders, arising disputes among involved stakeholders (customer relations), and profit loss** were the main impacts of price escalation on performance.

Finally, **the price adjustment was not effective for a time frame of less than 18 months; the lack of a recognized price database and the fact that the contracted adjustable portion does not reflect the actual price escalation that occurs** were the main obstacles to the effective implementation of price adjustments in public building construction mega projects.

5.2. Recommendations

The objective of this study was to generate findings from the predicted problems addressed in the research questions. Additionally, this thesis's objectives were to make recommendations on how to manage price increases more effectively in public building projects in light of the research's findings. The recommendation will therefore concentrate on addressing the main issues revealed throughout the study process.

Based on the findings of the study, the following recommendations are given:

- ✓ Clients' ought to put their best effort into the project's planning stage by developing contingencies and risk management protocols in terms of timing, budget, resources, and quality. Before beginning construction, seek and hire the engagement of capable firms that can oversee the various stages of any project, monitor and compare actual performance, anticipate and monitor risk, and deliver the project by meeting a predetermined set of objectives.

- ✓ The construction firms and regulatory bodies should jointly work to improve the compensation system, consider the application of price adjustment provisions in the contract, and adjust the adjustable portion needed to reflect the actual extent of price escalation that occurs. The method of price adjustment calculation should be clear, fair, and consistent across contractors, consultants, regulatory bodies, and clients.

- ✓ For accurate pricing information, the database has to be updated often, and at short intervals, the Ethiopian Statistics Agency or another regulating organization ought to compile and release the most updated indexes.

- ✓ The government ought to maintain stability in macroeconomics. Additionally, devise strategies to mitigate it before making macroeconomic decisions that could upset the overall market conditions and cause delays.

- ✓ FDRE ought to create a stable and strong economic environment that attracts and motivates local companies to specialize in the production of enough construction materials to fulfill the quality requirements set for every respective work item.

- ✓ The government has to amend the 2010 procurement directive as regards Article 16.14.2, which states for public projects that it only takes price adjustments into account for projects with a contract performance duration longer than 18 months, in light of the current unpredictable nature of construction input price escalation and the country's experience with inflation.

- ❖ **For Future Research**

To strengthen the thesis's conclusions even further and for the benefit of this entire research, the following three fields of study have been deemed to be studied;

1. Assessment of the modeling of strategic tools with delivery methods that minimize the adverse effects of price escalation on the performance of public projects
2. Assessments in macroeconomics on the minimization of the effect of price escalation on public building projects
3. Application of modern construction technology to minimize the effect of price escalation on public building projects

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Appendix-1: Questionnaire

ADDIS COLLEGE

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

IMPACT OF PRICE ESCALATION ON PUBLIC BUILDING CONSTRUCTION PERFORMANCE IN ADDIS ABABA

(QUESTIONNAIRE)

Dear Sir/Madam,

The goals of this survey are to obtain data for the specified research being conducted in partial fulfilment of the requirements for the Master of Science Degree in Construction Technology and Management. This questionnaire is designed to survey professional opinions on the **impact of price escalation on public building construction performance in Addis Ababa.**

The purpose of this study is to assess the causes and impacts of price escalation and, thereby, propose the measures that can be taken to minimize the effects of price escalation on the performance of public building construction projects.

Your response in this regard is highly valuable and contributes to the outcome of the research. I can assure you that your response will be kept strictly confidential; only my academic adviser and I will have access to the information you provided, and generalized analysis of the information contained within this completed questionnaire will be exclusively utilized in this research process. Use my contact information if there are any questions about the questionnaire that are unclear (if there are any). Thank you for your invaluable time and patience in advance.

Regards,

Tariku Asegidew

Tel: +251 911-01-42-35 or +251 910-08-74-48;

E-mail: tariku42001@yahoo.com

May 2023, Addis Ababa, Ethiopia.

Part one: General Information:

Please give your response to the questions, hereby indicating with "√" your appropriate choice and/or idea by putting your answers in the space provided.

1.1. Type or origin of your organization:

☐ Client ☐ Consultant ☐ Contractor

Others (please specify) _____

1.2. Years of experience of the respondent:

☐ from 6 to 10 years ☐ from 11 to 15 years ☐ Over 16years

1.3. Educational status of the respondent:

☐ Diploma ☐ B.Sc. ☐ M.Sc. ☐ PhD.

