Addis Ababa University

College of Technology and Built Environment

School of Civil & Environmental Engineering

(Construction Technology & Management Stream)

Study of Price Adjustment Practices in Medium Building Projects of Ethiopia Over the Last Ten Years

BY

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STATEMENT OF CERTIFICATION

This is to certify that Abenezer Abera has carried out this project work on the topic entitled a study of price adjustment practices in medium building projects of Ethiopia over the last ten years under my supervision. This work is original in nature and it is sufficient for submission for partial fulfillment of the Requirements for the Degree of Master of science in civil Engineering (Construction Technology and Management).

Abebe Dinku, Prof. (Dr.-Ing)

Signature_____

Date_____

DECLARATION

I, who have signed below, would like to state that the research project is unique and not previously been submitted for a Degree at any other university. Every source of information used in the thesis has been properly recognized.

Name: Abenezer Abera

Signature: _____

Place: Addis Ababa Institute of Technology

Date: _____

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Finally, I would like to acknowledge all the institutions and organizations that supported my research. Your assistance has been invaluable in shaping the outcome of this work.

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ABSTRACT

Price adjustment clauses in construction contracts serve to account for fluctuations in material and labor costs, helping to maintain fairness and financial stability for all parties. These clauses typically adjust contract prices based on economic indicators such as inflation, exchange rates, or key commodity prices. Their use reflects the inherently volatile nature of construction projects, where unexpected economic shifts can cause significant cost deviations. Incorporating such mechanisms allows stakeholders to manage risks and uphold contract balance amid changing market conditions.

This study focuses on medium-sized building construction projects in Ethiopia, aiming to evaluate the causes and impacts of price escalation, and to assess current price adjustment practices. The research highlights the importance of managing price fluctuations effectively to support sustainable construction and economic development. Data were collected using a combination of desk studies, self-administered questionnaires (both open- and closed-ended), unstructured interviews, and archival records.

Cronbach's alpha, Spearman's correlation coefficient and the Relative Importance Index (RII) were employed to analyze survey data and rank contributing factors. Results show that internal issues such as inaccurate cost estimation, poor planning, and unclear contract clauses significantly contribute to price escalation. External factors include volatile material prices and exchange rate instability, particularly affecting items like cement, fuel, and ceramics. These fluctuations result in project delays, cost overruns, cash flow problems, and contractual disputes.

Findings indicate that while the Public Procurement Agency (PPA) contract form is generally effective in addressing price adjustments, concerns remain regarding contractors' understanding of the mechanism and the accuracy of applied indices. Recommendations include enhancing contractor awareness, refining tender estimates, improving price databases, and encouraging regulatory oversight. These measures aim to reduce the negative effects of price escalation and strengthen the resilience of Ethiopia's construction industry.

Key words: price escalation, price fluctuation, price adjustment, construction price index, medium building projects.

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LIST OF ABBREVATIONS

BaTCoDA	Building and Transport Construction and Design Authority
CPA	Contract Price Adjustment
PA	Price Adjustment
CPI	Consumer Price Indices
FIDIC	Federation International des Ingenious-Conseils
GCC	General Conditions of Contract
GDP	Gross Domestic Product
GOE	Government of Ethiopia
ICB	International Competitive Bidding
MoI	Ministry of Infrastructure
MoUDH	Ministry of Urban Development and Housing
MoWUD	Ministry of Works and Urban Development
NCB	National Competitive Bidding
OECD	Organization for Economic Cooperation and Development
PAC	Price Adjustment Clause
PPA	Public Procurement Agency
PPI	Producer Price Indices
PPPAA	Public Procurement and Property Administration Agency
SCC	Special Conditions of Contract
SDB	Standard Bidding Document
SNA	System of National Accounts
UNIDO	United Nations Industrial Development Organization
SBD	Standard Bidding Document
CSA	Central Statistical Agency
BOQ	Bill of Quantity
MDB	Multilateral Development Bank
NBE	National Bank of Ethiopia
SNNPRS:	Southern Nations Nationalities and Peoples Regional State
NA:	Non- Available

Mos: Material on Site

CHAPTER ONE

1. INTRODUCTION

Price adjustment considers the fluctuation of cost of materials, labor and equipment due to currency fluctuation, inflation, shortage of materials due to some other on-going project, or any other circumstances that varies the cost. In principle, it can result in increase or decrease of actual cost, depending on the fluctuation of current indices comparing to base indices.

It is apparent that almost all construction works in Ethiopia are based on the unit price of items and the quantity of actual works executed. The provision of price adjustment for contractors due to market price fluctuations is not well addressed in the construction sector so far in Ethiopia especially for National Competitive Bidding (NCB). For asphalt road projects which are mostly done by International Competitive Bidding (ICB) have been treated by the FIDIC (Federation International des Ingenious-Conseils) and MDB (Multilateral Development Bank) condition of contract. These documents have price adjustment clauses that contain price adjustment formula and adjustment factor.

The adjustment factors addresses all round coverage of price variation. By looking into the price adjustment provisions for NCB and ICB contracts, it can be observed that the contractors under ICB contracts are compensated with reasonable costs to cover their actual additional costs incurred due to variation of market prices. On the other hand, the local contractors with NCB contracts have been exposed to loses due to no or small price adjustment provision. The increases of costs of labor, cement, fuel, reinforcement bar, bitumen, etc have resulted in major changes in the cost of construction both in the above adjustable items and the balance costs. Since this adjustment has not been paid to local contractors in most cases, it resulted in stoppage, suspension, and even termination of contract of contracts. This left the local contractors not to build their capacity for long period of time. Besides, some contractors have been dropped out from the market and some are on the verge of it due to unbearable great loses due to the additional costs incurred since the market prices are fluctuating from time to time. Thus, to save the contractors from such disaster, it is vital to develop a reasonable and realistic Index Factor to compensate their actual cost expenditure in executing projects and discharging their contractual responsibilities.

The main idea behind contract price adjustment is to compensate the contractor or the employer in case of rise and fall of labor and/or materials. It is, therefore, essential to make a proactive knowledgeable effort in identifying the risk associated to a contract, estimating the probable magnitude of the impact and the management of the same. Here, it should, however, be noted that it is not possible to foresee and identify all sorts of undesirable events right at the beginning. There may still be many more, which may surface out in duo course time. It is because of this fact that some define contract not simply as an exchange of legally bund promises of doing or not doing this and that, but it is also inherently, the allocation of risk to the contracting parties as well. The principle to be applied in the allocation of these risks is to identify the party that can be able to successfully handle them so that the objective of the

contract can be achieved as desired. If the contract is formulated with this in mind, then the agreement may be more or less be classified as fair.

The construction industry operates in a dynamic environment characterized by fluctuating prices influenced by factors such as market demand, raw material costs, and economic conditions. Ethiopia's construction sector has experienced a remarkable surge in activity over the last half-decade, driven by infrastructure development, urbanization, and growing demand for residential and commercial spaces (World Bank, 2021). In recent years, the local construction industry has witnessed significant fluctuations in prices. The industry's dynamics are often subjected to fluctuations in the pricing mechanisms influenced by various market forces and economic conditions (Addis Ababa Chamber of Commerce and Sectoral Associations, 2021). However, the industry has encountered significant challenges due to erratic price fluctuations in materials, labor, and other essential inputs (Tadesse et al., 2020). This volatility has triggered concerns about the efficacy of price adjustment mechanisms employed by construction firms, impacting their competitiveness and project feasibility (Dessalegn & Garoma, 2018).

Currently, the Ethiopian government is making significant efforts to support the construction industry and ensure that contractors can recover their actual expenses. They have issued directives regarding the implementation of price adjustments, indicating that most public contracts are subject to these adjustments as per the instructions from the Federal Democratic Republic of Ethiopia's Ministry of Finance in letters Ref. No. F/I/1/53/32 dated 25/6/2013 E.C. (4th March 2021 G.C.) and Ref. No. 7/2/1/53/49 dated 05/11/2013 E.C. (12th July 2021 G.C.). These letters reference an analysis by the Ministry of Construction and Urban Development regarding inflation in construction costs, stating that if previous procurement contracts did not include price adjustment provisions, amendments can be made under Article 29/4 of the implementation directive. This allows for price adjustments for cement, rebar, and finishing materials for remaining work using the price adjustment formula. Notably, the formula employed is based on the PPA 2006 Manual rather than the PPA 2011 formula, due to challenges and disputes that arose with the latter. This approach is in line with guidance from the Public Procurement and Property Authority, as outlined in their letter dated 13/08/2014, Ref. No. ሙግን/ሙ-1/1/342. The applicable base indices are derived from a letter from the FDRE Ministry of Urban and Infrastructure (Ref. No. 85/00200/195 on 15/09/2014), with current indices obtained from the same Ministry at the time of invoice submission. The government has also directed relevant parties to ensure price adjustments are applied during the bidding process.

Price adjustment mechanisms in construction contracts are vital for ensuring that the contract remains fair and equitable for both parties involved, particularly given the dynamic nature of construction projects where costs can fluctuate due to various factors. Price adjustment clauses are designed to address changes in costs such as inflation, fluctuations in material prices, changes in labor rates, or unforeseen circumstances that impact project costs. These clauses aim to maintain the financial balance of the contract by allowing adjustments to the contract price under specified conditions.