Others (please specify) _____

1.4. Job title of the respondent:

☐Project Manager ☐Construction Engineer ☐ Site Engineer/Office Engineer

☐ Resident Engineer ☐ Contract Administrator Others (please specify) _____

Contact addresses (optional)

E-mail_____ Name(optional): _____ Tel: _____

Part Two: The factors that contribute to price

2.1. The tables below contain lists of determinant factors that contribute to price escalation in construction projects identified in the literature. What is the likely contribution of these factors to price increases in public building construction projects that you have been involved in, based on your experience? Please indicate your preference by marking (√) next to each rate of occurrence (frequency of occurrence) based on the representative numbers listed below.

1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree

S. N	Factors that contribute to price escalation	Rating Occurrence				
		1	2	3	4	5
1	Poor design and Unclear/vague specification	☐	☐	☐	☐	☐
2	Untimely payment	☐	☐	☐	☐	☐
3	Frequent design changes at the project	☐	☐	☐	☐	☐
4	Poor contract management	☐	☐	☐	☐	☐
5	Number of changes/ extensive variation	☐	☐	☐	☐	☐
6	Cash flow and financial difficulties;	☐	☐	☐	☐	☐
7	Lack of timely decision-making.	☐	☐	☐	☐	☐
8	Force Majeure	☐	☐	☐	☐	☐
9	The quality of the tender documentation or Inappropriate or insufficient time given to tender document	☐	☐	☐	☐	☐
10	Political instability	☐	☐	☐	☐	☐
11	Unforeseen site conditions/not indicated or anticipated in the bidding document excessive change orders	☐	☐	☐	☐	☐

12	Fluctuations in money exchange rates	☐	☐	☐	☐	☐
13	Increase in global demand for construction materials	☐	☐	☐	☐	☐
14	Limited capacity of material producers	☐	☐	☐	☐	☐
15	Inflation/Increase in material costs (material cost fluctuation)	☐	☐	☐	☐	☐
16	Maximization of profit by construction material manufacturers	☐	☐	☐	☐	☐
17	Over-dependence on imported building materials /Difficulty in obtaining construction materials in the local market	☐	☐	☐	☐	☐
18	Unbalanced demand and supply of construction input	☐	☐	☐	☐	☐
19	Poor technical performance of those involved in the projects	☐	☐	☐	☐	☐
20	Change of schedule/suspension of work	☐	☐	☐	☐	☐
21	Delivery/procurement approach	☐	☐	☐	☐	☐
22	Insufficient bidding data concerning the project	☐	☐	☐	☐	☐
23	Poor estimation	☐	☐	☐	☐	☐

Part Three: The Impacts of Price Escalation

3.1 The effects of price escalation on the performance of public building construction projects that have been identified through literature are listed in the following table: Please mark (√) under each preference to indicate which of the following lists of the possible impact of price escalation on the performance of the public building construction projects most frequently, based on your experience and the representative numbers listed below.

1-No significance 2-Minorsignificance,

4-High significance 3-Average significance, 5- Extreme significance

Table 3.1: Impacts of price escalation on the performance of public building construction projects.

S. N	Impact of price escalation	Degree of significance				
		1	2	3	4	5
1	The project completion time is not complying with the agreed schedule.	☐	☐	☐	☐	☐
2	Affects the project budget cost	☐	☐	☐	☐	☐
3	Profit, turnover and return on investment,	☐	☐	☐	☐	☐
4	Unemployment among construction workers/reduced productivity	☐	☐	☐	☐	☐
5	Dissatisfaction by project owners and consequently by end users,	☐	☐	☐	☐	☐
6	Create poor-quality of project work	☐	☐	☐	☐	☐
7	Disputes among involved stakeholders (Customer Relations)	☐	☐	☐	☐	☐

Part Four: obstacles that affect the effective implementation of price adjustments in public building construction projects

4.1. Obstacles that affect the effective implementation of price adjustments in public building construction projects, there will be many disputes and claims between the various construction parties, which will ultimately hinder the performance of the construction projects due to the following that have been identified through literature and are listed in the following table: Please mark (√) under each preference to indicate which of the following lists of possible challenges that affect the current price adjustment provisions in the public building construction sector the most frequently, based on your experience and the representative numbers listed below.

1-Nosignificance 2-Minor significance 3- Average significance

4- High significance 5- Extreme significance

S. N	obstacles that affect the effective implementation of price adjustments	Degree of significance				
		1	2	3	4	5
1	Lack of a recognized price database for recording and updating the price of construction materials for contractual.	☐	☐	☐	☐	☐
2	Not applying price adjustment clauses for materials or items whose price significantly changes within time frames less than 18 months.	☐	☐	☐	☐	☐
3	Lack of use of the methods of construction input prices for forecasting	☐	☐	☐	☐	☐
4	In the application of price adjustment clauses, the contracted adjustable portion does not reflect the actual price escalation that occurs	☐	☐	☐	☐	☐
5	Contractors do not follow the proper contractual procedures for requesting price adjustments.	☐	☐	☐	☐	☐
6	Failure to make periodic payments *(i.e., if price adjustments are not made periodically (preferably monthly), the adjustment will no longer reflect the true value)*	☐	☐	☐	☐	☐
7	Constant weighting coefficients throughout the project's lifetime	☐	☐	☐	☐	☐
8	Clients resist honoring the escalation clauses	☐	☐	☐	☐	☐
9	Contractors do not provide the necessary basis cost index in their bidding document for approval by the Engineer.	☐	☐	☐	☐	☐

4.2. Please specify any other challenges that affect the current price adjustment provisions on the construction projects:

_____

_____

I sincerely appreciate your timely response and cooperation.

Thank You!!

Appendix-2: Interview

The purpose of this interview is to get additional information and validate the questionnaire survey results on topics related to price escalation, the impact of price escalation, and finally, forward-looking measures that can be taken to minimize the effects of price escalation on the performance of public building projects.

Question #1: What are the most determinant factors leading to price escalation in public building construction projects?

_____

_____

_____

_____

_____

_____

Question #2: What are the major impacts of price escalation on the performance (i.e., cost, quality, time, Stakeholder satisfaction, Profit, turnover and return on investment, and so on) of building construction projects?

_____

_____

_____

_____

_____

_____

Question #3: According to your experience, what are the potential challenges that affect the current price adjustment provisions to address the price escalation encountered in public building construction projects?

_____

_____

_____

_____

_____

_____

Thank you for your time and cooperation!

Appendix-2: List of Selected Projects

SN	Project	Client	Contractor	Original Contract Amount (Birr)
A	Sectoral Head Office - 3B+20G+R	Addis Ababa City Administration Mega Project Construction office	Zhongyang Construction Group Company Limited	1,575,236,702.75
B	Addis Ababa Leadership Academy	Addis Ababa City Administration Mega Project Construction office	YOTEK Construction PLC	1,399,467,534.57
C	3B+G+20+R Transport Management & Traffic Safety Training Institute Facility Building	Federal Transport and Logistic Minster	Beha Construction	1,736,144,224.41
D	Adwa Museum Zero Km	Addis Ababa City Administration Mega Project Construction office	China Jiangsu International	4,623,829,150.00
E	Addis Ababa Small & Medium Scale Manufacturing Industry Cluster (Lot-01)	Addis Ababa City Administration Mega Project Construction office	MCG Construction (Grade 1 Contractor)	4,354,971,939.50
F	Addis Ababa Small & Medium Scale Manufacturing Industry Cluster (Lot-03)	Addis Ababa City Administration Mega Project Construction office	TNT Construction and Trading PLC (Grade 1 Contractor)	2,814,442,252.25
G	Federal Documents Authentication Registration Agency Office Building	Federal Government Buildings Construction Project Office	Ethiopian Construction Works Corporation	1,434,323,142.49

Appendix-4: Desk Study Analysis

Desk Study Analysis	
Project Description	
	Project "A"
Project name:	Addis Ababa City Administration Mega Project Construction office
Building type	Sectoral Head Office - 3B+20G+R
Contract Signing date	5-Apr-20
Contract Amount (including VAT)	1,575,236,702.75
Contract Duration	1,330
Currency of Payment	ETB
Contract Commencement date	20-Apr-20
Contract Completion Date	11-Dec-23
Time Elapsed in days	1311
Percentage Time Elapsed	98.57
To date Executed Amount to Date: -	1,116,227,372.95
Accomplished Value of Works in %	70.86
Claims:	
Information studied during the desk study included site handover dates, prices quoted by contractors in the contracts, percentage time elapsed, physical progress, financial progress, price adjustment clauses in the GCC and SCC of the contracts, price adjustment requests for escalation in the price of construction input, claims by contractors, and other relevant correspondence letters between consultants, clients, and contractors.	
Causes of price escalations:	
	shortage of construction input from the market
	Inflation/Increase in material costs (material cost fluctuation)
	fluctuations in money exchange rates
	lack of timely decision-making
Major effects of the price escalation on the project	
	Project completion time delay
	Higher contract prices /Affect the project budget cost
	dissatisfaction by project owners
	Profit loss
	Customer relation
Obstacles to implementation of price adjustment	
	The price adjustment is Not effective for a time frame of less than 18 months.
	Lack of a recognized price database