Among these price fluctuations, the responsiveness of price adjustment practices within the Ethiopian construction industry has become a critical area necessitating scholarly attention. The ramifications of such price volatility reverberate throughout the construction sector, impacting project timelines, cost estimations, profitability, and overall industry sustainability. Construction firms, suppliers, and other stakeholders face the intricate task of devising and implementing effective strategies to adjust prices in response to these fluctuations while ensuring project continuity and financial viability (Assefa & Rukazambuga, 2018). Failure to adapt adequately to these price changes could lead to project delays, cost overruns, or compromised quality, jeopardizing the industry's growth trajectory and socio-economic development.

Understanding the responsiveness of price adjustment practices to dynamic fluctuations is crucial for several reasons. Firstly, it directly influences the cost structure of construction projects, potentially affecting project completion timelines and overall economic viability (Yimer & Abdella, 2019). Secondly, the construction industry's interconnectedness with other sectors underscores the ripple effects of price fluctuations, impacting the broader economy and development goals (Abebe et al., 2021). Therefore, investigating the strategies and mechanisms adopted by construction firms to navigate these price variations becomes imperative.

Price adjustment strategies adopted by construction firms play a pivotal role in navigating the challenges posed by dynamic price changes (Zeleke, 2019). Understanding how these practices have evolved and adapted to the recent price fluctuations can offer profound insights into the resilience and adaptability of the industry. Price adjustment practices are critical for businesses to maintain competitiveness and financial stability in the face of dynamic market conditions. As observed by Smith et al. (2019), "the ability of firms to adapt their pricing strategies in response to changing market dynamics is crucial for sustaining profitability and market share." In the context of the construction industry, where projects often span several months or years, the impact of dynamic price fluctuations on pricing strategies becomes particularly noteworthy.

Empirical studies focusing on the responsiveness of pricing mechanisms to dynamic fluctuations have been limited within the Ethiopian context. Therefore, this research aims to bridge this gap by comprehensively examining and analyzing the responsiveness of price adjustment practices employed by construction firms operating in Ethiopia over the past ten years. Understanding the underlying factors that influence these pricing decisions is essential for industry stakeholders and policymakers to enhance the overall resilience and efficiency of the construction sector.

To achieve this, the research employed a desk study approach to ensure a comprehensive understanding of the complex factors influencing price adjustments in the sector.

1.1. Statement of the problem

The Ethiopian construction industry has experienced significant dynamism in price fluctuations over the last ten years. Fluctuations in the cost of construction materials, labor,

and other essential inputs have created a complex economic environment for industry stakeholders. Despite the evident volatility, there is a lack of comprehensive research examining how price adjustment practices within the Ethiopian construction sector respond to these dynamic fluctuations. This knowledge gap hinders the industry's ability to develop effective strategies for managing costs and maintaining sustainable operations. Therefore, the central problem addressed by this research is the absence of a thorough understanding of how price adjustment practices within the Ethiopian construction industry align with and respond to the diverse and dynamic price changes encountered over the past ten years. This research aims to investigate the intricacies of this relationship, shedding light on the factors influencing price adjustments and providing insights that can inform more adaptive and resilient pricing strategies within the industry.

1.2. Significant of the research

The Ethiopian construction industry has experienced significant growth and transformation over the past few years, driven by economic development, urbanization, and infrastructural projects. Amidst this growth, the industry has encountered dynamic price fluctuations that pose challenges to market players, particularly in the context of price adjustment practices. This research holds paramount significance for several reasons.

Firstly, the construction sector plays a pivotal role in the economic development of Ethiopia, contributing substantially to GDP and providing employment opportunities. Understanding how construction firms respond to dynamic price fluctuations is essential for maintaining the stability and sustainability of this vital industry.

Secondly, price adjustments are crucial for the financial viability of construction projects. Fluctuating prices of construction materials and services can significantly impact project costs, profitability, and overall project success. Investigating the responsiveness of price adjustment practices is imperative for ensuring the financial health of construction enterprises and the successful execution of projects.

Furthermore, the study addresses a critical knowledge gap in the existing literature. While price fluctuations are acknowledged as a challenge in the construction industry, a comprehensive understanding of how firms adjust their pricing strategies in response to these fluctuations is lacking. This research contributes valuable insights that can inform industry practices, regulatory frameworks, and strategic decision-making.

The findings of this study are anticipated to benefit various stakeholders, including construction firms, policymakers, investors, and consumers. Construction companies can gain insights into effective pricing strategies that enhance their adaptability to dynamic market conditions. Policymakers can use the findings to refine regulations and policies that foster a more resilient and competitive construction industry. Investors and consumers will benefit from a more transparent and stable construction market, ultimately promoting economic growth and development in Ethiopia.

In conclusion, investigating the responsiveness of price adjustment practices in the Ethiopian construction industry is not only academically relevant but also holds practical implications

for the sustainable development of the sector. This research endeavors to contribute actionable insights that can enhance the industry's resilience, competitiveness, and overall contribution to the socio-economic landscape of Ethiopia.

1.3. Objective

1.3.1. General objective

The general objective of this research is to examine the degree of responsiveness of price adjustment practices with fluctuation of price over the last ten years in local medium building construction industry.

1.3.2. Specific objective

1. To identify the degree of impact of the price fluctuation in the construction industry over the last ten years.
2. To identify the degree of responsiveness of price adjustment practices in the construction industry of Ethiopia over the past ten years.
3. Identify and formulate measures to optimize price adjustment practices in the Ethiopian construction industry, aiming to foster stability and resilience amid fluctuating inflation rates

Through achieving these specific objectives, this research aspires to provide actionable insights that can inform policy-makers, guide industry practices, and contribute to the development of effective strategies for managing price adjustments in the Ethiopian construction sector.

1.4. Research questions

- How have price in the Ethiopian construction industries has fluctuated over the past ten years?
- How do construction firms in Ethiopia adjust their price in response to price fluctuations in the market over the last ten years?
- What strategies have been most effective for construction firms in Ethiopia to navigate and respond to the fluctuations in prices over the past ten years?

1.5. Scope of the research

The scope of this research is to comprehensively examine the responsiveness of price adjustment practices within the context of the Ethiopian construction industry, specifically focusing on the dynamic price fluctuations that have occurred over the past ten years. The study aims to provide a nuanced understanding of how construction firms in Ethiopia adapt their pricing strategies in response to the volatile economic conditions and changing market dynamics.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Overview of basis for understanding inflation

2.1.1. Inflation definition

According to Dinkayehu (2019), inflation is described as a sharp and sudden rise in the quantity of money or credit, or both, compared to the availability of goods for purchase. Similarly, Yigezu (2008) notes that inflation not only leads to a total rise in price levels but also diminishes the value of financial unit over time, with these effects being proportional to the inflation rate. In the construction sector, a number of scholars have provided definitions of project price escalation: Williams et al. (1999) define it as an increase in the original contract's construction elements' cost brought on by time; Lock (2003) likens it to cost increases in project components over two distinct time periods, while Jaeger (1996) views it as the allowance in cost estimates for increases brought on by ongoing price fluctuations. Stewart (1982) focuses on the rise in real or projected direct labor and material expenses, which are frequently addressed by policies and compensation plans that take inflation into account.

Inflation is generally understood as a measure of the overall increase in price levels within an economy, typically represented by comprehensive price indices like the Consumer Price Index (CPI) (Dinkayehu, 2019). The Consumer Price Index CPI is the most widely used measure, offering crucial insights for economic decision making in various sectors. On the other hand, the Producer Price Index (PPI), which tracks inflation at the wholesale level, is considered more relevant for the heavy construction industry (Akintola et al., 1998). According to Dinkayehu (2019), while inflation and escalation are connected, they are distinct concepts and cannot be used interchangeably. Dinkayehu (2019) explains that while overall inflation affects escalation, escalation can also be driven by factors specific to certain goods or services, such as technological changes and supply-demand imbalances. He stated that differential price escalation occurs when the price increase in some materials significantly outpaces others, leading to flawed outcomes when persistent cash flows are used.

Manaye (2019) citing Amaha (2012) in defining inflation as the rate of increase in general price levels within an economy, typically measured as an annual percentage increase. Bedada et al. (2020) characterizes inflation as a persistent rise in general price levels, which diminishes purchasing power. He identifies two primary causes of inflation: one is an increase in the money supply and the second is a decrease in the quantity of goods supplied. Bedada et al. (2020) also notes that the definition of inflation has evolved, with neo-classical economists attributing it to a rapid rise in prices due to excessive money supply, while Keynesians believe true inflation occurs when the money supply increases beyond full employment levels.

Inflation can be classified based on its rate as walking (moderate), running, and jumping (hyperinflation) (Bedada et al., 2020). Moderate inflation, with rates less than ten percent

annually, is slow and tolerable. Running inflation, indicated by double-digit annual rates, signals the onset of hyperinflation, characterized by rapid and uncontrollable price increases, as seen in historical instances like post-World War I Germany and post-World War II China (Mithani, 2001).

Hardilo (2020) defines inflation as a persistent rise in prices not offset by productivity gains. Adamu (2013) and Fichtner (2011) describe it as an upsurge in general price levels. Mishra and Aital (2020) highlight that price fluctuations result from various forces, both national and international, affecting the construction sector through cost changes and economic conditions. Ali et al. (2021) describe inflation as an increase in the price level of goods or services.

Chanie (2023) and other scholars provide definitions of project price escalation within the construction industry, generally emphasizing increases in costs over time due to various factors. The construction industry, encompassing building, civil, and heavy engineering works, significantly impacts socio-economic development (Mohammed, 2013). Chanie (2023) identifies three primary types of inflation impacting construction: demand-pull, cost-push and structural inflation. Demand – pull inflation occurs when demand for goods and services increases, cost-push inflation is driven by rising production costs, and structural inflation arises from supply and demand imbalances within particular sectors (International Monetary Fund, 2020).