Desk Study Analysis	
Project Description	
	Project "C"
Project name:	3B+G+20+R TRANSPORT SECTORJAL HEAD OFFICE
Building type	Transport Sectoral Head Office - 3B+20G+R
Contract Signing date	30-Jan-20
Contract Amount (including VAT)	1,736,144,224.41
Contract Duration	1,305
Currency of Payment	ETB
Contract Commencement date	13-Feb-20
Contract Completion Date	27-Aug-23
Time Elapsed in days	1382
Percentage Time Elapsed	105.90
To date Executed Amount to Date: -	953,011,939.16
Accomplished Value of Works in %	54.89
Claims: the contractor is notified that he was to suspend the TPMO project site operations. temporarily, as per GCC Cause 20 Sub-clause 20.I., due to the tremendous challenge faced, insufficient cash flow and severe losses on performance of the contract caused by external factors:	
The total price adjustment to date	1,838,211,144.17
Causes of price escalations:	
	shortage of construction input from the market
	Inflation/increase in material costs (material cost fluctuation),
	devaluation of the local currency
	The unrespectable, highly increasing price of all kinds of construction materials, especially the reinforcement bar
Major effects of the price escalation on the project	
	Project completion time delay
	Higher contract prices /Affect the project budget cost
	dissatisfaction by project stakeholders
	Profit loss of the contractor
	Customer relation
Obstacles to implementation of price adjustment	
The price adjustment is Not effective for a time frame of less than 18 months.	
Lack of a recognized price database	
A special condition of the contract restricts subject to price adjustment	

Desk Study Analysis	
Project Description	
	Project "D"
Project name:	Adwa Zero Km
Building type	Museum with different Function
Contract Signing date	17-Jul-19
Contract Amount (including VAT)	4,623,829,150.00
Contract Duration	1,522
Currency of Payment	ETB
Contract Commencement date	30-Sep-19
Contract Completion Date	30-Nov-23
Time Elapsed in days	1514
Percentage Time Elapsed	99.47
To date Executed Amount to Date: -	4,226,179,843.10
Accomplished Value of Works in %	91.40
Claims:	
The total price adjustment to date	784025464.52
Causes of price escalations:	
	shortage of construction input from the market
	Inflation/Increase in material costs (material cost fluctuation)
	fluctuations in money exchange rates
	Poor estimation
Major effects of the price escalation on the project	
	Project completion time delay
	Higher contract prices /Affect the project budget cost
	Profit loss
	dissatisfaction by project stakeholders
Obstacles to implementation of price adjustment	
	The price adjustment is Not effective for a time frame of less than 18 months.
	Lack of a recognized price database
	Special condition of contract on the adjustable portion and fraction for each specified element

Appendix-5: Case Study Analysis

Desk Study Analysis	
Project Description	
	Project "H"
Project name:	FEDERAL DOCUMENTS AUTHENTICATION & REGISTRATION AGENCY 4B+G+21 OFFICE BUILDING
Building type	Federal Government Buildings Construction Project Office 3B+20G+R
Contract Signing date	24-Sep-20
Contract Amount (including VAT)	1,649,471,613.86
Contract Duration	1,461
Currency of Payment	ETB
Contract Commencement date	4-Oct-20
Contract Completion Date	4-Oct-24
Time Elapsed in days	1144
Percentage Time Elapsed	78.30
To date Executed Amount to Date: -	797,504,324.37
Accomplished Value of Works in %	48.35
Claims:	
	Brief discussion The contractor has claimed to compensate for the additional costs incurred due to price escalation through a letter to the consultant for construction inputs that were stated on the contract after 12 months of the contract signing date. The claim was contractually feasible since the contract period exceeds 18 months and the SCC allows the application of price adjustments by categorizing the non-adjustable portion as adjustable, which, in the context of contract provisions, means the portion of the unit rate excluding the adjustable portions, which are cement, reinforcement bar, ceramics (all finishing materials), and diesel and benzene. For that reason, the non-adjustable portion of the bill item was determined based on its cost breakdown. As a result, each pay item has a different non-adjustable portion, and by using the weighted average method, a single non-adjustable portion was developed for

	the billing group. The analysis was revised and validated by the consultant, and consequently, it has been requested for the approval of the employer. Specifically, an indication that the price of construction materials escalated by more than 100% in the period after the signing of the contract. By conducting several meetings with higher officials, including government offices, all agreed that a committee or team consisting of representatives from the employer, consultant, and contractor should be formed to study the market price of the mentioned construction input and to present possible options. After the team completed their assignment and presented the possible options to the involved stakeholders, no decision was made for the several months when the project case study was conducted. This price escalation adjustment process failed to reach an agreement and was not implemented due to the employer not accepting all options presented by the assigned group. Finally, the contractor decided to terminate the project due to his prolonged loss of profit and bankruptcy from the project
The total price adjustment to date	
Causes of price escalations:	
	Unbalanced demand and supply of construction input
	Inflation/Increase in material costs (material cost fluctuation)
	fluctuations in money exchange rates
Major effects of the price escalation on the project	
	Project completion time delay
	Higher contract prices /Affect the project budget cost
	Customer relation
	Profit loss
	poor quality project work
	dissatisfaction by project owners
Obstacles to implementation of price adjustment	
	The price adjustment is Not effective for a time frame of less than 18 months.
	Lack of a recognized price database
	Special condition of contract on the adjustable portion and fraction for each specified element

Detail analysis

Overhead & Profit (Non-Adjustable Portion)				***35.00%***
Total Adjustable portion			*65.00%*	
Non-Adjustable Portion			*35.00%*	
	Contract Project amount		***1,434,323,142.49***	
Item no	***Basic Element***	***Unit***	***Total cost of material***	***Weighting Factor (%)***
1	***Cement***	*ETB*	*52,820,509.08*	*3.68%*
2	***Reinforcement Bar***	*ETB*	*560,105,273.46*	*39.05%*
3	***Ceramics (All Finishing Material)***	*ETB*	*207,072,219.11*	*14.44%*
4	***Diesel & Benzene***	*ETB*	*57,088,316.21*	*3.98%*
	Total Adjustable portion		*877,086,317.86*	***61.15%***
	Non-Adjustable Portion		*557,236,824.63*	***38.85%***

FEBRUARY 18,2022 Applied for PAYMENT-03					
Item no	***Basic Element***	***Weighting Factor (%)***	***Base Material Price***	***Current Material Price***	***M(Mn/Mo)***
1	***Cement***	*3.68%*	*208.83*	*450.00*	*0.079*
2	***Reinforcement Bar***	*39.05%*	*38.00*	*110.00*	*1.130*
3	***Ceramics (All Finishing Material)***	*14.44%*	*330.89*	*475.03*	*0.207*
4	***Diesel & Benzene***	*3.98%*	*18.75*	*28.94*	*0.061*
	Total Adjustable portion	*61.15%*			
	Non-Adjustable Portion	*38.85%*			*0.389*
		Pn=A+B+C= A+B(Mn/Mo) +C(Ln/Lo)			***1.867***

OCTOBER 09,2022 Applied for PAYMENT-04					
Item no	***Basic Element***	***Weighting Factor (%)***	***Base Material Price***	***Current Material Price***	***M(Mn/Mo)***
1	***Cement***	*3.68%*	*208.83*	*814.70*	*0.144*
2	***Reinforcement Bar***	*39.05%*	*38.00*	*85.00*	*0.873*
3	***Ceramics (All Finishing Material)***	*14.44%*	*330.89*	*575.03*	*0.251*
4	***Diesel & Benzene***	*3.98%*	*18.75*	*59.90*	*0.127*
	Total Adjustable portion	*61.15%*			
	Non-Adjustable Portion	*38.85%*			*0.389*
		Pn=A+B+C= A+B(Mn/Mo) +C(Ln/Lo)			***1.784***