The escalation of prices for building materials, such as reinforcement bars, cement, and corrugated iron sheets, is driven by factors like energy costs, raw materials, transportation, import duties, demand-supply dynamics, exchange rates, and market conditions (Hardilo, 2020; Abreham, 2020). Bedada et al., (2020) also highlights demand-pull and cost-push as the primary causes of inflation, where the former is linked to increased money supply and the latter to rising production costs.

Price escalation in the construction sector is defined as increases in costs over time, affecting materials like steel (Dinkayehu, 2019). Jha and Mata (2022) describe it as changes in the cost or value of goods and services, emphasizing the need for risk assessment in construction projects due to its significant impact on costs. Ali et al. (2021) notes that neglecting inflation in project economics and budgeting often leads to cost overruns.

In the Ethiopian construction sector, inflation and price escalation present major challenges, significantly impacting project costs and timelines (Belay and Jain, 2023; Chane, 2023). Studies by Mekonen et al. (2023) and Yigezu (2008) indicate severe price fluctuations in construction inputs, leading to substantial escalations in material costs, particularly steel. Geberemeskel (2020) and Sisay et al. (2022) underscore the pronounced impact of general inflation on the construction industry, with inflation acting like a "cancer" on the economy, depleting citizen welfare and distorting economic policies (Goshu et al., 2022).

2.1.2. Inflationary pressure on construction

Ali et al. (2021) highlighted inflation as a growing problem negatively impacting the construction industry. Melkanti (2023) emphasized the inherent long durations and high costs of construction projects, noting that extended project durations can lead to cost escalations,

with initial estimates often insufficient to cover actual costs. Chane (2023) found that over the past four years, inflation and currency depreciation in Addis Ababa's building construction industry have decreased consumer expenditure, let down property prices, and increased import expenses for construction supplies. This has resulted in higher costs for materials and labor, making it challenging for contractors to complete projects successfully on time and within budget, leading to delays, decreased profits, and reduced demand for construction services.

Kassahun (2019) noted that inflation has remained a longstanding challenge in Ethiopia, significantly driving up the costs of goods and services, including construction materials. According to the World Bank (2020), inflation can deter foreign investors due to increased costs and uncertainty. Understanding inflation's impact on Ethiopia's construction sector can help policymakers promote foreign investment, which could spur economic growth (Chane, 2023).

Mehari et al. (2019) noted that inflation can make it tougher for individuals to have the funds for new homes and cause delays or cost overruns for construction companies. Gebreeyesus et al. (2020) explained that inflation impedes construction companies' ability to obtain financing for new projects, resulting in fewer new projects and potential career losses. Inflation diminishes the purchasing power of money, as reflected by the Consumer Price Index (CPI) (World Bank, 2020).

Chane (2023) argued that inflation impacts the construction sector both positively and negatively. On one hand, it increases construction costs and reduces investment profitability (Blinder, 2013; IMF, 2021). On the other hand, it can arouse demand for construction as people invest in real assets to protect their wealth. Zhou et al. (2020) found that inflation directly impacts construction project outcomes, leading to delays and cost overruns. High inflation also leads to higher interest rates, making it more difficult for firms to obtain credit (IMF, 2019).

Admasu (2023) pointed out that cost escalation leads to higher project costs, delays, profit losses, and project abandonment. Belay and Jain (2023) identified major consequences of price inflation in Adama city building projects, including delayed progress, cash flow issues, higher costs, and increased disputes. Goshu et al. (2022) discussed inflation's differentiated effects across various Ethiopian regions and income groups, noting significant welfare losses among lower-income households.

Ali et.al (2021) contended that inflation results in yearly fluctuations in building material prices, labor wages, and machinery rental rates, causing deviations from the original project budget. Mulat (2020) stated that persistent inflation introduces economic uncertainties, discouraging investment and slowing economic growth, with disproportionate impacts on the poor. Serani and Wodaje (2020) identified key causes of construction delays, including economic conditions, price fluctuations, and financing issues.

Geberemeskel (2020) highlighted inflation as a major constraint for policymakers, affecting economic progress and the welfare of wage earners and pensioners. He linked inflationary

pressures to government deficit financing. Niken et al. (2023) argued that cumulative price escalation significantly impacts long-term contracts, affecting cash flow and project quality. Chane (2023) noted that cautious lending due to inflation has reduced new construction projects, particularly affecting small and medium-sized firms.

Reports by the Ethiopian Ministry of Urban Development and Construction (2018) and the Central Statistical Agency currently named Central Statistical Services (2019) indicated significant increases in construction material costs due to inflation, making housing less affordable, particularly for low-income families. The devaluation of the Ethiopian Birr has exacerbated these issues by increasing the cost of imported materials (National Bank of Ethiopia, 2018).

Inflation also affects property values and the ability of construction firms to secure financing. The Ethiopian Real Estate Development Association (2019) reported property values have been decreased due to inflation. Rising construction costs have led to project delays and cost overruns, impacting housing affordability and new project initiation. Reports by the IFC and UNCTAD (2020) noted that inflation reduces appeal of a country for foreign financiers, limiting financing for construction projects.

The construction industry, encompassing building, civil, and heavy engineering works, significantly impacts socio-economic development (Mohammed, 2013). Chanie (2023) discussed the main types of inflation affecting construction are demand-pull, cost-push, and structural inflation. Demand-pull inflation occurs when there is rise in demand for goods and services; cost-push inflation happens due to increasing production costs; and structural inflation is caused by imbalances in supply and demand within particular sectors (International Monetary Fund, 2020).

The escalation of prices for building materials, such as cement, reinforcement bars and corrugated iron sheets is driven by factors like energy costs, raw materials, transportation, import duties, demand-supply dynamics, exchange rates and market conditions (Hardilo, 2020; Abreham, 2020). Bedada et al. (2020) also highlights demand-pull and cost-push as the primary causes of inflation, where the former is linked to increased money supply and the latter to rising production costs.

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the construction industry, with inflation acting like a "cancer" on the economy, depleting citizen welfare and distorting economic policies (Goshu et al., 2022).

The FDRE, Ministry of Finance (2021) also mentioned the study of Ministry of Construction and Urban Development which announce there is a significant increase in major materials such as cement, reinforcement bar and finishing materials and this highly affects the construction industry in Ethiopia.

Overall, inflation has profound and multifaceted effects on the construction industry in Ethiopia, leading to increased costs, financing difficulties, project delays, and reduced investment, with significant implications for economic growth and development.

2.1.3. Ethiopian economy

The construction sector plays a significant role in many economies, contributing to millions of jobs and a substantial portion of GDP (Chanie, 2023). As per FDRE, Ministry of Planning and Development the Ethiopian construction contributes to 1.5% GDP growth next to agriculture, hunting and forestry. According to Niken et al. (2023), maintaining price stability can support sustained growth and lower unemployment rates. Remarkably, as Chanie (2023) argued Ethiopia has experienced stable economic growth despite persistent and sometimes hyperactive inflation and rising unemployment over the past decade. For instance, as the data gathered from FDRE, Ministry of Planning and Development between 2006 and 2007, Ethiopia's economy grew at an average rate of 10%, ranking it among the fastest-growing economies in Africa. However, during this period, inflation and unemployment also increased significantly, averaging 15% and 17%, respectively. In the last ten years, the economy's real output growth rate decreased to an average of 7.2%, with inflation and unemployment rates rising to 20.4% and 26.7%, respectively.

Chanie (2023) highlights Ethiopia's significant economic growth over the past decade, characterized by double-digit growth and notable expansion in the construction sector. He notes that the construction industry has played a key role in developing critical infrastructure, including roads, real estate, dams, railways and condominium housing. According to the Ministry of Urban Development and Construction, the sector's contribution to GDP rose to 5.8% in 2010 (Gebremariam et al., 2017). This sector is vital for economic development and job creation (Ethiopian Ministry of Urban Development and Construction, 2017). However, prolonged economic contraction has led to a reduced disposable income and a 36.5% decline in GDP per capita between 2019 and 2021 (Teshome et al., 2023).

Admasu (2023) highlights that the construction industry is the largest recipient of the government's development budget, accounting for nearly 60% of it annually (MoWUD, 2013). This sector plays a crucial role in Ethiopia's economy, providing significant employment, particularly in major cities with active construction activities. Building projects are divided into private and public categories based on ownership (Admasu 2023). Private projects are funded by individuals or organizations, while public projects are financed by government bodies (Dinkayehu, 2019). According to the Federal Democratic Republic of

Ethiopia Ministry of Urban Development and Construction (2021), a medium sized building is defined as one that is at least five stories high but no more than fifteen stories.

The importance of the construction industry in driving economic growth and national development is widely acknowledged, especially in developing countries (Tembo et al., 2023; Isa et al., 2013; Lopes et al., 2011; Berk & Biçen, 2018; Oladinrin et al., 2012; Khan, 2008). Tempo et.al., (2023) argues the focus in modern times includes improving construction firm performance, contractor development, technology advancement, and environmental performance.

Sisay et al. (2020) recount that the 1974 revolution led to the Derg regime, characterized by socialist policies that hindered market forces and resulted in irregular economic growth due to agricultural dependence and conflict. They stated the Derg era saw low inflation due to government price controls and fixed exchange rates and post-Derg, the shift to market-based policies led to economic fluctuations, with inflation averaging 18.69% from 2006 to 2015. Price stability remains a challenge, with inflation rising to 34.7% in March 2022, despite government efforts to control it (CSA, 2022).