MARCH 02,2023 Applied for PAYMENT-05					
Item no	***Basic Element***	***Weighting Factor (%)***	***Base Material Price***	***Current Material Price***	***M(Mn/Mo)***
1	***Cement***	*3.68%*	*208.83*	*900.00*	*0.159*
2	***Reinforcement Bar***	*39.05%*	*38.00*	*108.00*	*1.110*
3	***Ceramics (All Finishing Material)***	*14.44%*	*330.89*	*652.17*	*0.285*
4	***Diesel & Benzene***	*3.98%*	*18.75*	*67.30*	*0.143*
	Total Adjustable portion	*61.15%*			
	Non-Adjustable Portion	*38.85%*			*0.389*
		Pn=A+B+C= A+B(Mn/Mo) +C(Ln/Lo)			***2.084***

Item no	***Description***	***Payment Amount with VAT***	***Index (Pn)***	***Adjusted Amount***	***Total With Adjusted Amount***
		A	***B***	***C=(B-1) *A***	***D=C+A***
1	***IPC-03***	*28,760,321.26*	*1.867*	*24,933,661.19*	*53,693,982.454*
2	***IPC-04***	*76,211,964.56*	*1.784*	*59,727,438.91*	*135,939,403.467*
3	***IPC-05***	*30,917,592.45*	*2.084*	*33,529,045.65*	*64,446,638.096*

Summary of Material Price

No	*Material Description*	*Unit*	*Qty*	*Unit price*	*Subtotal Amount*
	Cement, OPC	*Qty*	*124,443.69*	*208.83*	*25,987,576.77*
	Cement, PPC	*Qty*	*18,289.42*	*208.83*	*3,819,379.08*
	Rebar, S-400	*kg*	*2,212,417.82*	*38.00*	*84,071,877.14*
	Rebar, S-500	*kg*	*836,354.40*	*38.00*	*31,781,467.20*
2.2	*Steel and metal*			*65% of contract price*	*11,350,526.62*
	Aluminum Works	*No*			*71,306,268.84*
	waterproofing material	*m2*			*12,229,842.27*
	Finishings	*m2*			*74,293,516.98*
	Plastic Paint	*m2*			*7,954,900.42*
2.3	***Electrical PVC pipe***				
	PVC conduit of 110mm diameter	*M*		*65% of contract price*	*27,955.98*
	25mm diameter from MDB-B to SDB-MF	*M*			*146,995.03*
	32mm diameter from MDB-A/B/MEC to SDBs	*M*			*648,737.96*
	50mm diameter from MDB-B to SDB-L2	*M*			*48,095.84*
	110mm diameter from MDB-MEC to SDB-5M	*M*			*122,307.41*
	FEEDER CABLES				
	3x6mm sq. from MDB-B to SDB-MF	*M*			*29,308.50*
	3x4mm sq. from intake point to SDB-GT	*M*			*0.00*

	5x2.5mm sq. from MDB-MEC to SDBs	*M*			*64,478.70*
	5x4mm sq. from MDB-A/B/MEC to SDBs	*M*			*430,199.71*
	5x6mm sq. from MDB-A/B/MEC to SDBs	*M*			*247,811.85*
	5x10mm sq. from MDB-A/B/MEC to SDBs	*M*			*2,595,745.62*
	5x16mm sq. from MDB-B to SDB-L2	*M*			*82,315.35*
	3x35/2x16mm sq. from MDB-B to SDB-L1	*M*			*124,847.32*
	3x95/2x50mm sq. from MDB-MEC to SDB-5M	*M*			*198,397.68*
	3x240/1x120mm sq. from MDB-MEC to SDB-TM	*M*			*2,092,195.43*
	3x300/1x150mm sq. from intake point to MDB-A	*M*			*670,052.11*
	3x240/1x120mm sq. from intake point to MDB-B	*M*			*937,880.71*
	3x300/1x150mm sq. from intake point to MDB-MEC	*M*			*1,531,547.68*
	Switch	*No*			*238,839.67*
	Socket Outlet and Power Outlet	*No*			*5,342,192.86*
2.4	*Water Closet*	*No*			*1,376,060.40*
	Hand Wash Basin	*No*			*937,846.00*
	Shower Tray	*No*			*19,628.96*
	Janitor sink	*No*			*19,383.31*
	Water Pipe				
	outer diameter 20mm Minimum wall thickness 2.8mm	*ml*			*19,599.45*
	outer diameter 25mm Minimum wall thickness 3.5mm	*ml*			*144,357.20*
	outer diameter 32mm Minimum wall thickness 4.4mm	*ml*			*9,041.76*
	outer diameter 40mm Minimum wall thickness 5.5mm	*ml*			*7,377.83*
	outer diameter 50mm Minimum wall thickness 6.9mm	*ml*			*8,252.40*
	outer diameter 65 mm Minimum wall thickness 8.6mm	*ml*			*40,405.37*
	outer diameter 75mm Minimum wall thickness 10.3mm	*ml*			*36,131.16*