Tewodros M. Geberewolde et al. (2022) discuss the impact of exchange rate shocks on Ethiopian and Ugandan firms. He argued that Ethiopia's Birr experienced significant devaluation and real depreciation, affecting importers and productivity due to currency shocks, unlike Uganda, which managed these shocks better due to its flexible exchange rate regime.

Gadisa (2021) compares inflation rates between developed and developing countries, noting Ethiopia's high inflation despite economic growth. Post-2002, Ethiopia transitioned to a market system, leading to rapid economic growth but also higher inflation due to less conservative fiscal and monetary policies (Geda & Tafere, 2020).

According to Geda (2020), Ethiopia's remarkable economic expansion since the early 2000s can be ascribed to the country's adoption of a developmental state strategy and rejection of neoliberal approaches. However, macroeconomic instability, especially high inflation, has coincided with this expansion, disproportionately impacting the poor, according to Geda (2020). With the broad money supply expanding 15 times between 2007 and 2019, the government's increased spending, especially on capital projects, has contributed to inflationary pressures. Financing these projects with domestic money creation has also had a substantial impact on inflation dynamics (Geda, 2020).

In summary, despite major obstacles like unemployment and inflation, Ethiopia's economy has seen impressive growth, especially in the construction industry. Although economic policies and outside factors continue to affect inflation and overall economic stability, the growth of the construction industry has been a major contributor to this expansion. According to Geberemesekel (2020), Ethiopia's economy has grown significantly over the past 20 years, however initially there was creeping inflation until the middle of the 2000s. Although fiscal and monetary measures were implemented under the Growth and Transformation Plans (GTP I from 1995/96-2010/11 and GTP II from 2010/11-2014/15) to sustain single-digit inflation,

starting in 2005, this growth was hampered by growing inflation. Real interest rates went negative as a result of the ongoing inflation. According to official records, inflation rates were 2.5% until 2004, at which point they jumped to 15.1%. The actual economic growth rate was 10.9%, which was just below than the 11.1% target set under GTP II.

The greatest regional Consumer Price Index (CPI) inflation in October 2019 was 37.1% in Dire-Dawa City, followed by 32.3% in Harari and 28.6% in Addis Ababa, according to the Central Statistical Agency (CSA), now known as Central Statistics Services. The majority of the population was impacted by inflation, with wage earners and pensioners on fixed incomes suffering greatly from the average welfare cost, which was projected to be Birr 22.354 billion. From 1974 to 2017, the Ministry of Finance and Economic Cooperation (MoFEC) reported an average yearly finance need of 8492.971 million Birr. During this time, the average annual gross borrowing, international borrowing, and domestic borrowing figures were 5,448.625 million, 4663.038 million, and 2140.716 million Birr, respectively.

A saving-investment imbalance of 3.63 billion Birr resulted from the average annual domestic demand for investment and net savings of 8 billion Birr and 4.37 billion Birr, respectively, according to the World Development Indicator (WDI) during 1990–2013. With the average resource gap (budget deficit) including grants at 8492.971 million Birr and excluding grants at 14493.69 million Birr, the domestic imbalance increased between 1974 and 2017. These amounts increased to 66643.18 and 84557.13 million Birr, respectively, during 2017. Over this time frame, the average annual spending was 124.65% of total income, with 123.17% in 2017.

According to Geberemesekel (2020), the nominal exchange rate fell 5.7% during GTP II, hitting 20.1 Birr/USD. Ethiopia's debt-to-GDP ratio was 35.34% from 1991 to 2019, reaching a peak of 60% in 2018, signifying substantial macroeconomic volatility. The country's yearly average Balance of Payments (BoP) deficit from 2013 to 2019 was USD 5639.838 million, which was a modest improvement above 2016 (Geberemesekel, 2020).

The largest weights for non-food items were housing, water, electricity, gas, and other fuels (16.8%), followed by clothing and footwear (5.7%). Title inflation averaged 38.5% for 279 commodities over 280 months from January 1997 to April 2020, with monetary growth and non-monetary components accounting for 10.5% and 28% of the total, respectively. The mean and greatest rates of inflation brought on by monetary expansion were 27.2% and 80%, respectively (Geberemesekel, 2020).

According to Geberemesekel (2020), inflationary pressures varied from 1997 to 2020. From 1997 to 2001, imported iron pipes contributed to the highest five-year average inflation of 168%. From 2002 to 2006, food items dominated with a five-year average inflation of 3.7%. From 2007 to 2011, a mix of imported items like motor oil and food showed inflation rates of 2.5% and 1%, respectively. From 2012 to 2016, construction items like stone for house construction led with a five-year average inflation of 774%. From 2017 to 2020, food items like onions and garlic were the main drivers of inflation.

With its substantial GDP contribution and job creation, Ethiopia's construction sector is vital to the country's economy. It does, however, encounter difficulties including input shortages and price swings. Costs and project completion were impacted by the October 2017 devaluation of the Ethiopian Birr, which raised the cost of building supplies.

Overall, even though Ethiopia's economy has grown, macroeconomic stability and progress have been hindered by ongoing inflation, budget deficits, and debt loads.

2.1.4. Factors causing price escalation in construction

According to Mekonen et al. (2023), one important factor contributing to price increases of up to 28% in Ethiopia is the lack of construction inputs. Shane et al. (2009), who draw attention to the unpredictability of cost increases linked to project delays, concur with Ayalew et al. (2016) that delays are a major cause of price escalation. While Amoa-Abban and Allotey (2014) stress that delays expose projects to inflation, hence increasing costs, El-Sawalhi and Eleyan (2022) contend that longer project durations generally lead to price escalations.

Inflation, local currency devaluation, monopolistic and unethical supplier practices, political instability, high gasoline prices, and shortages of both dollars and building materials are the main factors that contribute to price increases for construction materials, according to Admasu (2023). According to many researches, devaluation of local currency has a major effect on manufacturing costs when there are no alternatives for imported inputs (Ughamadu, 1993; Dinkayehu, 2019; Makoju, 1995). According to Gashaw (2015) and Admasu (2023), poor estimating techniques also result in cost escalations and underestimations. Furthermore, Admasu (2023) emphasizes how labor shortages affect building projects, pointing out that a lack of competent workers raises the possibility of delays (Henson and Newton, 1995; Gashaw, 2015).

Bimpe (2017) identifies a number of causes of cost increases, such as shifting government regulations, shortages of raw materials, changes in fuel prices, poor infrastructure, and corruption. When fair contracts and conflict resolution procedures are absent, these problems result in serious complications like disagreements over price increases.

According to Belay and Jain (2023), supply-demand mismatches, uncertain market conditions, changes in project schedules, fluctuations in foreign exchange rates, and material cost hikes are the main causes of price inflation in construction projects. Construction projects have historically seen significant cost increases as a result of these problems, particularly in impoverished nations like Ethiopia where cost escalations might reach 100%.

In his analysis of supply-side and demand-side inflationary forces, Gadisa (2021) points out that supply-side factors, such import prices and output growth, raise production costs. Demand-side elements like government spending and the money supply lower buying power, which fuels inflation even more. Eftekhari Mahabadi & Kiaee's (2015) study was cited by Gadisa (2021). The expansion of the money supply, private consumption, and government spending are a few pertinent demand-side variables. Due to corruption and bad leadership, the Ethiopian government's large projects take longer to complete and cost more money than

they should (Ethiopia: 50 Charged with Graft in Nile Dam Project, n.d.). He uses the Renaissance Dam, which construction began in April 2011 and was supposed to be finished in five years at a cost of $5 billion USD, as an example. However, the completion date has been moved to 2023. Since Ethiopia's inflation is attributed to the expansion of the national debt and budget deficit, the completion of these large projects will increase the amount of money available to pay off the national debt and close the budget deficit. As a result, when projects are delayed, the government must act.

Alemayehu and Kibrom (2008) and Geberemeskel (2020) point out that supply and monetary cost-push variables are what cause Ethiopia's inflation. Political unrest, monopolistic supplier tactics, inflation, devaluation of the national currency, and an excessive reliance on imported goods are some of the major factors contributing to price increases (Hardilo, 2020).

Nyangwara and Datche (2015) highlight how resource availability and material shortages affect construction performance. According to several studies cited by Hardilo (2020), energy costs, raw material prices, transportation costs, and exchange rates are some of the major causes of cost increases. Poor site management, budgetary challenges, design revisions, and faulty projections are some of the major causes of cost overruns, according to Ahmed et al. (2018) and Jha & Iyer (2006).

Bimpe (2017) divides the causes of price increases into four categories: stakeholder-related, external, building production, and economic. Interest rates, inflation, and exchange rate swings are important economic drivers (Windapo & Cattell, 2012; Oladipo and Oni, 2012). Labor and transportation costs are building production elements (Windapo & Cattell, 2012; Eshofonie, 2008).
Project costs are greatly impacted by stakeholder-related problems, such as monopolistic supplier tactics and material delivery delays (Manavazhi and Adhikari, 2002; Ramanathan et al., 2012). Cost increases are also significantly influenced by external factors, such as government policies and incidents of force majeure (Nega, 2008; Mansfield, Ugwu, and Doran, 1994). The most common reasons for price increases for federal road contracts in Ethiopia, according to Dinsa (2015), are improper budgetary planning, a lack of focus on planning by clients and financiers, fluctuations in the foreign exchange rate (for imported materials), and inflation in the cost of building materials.

Salim et al. (2020) and Bedada et al. (2020) talk about how inflation and material costs are impacted by global economic trends like rising oil prices and export restrictions. According to Dinkayehu (2019), the depreciation of the Ethiopian Birr, inflation, and the need for imported supplies are the main causes of rising building project costs.

Overall, a combination of economic, political, and project management factors contribute to the rising costs of construction materials, posing significant challenges to project completion and financial stability.

2.2. Overview of basis for understanding the price adjustment practice with respect to inflation

2.2.1. Price adjustment and other mitigation measures against price escalation

Niken et al. (2023) emphasize that maintaining price stability is crucial for sustaining economic growth and reducing unemployment. FDRE, Ministry of Finance also stated in their circular with letter reference number ገ/ጵ/1/53/32 dated 25/6/2013 E.C maintaining price adjustment is necessary to protect the construction industry.

2.2.2. Price adjustment

The Asian Development Bank's Guidance Note on Procurement (January 2023) defines price adjustment as modifications made to a contract's overall price to account for legitimate changes in costs, protecting both buyers and sellers from unforeseen input price fluctuations. Price adjustment is essential for contracts susceptible to such risks, especially those with delivery or completion periods exceeding 18 months. These adjustments typically include a non-adjustable element, an adjustable element, and a price index to measure the adjustment.

2.2.3. Mitigation measures

According to Mekonen et al. (2023), there are a number of ways to deal with price escalation, including implementing price escalation clauses in contracts, correct monitoring based on schedules, staff training to lower turnover and boost productivity, and effective resource planning.

Malkanthi et al. (2023) point out important steps to lessen the impact of price volatility. Price fluctuation clauses, bulk material purchases and storage at project inception, frequent cost monitoring, skill and efficiency enhancement, value engineering concepts, ensuring thorough and error-free designs, minimizing site waste, and efficient human resource management are a few of these.

Ethiopia has taken a number of governmental actions to address the issues facing the construction industry. In order to stimulate local construction and material production, these measures include policies to increase foreign currency reserves, encourage exporting, draw in foreign direct investment, and start infrastructure development projects (Fekadu and Zeleke, 2021).

2.2.4. Price adjustment formulas

Mishra et al. (2023) outline that price adjustment formulas typically consist of fixed (non-adjustable) and adjustable cost components, with each component assigned a weight based on its relative value to the total contract amount.

2.2.5. Risk management

Price adjustments shift the risk of rising material prices from the contractor to the contracting parties, according to Admasu (2023) and Brown (2017). To lessen the pressure on contractors

and the necessity for bidders to include premium charges, project owners should acknowledge price inflation as a genuine issue and share this risk.

According to Gashaw (2013), project owners can better control price escalation by taking on greater responsibility for material pricing concerns and making use of their increased capacity for risk diversification. Among the tactics are cost-plus contracts, supplier partnerships, fluctuation clauses, bulk material purchases, program-wide contingencies, frequent cost monitoring, and the use of locally accessible resources in design.

2.2.6. Government and policy implications

Tembo et al. (2023) and Soares (2013) argue for the necessity of adapting construction project management to meet socioeconomic demands by improving quality, reducing costs, and speeding up delivery.

Jha and Mata (2022) stress the importance of quantifying and managing price increases to ensure sufficient funds for project completion within budget and schedule.

2.2.7. Economic and policy considerations

Mulat (2020) notes that stable macroeconomic conditions require maintaining reasonably stable prices, a primary government objective.

Mishra and Aital (2020) highlight the persistent challenge of price fluctuation in the construction industry, necessitating price adjustment mechanisms.

Salim et al. (2020) discuss how in India, material prices and labor costs are closely tied to petroleum fuel prices, with price variation clauses included in contracts for high-value projects to adjust prices according to market trends.

2.2.8. Recommendations for Ethiopia

Bedada et al. (2020) recommend controlling money supply growth to manage inflationary pressures and maintaining a balance between GDP growth and inflation rates. They also argued that transparent fiscal operations and strategic government spending on productive investments are crucial for stable price levels.

2.2.9. Practical recommendations

For projects to effectively deal with price escalation, Dinkayehu (2019) advises stabilizing currency exchange rates, lowering the minimum contract time for price adjustment, upgrading price adjustment administration procedures, and optimizing project planning and scheduling.

In order to compensate contractors for price increases in labor, materials, fuel, and plant costs, Manaye (2019) advocates for price adjustment clauses in contracts with appropriately extended durations. This transfers risk from contractors to contracting agencies.

All things considered, these studies highlight how crucial it is to have strong price adjustment procedures and all encompassing mitigation techniques in order to successfully control price increases in building projects.

2.2.10. The need of adjustment of price

The Asian Development Bank (ADB) (2023) emphasized the significance of price adjustment provisions in construction contracts, highlighting their potential to enhance efficiency, fitness for purpose, and value for money. These provisions help manage situations that necessitate price adjustments, allowing borrowers, including grant recipients, to optimize resource use. They are integral to the procurement process and contract execution, providing a framework for applying various approaches and formulas based on the contract's nature and scope. Such provisions mitigate the risks associated with price escalation during contract execution, thereby improving the overall quality of projects. Additionally, they promote fairness and transparency by ensuring fair adjustments to contract prices in response to cost component fluctuations. This also supports the development of the domestic industry by protecting local contractors from price escalation impacts.

According to the FDRE, Ministry of Finance (2021), it is essential to include a price adjustment clause in contracts in order to protect the construction sector. For example, if a contractor submitted a specific amount for a particular job, he will receive precisely the same amount for the work completed after a set amount of time, in relation to the currencies he proposed in the tender. However, the contractor would still only get the amount that was initially tendered even if labor and material costs rose. There will not be any safeguards against rising labor and material costs. Following this the need to price adjustment comes in to picture. It is reasonable that the client should accept the risk of price increase associated with the work. If the contractor is asked to assume the risk of labor and material increases, they may find it difficult to predict the long-term effects of cost changes and may:

- Price tenders conservatively, resulting in excessively high contract prices; or
- Guess or take a risk on the effects of cost changes, resulting in excessive or uneconomically low tender prices (with consequent risk of the contractor's financial failure).

By taking on the risk of price increases, the client gives the contractor the opportunity to determine the project's actual cost and ensures that they will be paid that sum in the currencies they determined at the time of the offer, appropriately adjusted for cost fluctuations. Therefore, the inclusion of price adjustment system in the contract is important and by this the parties are meaning that they are ready to either give or take the benefit that the result of the system depending upon the market interval considered.

Malkanthi et al. (2023) discussed on how construction projects are inherently expensive and time-consuming, which causes cost increases. The "ICTAD formula method" was developed by Sri Lanka's Construction Industry Development Authority (CIDA) to deal with price variations in construction contracts. In Sri Lanka, provisions for price changes based on current indices and prices are included in Standard Bidding Documents (SBD). Eight advantages of fluctuation clauses were outlined by Malkanthi et al. (2023): reducing disputes, recovering higher construction costs, taking advantage of lower material prices, easing the financial strain on contractors, lowering the risk of bankruptcy, preventing cost overruns,

ensuring equitable risk sharing, and lowering the rate of abandonment in the construction sector.

According to Mishra et al. (2023), contractors may manipulate bidding documents if price adjustment coefficients are not included. They argued that price adjustment provisions are essential for long-term contracts to address price fluctuations.

Admasu (2023) stated that construction contracts are legally binding agreements with inherent obligations. The type of contract directly impacts cost estimations and compensation for price escalations. Price adjustment clauses aim to compensate for rises and falls in labor, materials, or legislative changes.

Getu et al. (2022) explained that price change provisions protect contractors from price hikes. Construction contracts, being complex agreements, involve lengthy tendering and negotiation processes. Terminating such contracts is difficult, leading employers to hesitate even when contractors breach terms due to the complexities of retendering.

Jha and Mata (2022) discussed the principle of "circumstance-alteration" in construction contracts, allowing for adjustments due to unforeseen economic changes. This principle ensures fairness by altering or terminating contracts in response to significant changes in circumstances.

Mishra and Aital (2020) emphasized the necessity of price adjustment provisions in contracts exceeding 12 months. They noted that no single formula fits all situations, and different formulas are used based on contract size and components. Contracts often involve multiple currencies, requiring specific formulas for each. Major and complex projects may require different price adjustment formulas for various sections. FIDIC formulas is commonly used to minimize risk.

Hardilo (2020) identified major challenges in price adjustment practices, including the failure to apply clauses for items with significant price variations within short periods, lack of updated material price databases, contractors' non-compliance with contractual procedures, clients' resistance to honoring escalation clauses, and contractors' failure to provide necessary base price indexes.

2.2.11. Review of construction contracts related to price adjustment

According to the Ethiopian civil code, a contract is an arrangement in which two or more people create, modify, or terminate proprietary obligations between themselves. We have construction contracts for the construction business. There are three components to a construction contract: legal, commercial, and technical. The contract agreement, the most recent meeting minutes, the acceptance letter, the tender, the general and specific conditions of the contract, and other documents are all included in the legal section.

A contract's terms outline the parties' rights and obligations as well as the specific circumstances under which the agreement must be fulfilled. Some of the subjects to be defined in the conditions of contract are definitions and interpretations, duty and responsibilities of the Engineers, contract period, method of payment and periods, retention

money, payment for variation orders, conditions for contract termination, price escalation etc..