	outer diameter 90 mm Minimum wall thickness 10.3mm	*ml*			*32,090.18*
	outer diameter 110 mm Minimum wall thickness 10.3mm	*ml*			*16,877.06*
	Electric Water Heater	*No*		*65% of contract price*	*39,653.38*
	UPVC Pipe (Waste and Storm)				
	a) Dia 50 mm	*ml*			*111,727.33*
	b) Dia 75 mm	*ml*			*20,289.54*
	c) Dia 110 mm	*ml*			*169,636.16*
	e) Dia. 160 mm	*ml*			*43,409.87*
	f) Dia 200 mm	*ml*			*5,310.16*
	g) Dia. 250 mm	*ml*			*14,509.42*
	Galvanized Steel Pipes				
	GSP diameter 65mm	*ml*			*100,440.08*
	GSP diameter 125mm	*ml*			*205,861.50*
	GSP diameter 150mm	*ml*			*151,651.31*
	GSP diameter 150mm for Dry riser	*ml*			*218,060.70*
	GSP diameter 150mm for FDC	*ml*			*174,481.45*
2.5	*Styrofoam*			*65% of contract price*	*124,365.25*
	Hollow Tube				*13,311,566.83*
	epoxy material				*7,627,724.99*
	Carpet				*5,262,590.13*
	Ceiling, Partition and Signage				*52,124,022.72*
2.6	*Distribution Boards*			*65% of contract price*	*1,866,502.42*
	Light points				*3,774,179.50*
	Light Fittings/Fixtures with Lamps				*11,347,967.76*
	Lightning Prevention System				*153,870.99*

	Generator				*9,440,988.88*
	UTILITY CONNECTION				*6,500,000.00*
	COMMUNICATION				*11,395,916.00*
	ELECTRONIC SAFETY AND SECURITY				*27,737,005.22*
	PASSENGER LIFT				*25,218,752.62*
2.7	*Water Tank*				*1,721,223.34*
	Pump and others			*65% of contract price*	*2,212,976.04*
	Floor Drain and roof drain				*36,773.67*
2.8	*Air Handling & Air-cooled chiller & fan coil*				*44,221,733.74*
	Air Grills & Air Linear Diffuser			*65% of contract price*	*7,595,508.05*
	Air duct				*20,778,208.10*
	Dampers and accessories				*2,686,675.55*
3.0	*Fuel for Materials Transportation and Construction*	*L*	*2,961,021.49*	*18.75*	*55,519,152.93*
					652,955,047.40

Representatives Groupings

Material Description	Material Total Price	Weightage %	Represented by
Rebar, S-400	84,071,877.14	5.8614%	
Rebar, S-500	31,781,467.20	2.2158%	
Steel and metal	11,350,526.62	0.7914%	
Aluminum Works	71,306,268.84	4.9714%	
Hollow Tube	13,311,566.83	0.9281%	
Air duct	20,778,208.10	1.4486%	
Ceiling, Partition and Signage	52,124,022.72	3.6341%	**284,723,937.44**
			20%
Material Description	**Material Total Price**	**Weightage %**	**Represented by**
Cement, OPC	25,987,576.77	1.8118%	**Cement**
Cement, PPC	3,819,379.08	0.2663%	
Finishings	74,293,516.98	5.1797%	
Plastic Paint	7,954,900.42	0.5546%	
PVC conduit of 110mm diameter	27,955.98	0.0019%	
110mm diameter from MDB-MEC to SDB-5M	122,307.41	0.0085%	
25mm diameter from MDB-B to SDB-MF	146,995.03	0.0102%	
32mm diameter from MDB-A/B/MEC to SDBs	648,737.96	0.0452%	
50mm diameter from MDB-B to SDB-L2	48,095.84	0.0034%	
3x6mm sq. from MDB-B to SDB-MF	29,308.50	0.0020%	
5x2.5mm sq. from MDB-MEC to SDBs	64,478.70	0.0045%	
5x4mm sq. from MDB-A/B/MEC to SDBs	430,199.71	0.0300%	
5x6mm sq. from MDB-A/B/MEC to SDBs	247,811.85	0.0173%	
5x10mm sq. from MDB-A/B/MEC to SDBs	2,595,745.62	0.1810%	
5x16mm sq. from MDB-B to SDB-L2	82,315.35	0.0057%	
3x35/2x16mm sq. from MDB-B to SDB-L1	124,847.32	0.0087%	
3x95/2x50mm sq. from MDB-MEC to SDB-5M	198,397.68	0.0138%	
3x240/1x120mm sq. from MDB-MEC to SDB-TM	2,092,195.43	0.1459%	