Definitions and interpretations, the engineers' duties and obligations, the contract time, the payment method and periods, retention money, payment for variation orders, conditions for contract termination, price escalation, and other topics should all be covered in the conditions of the contract.

All contracts involving civil work projects must adhere to the usual conditions of contract. All contractors must abide by the same terms and conditions, which cannot be altered by the parties' contractual interactions. The following standard contract conditions are frequently used in Ethiopia's construction industry.

- FIDIC
- PPA Standard Bid Document 2006 & 2011
- Standard Conditions of Contract (MoWUD, 1994)
- BactocoDA, Contractual Conditions

Belgium, France, and Switzerland established the International Federation of Consulting Engineers (FIDIC) in 1913. The FIDIC series of contract templates is the most well-known product of FIDIC, an international standards group for the construction industry.

Proclamation No. 649/2009 reestablished the Public Procurement Agency (PPA) in Ethiopia. Its goal is to create a modern, integrated system of public procurement and property administration on a national and international level while strengthening the sector's ability at every level to guarantee economy, efficiency, and fairness.

For the supply, implementation, and procedure of price adjustment, both the FIDIC and PPA standard conditions of contract have determined that the construction sector is most affected when there is market price fluctuation of construction inputs (material, labor, and equipment utilization). Contractors are unable to finish their projects within the client's accepted time and quality margin and within their own intended cost margin due to the unpredictable, steep price hikes. This impedes their development in every way. As a result, in accordance with the terms and circumstances of the contract, the parties shall identify and divide the risk of price increases and decreases. Therefore, in addition to being a legally enforceable agreement, a contract also involves risk sharing or distribution between the parties.

The Asian Development Bank (2023) noted that price adjustment provisions are considered during procurement planning and bid preparation stages and applied as necessary during contract implementation. In fixed-price contracts, bidders might incorporate high risk factors into their bids, leading to excessive costs and potential rebidding. Thus, price adjustment provisions aim to protect parties from unexpected price escalations, especially in contracts with long delivery or completion periods, defined as those extending beyond 18 months. Price fluctuations in components like bitumen, fuel, cement, and reinforced steel necessitate these clauses, regardless of contract length. Although price adjustments are not part of bid evaluation, borrowers must evaluate proposed price indexes and weights thoroughly.

Implementing these provisions requires extensive verification and contract management skills. Proper management is crucial to avoid delays in contract payments and potential abuses. Qualified personnel must oversee price adjustments to prevent corruption and fraud. Clear and objective formulas and indexes are essential to avoid manipulation and unwarranted payments.

2.2.12.Price adjustment clauses according to MDB FIDIC, 2010

The MDB FIDIC (Multilateral Development Bank Harmonized Edition) is developed for contracting of construction works designed by the employer. It is designed for projects financed by development banks. In our country it is mainly used by the Ethiopian roads authority. The MDB FIDIC's price fluctuation adjustment provision is outlined in Article 13.8: Adjustment for Cost Change "Table of adjustment data" refers to the finalized table of adjustment data for both local and foreign currencies that is part of the schedules in this sub clause. This sub clause will not be applicable if there is not a table of adjustment data. If this sub clause is applicable, the sums owed to the contractor will be modified to reflect increases or decreases in the price of labor, goods, and other materials used in the project by adding or subtracting the sums calculated using the formulas outlined in this sub clause. To the extent that full compensation for any rise or fall in costs is not covered 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. 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 basis prices or cost indices listed in the adjustment data sheet must be applied. The engineer will decide their source if it is unclear. In order to clarify the source, reference will be made to the index values at certain dates, even though these dates might not match the base cost indices. The selling rate of the relevant currency on the aforementioned date, which the index must be applicable for, will be used to convert each index into the relevant currency of payment in situations where the "currency of index" is not the relevant currency of payment. The engineer will establish a provisional index for the issuance of Interim Payment Certificates until each current cost index is available. The adjustment will be computed in accordance with a current cost index when it becomes available.

If the contractor doesn't finish the work by the deadline, the prices will be adjusted using either (i) the price or index that was in effect 49 days before the deadline for finishing the work, or (ii) the current price or index, whichever is more advantageous to the employer. From MDB FIDIC in Article 13.8 above price adjustment can be applicable at any time after signing of the contract. It entertains price adjustment without any time limit.

- Period of Costs element to be taken for adjustment is on the date 49 days prior to the last day of the period to which the particular Payment Certificate relates.

- The formula used in this document is more practical and simpler to interpret. This makes it preferable.

2.2.13.Price adjustment clauses according to public procurement agency (PPA, 2011)

PPA conditions of contract are developed by the public procurement agency of the federal democratic republic of Ethiopia in August 2011. This standard bidding document's objective is to give Procuring Entities (PEs) a single, uniform draft that includes the fundamental contractual clauses and protections that the Federal Democratic Republic of Ethiopia's government mandates be included in public procurement and the use of public funds. The SBD for the Procurement of Works was created to:

1. Make it easier for procurement staff to draft a specific bidding document for the Procurement of Works;
2. Cut down on the amount of time the Tender Committee needs to approve bidding documents before they are released;
3. Lessen the time and effort bidders must expend preparing their bids;
4. Simplify the evaluation and comparison of bids and contract award by the securing entity.

Related to this research title the general condition of contract (GCC) of this Document (PPA 2011) provides clauses which provide price adjustment in clause 62. Accordingly, below this the clauses are tried to review and elaborate on how to apply in the actual projects based on General Condition of PPA 2011 Contract Clause 62 which is discussed about Price Adjustments.

- ❖ According to GCC of PPA 2011 sub clause 62.1, adjustments of contract prices shall be allowed after twelve (12) months from the effective date of the Contract where it is verified that the performance of the contract requires more than 18 months.
    - PPA 2011 in sub clause 62.1 above clearly indicates price adjustment is applicable if the performance of the contract requires more than 18 months. From this, one can easily understood that weather the project is completed within the original contract time or with in the Approved Extension of time, price adjustment is applicable if the project takes more than 18 months (547days).
    - This price adjustment is applicable for works which takes place after 12 months. All works executed before that are not part of the price adjustment and not payable.
    - The practical problem in our country related to this provision in most projects is the public body as well as the consultant raise the question for projects which initially was less than 18 months but actually takes more than 18 months reasoning the original contract time is less than 18 months. But the clause is not talking about original contract time but it is about the total time to perform the project. Therefore, it is practical problem in our country.

- ❖ According to GCC of PPA 2011 sub clause 62.2, request for price adjustment in relation to a particular work items under this Contract may be filed by the Contractor after twelve (12) months from the effective date of the Contract where it is verified that the performance of the contract requires more than 18 months, which adjusted price takes effect as the new Contract Price in relation to that work item on the expiration of 30 days from the date on which the Public Body receives notification of that adjusted price from the Contractor, unless another date is agreed in writing between the Parties.
    - This clause elaborates that the PA request is going to be filled by the contractor after 12 months from effective date of the contract. This clause also indicates that verification about the total time to perform the project is needed to forward PA request. The importance of this clause is sometimes original contract date is less than 18 months but due to reasons beyond the contractual parties it may be extended more than the said time. In such cases it needs verification (i.e. approved extension of time and new adjusted contract duration) to apply price adjustment.
    - Practically this clause also not properly applicable in our country since it doesn't give clear meaning for the term verification.
- ❖ According to GCC of PPA 2011 sub clause 62.3, all prices shall be firm unless the Contractor has provided claim for price adjustment. The contractor may invoke this provision at any time during the contract by notice in writing to the engineer.
    - This clause provides the right to claim at any time during the contract duration and original price is not changed unless requested by the contractor.
- ❖ According to GCC of PPA 2011 sub clause 62.4, the public body can increase or decrease the Contract Price amount as described by this Clause.
    - This clause provides the right to change the contract price by the public body. This may be increment or decrease of contract price. Mostly in our country price is increased but in cases where price of material decreases the public body have a right to justify and decrease the contract price.
- ❖ According to GCC of PPA 2011 sub clause 62.5, price adjustment shall be applicable as payable in full for the original scheduled completion period.
    - Clause 62.5 specifically provides PA is fully payable in full for the original scheduled period. i.e it has to be paid based on the actual price from the market & the formula in that specific period. The next sub-clause provides how to manage where the time is beyond the original contract period.
- ❖ According to GCC of PPA 2011 sub clause 62.6, in the event the completion of contract exceeds the original scheduled period:
    a) In case of default on the part of the Contractor causing delay in original scheduled completion, the rate of Price Adjustment will be frozen at the original scheduled date of completion; however, Price Adjustment will be applicable till actual completion. While computing Price Adjustment beyond the scheduled completion period, in the event the rate is reduced, then that reduced rate will be applied.

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

- In an event where the delay is occurred due to the contractor default the rate of price adjustment factor is frozen (stop increasing) with the increment in resource price. Rather it will be paid based on the rate at the time of original contract period end. However, it is clearly indicated it will be payable till the end of the actual completion.
- On the other hand, PA is fully applied(payable) for extended time if the contractor is not responsible for the delay (or EOT is approved by the public body).

❖ As per PPA 2011 GCC sub clause 62.7, unless specifically stated otherwise in the Contract, the basis for compensation will be only those categories of inputs, which are specifically listed as specified items in the SCC.

❖ As per PPA 2011 GCC sub clause 62.8, an adjustment of the contract price, depending of selected categories of contract price, shall be limited to an amount which takes account of price indexes or price indicators issued by Ethiopian Central Statistical Agency or Public Procurement and Property Administration Agency.