3x300/1x150mm sq. from intake point to MDB-A	670,052.11	0.0467%	
3x240/1x120mm sq. from intake point to MDB-B	937,880.71	0.0654%	
3x300/1x150mm sq. from intake point to MDB-MEC	1,531,547.68	0.1068%	
Styrofoam	124,365.25	0.0087%	
epoxy material	7,627,724.99	0.5318%	
Carpet	5,262,590.13	0.3669%	
			135,068,926.49
			9.42%
Material Description	**Material Total Price**	**Weightage %**	**Represented by**
waterproofing material	12,229,842.27	0.8527%	**Ceramic**
Switch	238,839.67	0.0167%	
Socket Outlet and Power Outlet	5,342,192.86	0.3725%	
Water Closet	1,376,060.40	0.0959%	
Hand Wash Basin	937,846.00	0.0654%	
Shower Tray	19,628.96	0.0014%	
Janitor sink	19,383.31	0.0014%	
Distribution Boards	1,866,502.42	0.1301%	
Light points	3,774,179.50	0.2631%	
Light Fittings/Fixtures with Lamps	11,347,967.76	0.7912%	
Lightning Prevention System	153,870.99	0.0107%	
Generator	9,440,988.88	0.6582%	
UTILITY CONNECTION	6,500,000.00	0.4532%	
COMMUNICATION	11,395,916.00	0.7945%	
ELECTRONIC SAFETY AND SECURITY	27,737,005.22	1.9338%	
PASSENGER LIFT	25,218,752.62	1.7582%	
Water Tank	1,721,223.34	0.1200%	
Pump and others	2,212,976.04	0.1543%	
Floor Drain and roof drain	36,773.67	0.0026%	
Air Handling & Air-cooled chiller & fan coil	44,221,733.74	3.0831%	
Air Grills & Air Linear Diffuser	7,595,508.05	0.5296%	
Dampers and accessories	2,686,675.55	0.1873%	
			176,073,867.26
			12.28%

Material Description	Material Total Price	Weightage %	Represented by
outer diameter 20mm Minimum wall thickness 2.8mm	19,599.45	0.0014%	
outer diameter 25mm Minimum wall thickness 3.5mm	144,357.20	0.0101%	
outer diameter 32mm Minimum wall thickness 4.4mm	9,041.76	0.0006%	
outer diameter 40mm Minimum wall thickness 5.5mm	7,377.83	0.0005%	
outer diameter 50mm Minimum wall thickness 6.9mm	8,252.40	0.0006%	
outer diameter 65 mm Minimum wall thickness 8.6mm	40,405.37	0.0028%	
outer diameter 75mm Minimum wall thickness 10.3mm	36,131.16	0.0025%	
outer diameter 90 mm Minimum wall thickness 10.3mm	32,090.18	0.0022%	
outer diameter 110 mm Minimum wall thickness 10.3mm	16,877.06	0.0012%	
Electric Water Heater	39,653.38	0.0028%	
UPVC Pipe (Waste and Storm)			
a) Dia 50 mm	111,727.33	0.0078%	
b) Dia 75 mm	20,289.54	0.0014%	
c) Dia 110 mm	169,636.16	0.0118%	
e) Dia. 160 mm	43,409.87	0.0030%	
f) Dia 200 mm	5,310.16	0.0004%	
g) Dia. 250 mm	14,509.42	0.0010%	
Galvanized Steel Pipes			
GSP diameter 65mm	100,440.08	0.0070%	
GSP diameter 125mm	205,861.50	0.0144%	
GSP diameter 150mm	151,651.31	0.0106%	
GSP diameter 150mm for Dry riser	218,060.70	0.0152%	
GSP diameter 150mm for FDC	174,481.45	0.0122%	
Fuel for Materials Transportation and Construction	55,519,152.93	3.8708%	
			57,088,316.21
			3.98%