- It provides institutions for provision of price indices. However, this clause is not widely applicable since the date from central statistics agency is not enough to use for sophisticated construction industry. PPA as an institution doesn't work in provision of material and other resources price data.

❖ PPA 2011 GCC sub clause 62.9 specifies that notwithstanding the provision of GCC Sub-Clause above, price information available from a renowned local producer or competent foreign institution may be used in case the Ethiopian Central Statistical Agency or Public Procurement and Property Administration Agency are not in a position to issue current price indexes,

- To solve the problem in clause 62.8 this clause provides other data sources to help the application of reasonable and accurate price adjustment. This is helpful in most price adjustment works.

❖ PPA 2011 GCC sub clause 62.10 states that the contractor shall submit to the Public Body for review and approval all calculations and supporting information necessary to determine the price adjustment.

- Clause 62.10 provides the process after development of proposal for price adjustment. Review and approval is one of the major professional duties of the consultant in administrating the contract. This clause is basis for the entire process and output. The contractor is responsible to provide a reliable, clear and well-organized document with supporting files for the review of the Engineer. On the other hand, it is clearly indicated that review and approval of price adjustment is the role of the Engineer. However, in most construction projects in our country the Engineer doesn't carry out this task.

❖ GCC sub clause 62.11 of PPA 2011 specifies that adjustments in compensation may be either plus or minus depending on the differences between the Benchmark Price Index and the Monthly Price Index.

- PPA 2011 GCC sub clause 62.12 states that to determine the adjustment on each item any such price variation shall be calculated in accordance with Equation 2.1 of the following formula by applying the combination of above said criteria:

$$PA = \left[NV + A\frac{(MLI - BLI)}{BLI} + B\frac{(MMI - BMI)}{BMI} + C\frac{(MEI - BEI)}{BEI} + D\frac{(MFI - BFI)}{BFI} \right](BC)Q \text{ ..[Equation 2.1]}$$

And where:

NV+A+B+C+D are equal to 1.00

Currently, since the formula of PPA 2011 have limitations during applications of the adjustment the Public Procurement and property authority states that 'all other conditions remain as per stipulated in the contract, only the formula of PPA 2011 clause 62.12 is amended to the previous formula of PPA 2006 Clause 47.1 as shown in the Equation 2.2 below and the Contractor can use the formula during application of the adjustment.

$$\mathbf{Pn} = a + B\frac{Ln}{Lo} + c\frac{En}{Eo} + d\frac{Mn}{Mo} + etc \quad \text{..... [Equation 2.2]}$$

Accordingly, the formula taken from the PPA 2006 solves the limitation in the above formula. In this case, the problem which arises from the formula is solved after PPA releases adjustment on the formula.

- PPA 2011 of GCC sub clause 62.13 states that the fraction for each specified element and exact combination of elements that will be applied in the formula for price adjustment shall be determined in the SCC.
  - This clause is about fraction and exact combination of elements. However, in most projects in our country PA is prepared after the contract is signed, the option to apply this provision is less.
- According to PPA 2011 GCC sub clause 62.14, an increase in the Contract Price takes effect as the new Contract Price in relation to the selected category on the first day of the next Payment Period following receipt of an application for increase provided the application is received no later than 14 days prior to the commencement of that Payment Period.
  - This clause provides the effective date of the price adjustment. In most projects after approval of price adjustment practically the payment is requested and collected with interim payment certeficate of original contract.
- In accordance with GCC sub clause 62.15 of PPA 2011 contract it is stated that an increase in the Contract Price takes effect as the new Contract Price in relation to the selected categories of inputs on the expiration of 30 days from the date on which the Public Body receives notification of the increased price from the Contractor, unless another date is agreed in writing between the Parties;
- As per GCC sub clause 62.16 of PPA 2011 specifies when the contractor varies the Contract Price of a Product or Service it must supply a copy of a revised Pricing

Schedule which incorporates the proposed changes in price and specifies the date on which the proposed variation in price is to take effect in accordance with GCC Sub-Clauses 62.14 and 62.15.

- In accordance with GCC sub clause 62.17 of PPA 2011 contract, the contractor shall, when it notifies or requests a price adjustment under GCC sub-clause 62.12, provide to the Public Body such document or other information as the contractor considers appropriate for the purpose of substantiating the requested price adjustment.
- As per GCC sub clause 62.18 of PPA 2011 specifies where the Public Body questions a price increase notified or requested under GCC sub-clause 62.12, and the contractor is not able, on the basis of the information it provided to the Public Body, to substantiate to the Public Body any, or a part of, the notified or requested price adjustment, the Contract Price shall be increased by only so much as the Contractor is able to substantiate and:

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

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

- In accordance with GCC sub clause 62.19 of PPA 2011it is specified that any discount offered by the contractor under this agreement cannot be reduced during the term of this contract without the agreement in writing of the Public Body.

2.3. Price adjustment mechanisms in the construction industry

2.3.1. Items subjected to price adjustment

The following are the primary things covered by the contract for which a price adjustment may be applied:

1. Costs associated with materials include fuel, cement, reinforcement bars, asphalt, bitumen, and so on.
2. Labor costs: any changes in the market price of labor or the officially agreed-upon wage rates are adjusted. Under most international contracts, labor adjustment is included.
3. Expenses associated with equipment usage: fluctuating equipment rental rates are an additional expense that must be considered. The equipment is adjusted in the majority of foreign contracts.

2.3.2. Method of price escalation

When construction project owners conduct reasonable long-term projects in regions where prices fluctuate, they take these fluctuations into account to make up for any losses incurred by contractors as a result of price rises for the specified item in the contract. There are two

different approaches that can be used to determine how much is owed to the contractor for cost increases or deducted from the contractor's price for decreases:

1. The Index based/Traditional /Proven Cost Method
2. The Adjustment formula(e) Method

1. Traditional/Proven cost method

"Basic prices" or "basic date prices" are the foundation of this approach. Its goal is to determine the real increases or decreases in the contract sum brought on by variations in the cost of building materials. This method determines the increase or decrease by comparing the material prices included in the tender with the labor rate schedule. The amount of labor and material used on the contract after the date of increase or reduction multiplied by the rise or decrease in rates and prices permitted by the price variation provisions. Typically, just the basic list is reimbursed for material fluctuations, and profit and overheads are not typically specifically reimbursed.

When using this strategy, the contractor must specify which aspects of his costs he needs to alter the contract price for during the tender stage. He backs this up with a list of the suppliers and the prices of the different components that made up the tender. In order to get payment for the difference between the "Basic price" shown in the bill of quantities (BOQ) and the "Actual" invoiced cost of the same items, the contractor must provide documentation of the actual price paid at the time of purchase. Therefore, it's crucial to make sure that every purchase comes from the vendors that were chosen at the time of the tender. Any supplier change is likely to lead to overcompensation and an invalid pricing comparison. According to Table 2.1 below, a typical month's contract price adjustment calculation utilizing the tried-and-true cost approach would look like this.

Table 2.1: Invoice/ traditional/proven cost method

Item No	**Quantity**	**Basic Price in BOQ**	**Current Market Price**	**Variation in Unit rate**	**Addition Cost due to variation**
Cement	100	190	210	20	2000
Fuel	500	4.50	5.50	1.00	500
	Total price escalation for this month in Birr				2500

When employing this strategy, it is crucial that the client or his agent confirm the legitimacy and dependability of the suppliers and prices that are offered as the base rates. Any supplier change is likely to lead to varying base costs, which will make price adjustment calculations more difficult. Table 2.2 below lists the benefits and drawbacks of the invoice/traditional/proven cost technique.

Table 2.2: Advantages and disadvantages of invoice/ traditional/proven cost method

Advantages	Disadvantages
It can be used where there is no index in the country	Under quoting base prices by the contractor and supplier
Easy to apply if price adjustment is to be applicable after signing of the contract (by agreement or by law)	Over invoicing current prices by the contractor and supplier
Avoids time required during design and tendering stage process on the flip side of formula method	Changing suppliers
Flexible application	Liquidation of suppliers
	Detail and proper checks need to be done by the owner to validate the claims for increased materials pricing and the quantities of material, labor and equipment used for the particular period

Larger projects take many years to complete, thus it is essential to have a price index-based technique of contract price adjustment to reduce such exploitation and have an appropriate approach. These can be accomplished using the real cost approach or formula method, which will be covered in the following section.

2. Actual cost method/Formula method

This approach, which is based on "price indices," examines changes and takes into account key elements for cost compensations using an adjustment formula. When appropriate indexes are available, this approach is advised. It will be assumed that the index value accounts for all cost changes brought on by price fluctuations.

This approach uses a formula to mathematically describe the works to be taken. The formula includes several components that represent the different aspects of the project at the time of the tender, as well as several comparable factors for the various aspects of the job at the time of the undertaking. A percentage increase in the tender value of the work completed is generated by applying these elements to the calculation; the amount that results is the contract price adjustment that the contractor is responsible for. When such factors or indexes are available, this is the recommended approach.

Equation 2.3 below illustrates the types of formulas that are typically used in the actual method:

$$Pn=A + b\,(Ln/Lo) + c\,(Mn/Mo) + d\,(En/EO) +\ldots \quad \text{..... [Equation 2.3]}$$

Whereas:

- For the payment of the task completed in the relevant month, where Pn is a price adjustment factor to be applied to the amount in each particular currency

- b, c, d, etc. are weightings or coefficients that represent 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 appendix to Bid.
- A is a constant, specified in the appendix to Bid, representing the nonadjustable portion in contractual payments, i.e., it has no representative or linked indices.
- Lo, Co, Fo, etc. are the base cost indices or reference prices that correspond to the aforementioned cost elements at the base date, Ln, Cn, En, etc. are the current cost indices or reference prices of the cost elements in the particular currency for months "n," applicable to each cost element.
- Pn may be larger than or less than one as a result of price changes and corresponding index changes. The following Equation 2.4 provides a summary of it:

Amount Due this Month =Value of Work Done this Month x Pn	….. [Equation 2.4]

A factor of correction if a price adjustment factor is applied to payments made in a currency other than the currency of the index's source for a particular indexed input, Zo/Zn will be applied to the corresponding component factor of Pn for the formula of the relevant currency. On the date of the base index, Zo is the number of currency units of the index country that correspond to one unit of the currency payment, whereas Zn is the corresponding number of such currency units on the date of the current index. The updated formula is shown in Equation 2.5 below as follows:

$Pn=A + b(Ln/Lo)\ (Zo/Zn) + c\ (Mn/Mo)\ (Zo/Zn) + d(En/EO)\ (Zo/Zn) +\ldots$	… [Equation 2.5]

This method helps with construction contract forecasts and computations to ascertain the contract price adjustment by using a mathematical model, which is a simplified mathematical representation of a system or process. The client/contractor builds the model by first identifying the most costly goods and then combining them with statistically derived indices that indicate the amount of price change for those items.

To adjust for changes in labor, supply, and other work-related input costs, the amounts payable to the contractor will be adjusted by adding or deducting the amounts determined by the designated formulas.

2.3.3. Weightings

Weightings are coefficients representing the estimated proportion of each cost element related to the execution of the works. During the use of price adjustment formula method the following points are considered during bidding stage;

- The identification of the items considered to be affected (referred to be as variable) by the market conditions (referred as basic items) vis-à-vis items to be unaffected (referred as fixed) during the contract period are decided.

- The estimations of the weightings of the selected basic items as a percentage of the total contract amount are decided based on the prices from specified sources prevailing at fixed time before the date of bid closing; and

- Agree on the source of the selected basic items and on their rates or indices. During the estimation of the weightings the main elements to be considered are quantity of works, the rate of utilization of input resources per unit of work and prices of a pay item.

The following table serves as an illustration of the weightings for a sample road project. As shown in Table 2.3 below, the most expensive things in a normal road building project may be responsible for the percentages of local and foreign currency costs:

Table 2.3: Example of percentage

Cost	**Local Currency (%)**	**Foreign Currency (%)**
Fixed	10	10
Local Labor (LL)	20	0
Foreign Labor (FL)	0	15
Cement (C)	12	0
Bituminous Products (B)	0	25
Fuel (F)	33	0
Plant and Equipment (P)	0	50
Crushed Stone (CS)	25	0
Total	**100**	**100**

A number of other components will incur costs, but their percentages of the total contract price will be negligible, and changes in these costs are unlikely to have a substantial impact on the final contract value. Therefore, it is not worth adding unnecessary complexity to the price adjustment formula (e) by include items that are irrelevant or that have no bearing on the result. Road marking paint, road signs, pre-cast culverts, road barriers, and so forth are examples of these additional goods.

2.3.4. The non-adjustable or fixed

In the price adjustment formula approach, the first item denoted by the letter "A" is called "Fixed," which is clearly not a material or expense related to materials. However, it is common practice to add an item like this to cover a tiny amount of the cost, so the client is not exposed to price fluctuations. Among the fixed portion's most talked-about elements are;

- ❖ Inputs not subjected to price fluctuation such as materials supplied by the owner at fixed contractual price;

- ❖ A small amount that the client estimates represents a specific percentage of the cost that the contractor must control. Examples of this could be the kind of cars the

contractor decides to buy for his employees, the insurance company he goes with to insure the work, the bankers who provide the guarantees, etc.

- ❖ The general expenses that must be covered throughout the mobilization and start of the project. Given that the bid estimate may have been completed months before the work started, there are reasons why this should be covered by the set price. It is also noteworthy that this is a one-time adjustable element that can be deducted from future payments if it is included in the adjustable component.

- ❖ The majority view that is being debated is that the fixed part should include the profit margin and overhead. Nevertheless, the reasoning behind such an argument is not sufficiently supported to be deemed persuasive. There won't be any price hikes for this fixed component. The greater the fixed component's size, the greater the contractor's exposure to inflation and price increases. However, if the fixed amount is made very large, the owner will lose the benefit of the adjustment if the price decreases.

2.3.5. The adjustable portion

The other items in the cost schedule above are termed the adjustable. Once we have defined the fixed cost the value of adjustable portion is found by deduction of the nonadjustable portion from 100%. However, the main arguable point lies on the selection of the types and determinations of the magnitudes of the proportions (weightings) of the input resources. It is evident that the weightings are done for materials, labor and equipment usage. Detail work has to be done on the specifying, quantifying and pricing of an item for each category. The following points further clarify this matter;

- The specifications given along with the bill of quantities entails a relatively elaborate work breakdown structure of the works. The work breakdown in turn leads to the types of input resources and the class of work or quality standard required.

- To achieve the desired quality of work it needs to determine the method of work for each activity.

- The selected method of work calls for specific types of input resources.

- The type, number, size, etc of each input resources is determined based on the complexity given specification and productivity per unit of standard measurement should be identified.

The weightings are sensitive to productivities of human; equipment and material in their respective units of measurements due to a number of factors besides the main ones are such as quality standard required, quantity, proximity, unit price and the likes. Once the types and quantities of the required input resources are determined in the next step is to determine the sources and locations of each input resources. After the types and magnitudes are determined the next step is to reduce the number of variables to a relatively fewer number for the purpose of simplification during the project execution. Say instead of working on 50 or even more items it is easier to work on any lesser number than this. This is done by the method of proxy

or substitute, for example replacing components of steel structure by reinforcement steel. The above description merges down to an amount in the value of a particular or substitutable input resource(s) out of which weightings are calculated from the relevant total value of a project in question.

The above road project's cost shown on Table 2.3 can be modeled as Equation 2.6 below:

Cost = ƒETB(0.10 + 0.20LL + 0.12C + 0.33F + 0.25CS) + ƒUSD(0.10 + 0.15FL + 0.25B +0.50P + 0.10St)……..…[Equation 2.6]

The majority view that is being debated is that the fixed part should include the profit margin and overhead. Nevertheless, the reasoning behind such an argument is not sufficiently supported to be deemed persuasive. There won't be any price hikes for this fixed component. The greater the fixed component's size, the greater the contractor's exposure to inflation and price increases. However, if the fixed amount is made very large, the owner will lose the benefit of the adjustment if the price decreases.

2.3.6. Price adjustment indices

The prices of items or groupings of materials are measured by indicators, whose present values are contrasted with their historical values. An index typically depicts a collection of related goods or materials, such as:

i. The costs of gasoline, diesel, paraffin, and lubricants added together in proportion to the amount of each consumed in that nation or area can be used to create a fuel index.

ii. To create a representative index, rolled steel sections, steel plate, cold rolled sections, and reinforcing steel can all be integrated. The ratio of the index's current value to its base value can be used to modify any of the cost components of the model mentioned above. The ratio of the index's current value to its base value can be used to modify any of the cost components of the model mentioned above. The date and value of the base index are typically set 28 days prior to the tender submission date, just as the exchange rates and base prices. These can be used to create the two models that are illustrated below, Equations 2.7 and 2.8.

PnETB = 0.1 + 0.2 LLn/LLo + 0.12 Cn/Co + 0.33 Fn/Fo + 0.25 CSn/CSo ….. [Equation 2.7]

and

PnUSD = 0.1 + 0.15 FLn/FLo + 0.25 Bn/Bo + 0.5 Pn/Po + 0.1 Stn/Sto…… [Equation 2.8]

Whereas:

- The component's "n" values represent the new values in the index's "n" month, whereas the component's "o" values represent the index's base value.
- The adjustment factors that must be applied to the sums due for payment of the job completed in month "n" are Pn USD and Pn ETB, respectively. Pn can consequently be higher than or less than one due to fluctuations in prices and corresponding indices.

Equation 2.9 following provides a general formula that summarizes the aforementioned equation.

$$Pn=A + b(Ln/Lo) + c (Mn/Mo) + d(En/EO)+\ldots, \ldots\ldots\ldots\ldots \text{ [Equation 2.9]}$$

According to the relevant table of adjustment data, "A" is a fixed coefficient that represents the non-adjustable portion of contractual payments; "b," "c," "d," … are coefficients that represent the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; these tabulated cost elements may be indicative of resources like labor, equipment, and materials; and "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," which is a month unless otherwise specified in the Contract Data; On the one hand, "Ln," "En," "Mn," … are the current cost indices or reference prices for period "n," expressed in the applicable currency of payment, and each one applies to the relevant tabulated cost element on the date 49 days before the end of the period (to which the specific Payment Certificate relates); on the other hand, "Lo," "Eo," and "Mo," … are the base cost indices or reference prices3, expressed in the applicable currency of payment, and each one applies to the tabulated cost element on the Base Date.

2.3.7. Source of Indices

Indicators are typically created by government statistics departments to show the prices of specific items or sets of materials within their purview. Therefore, indicators are closely related to the economy of that country or region of influence, and consequently to the rate of inflation, political stability, and exchange rates. Indexes are not typical of other places because they are location specific.

Arbitrary indexes would essentially bring local inflation into the project and either overpay or underpay the contractor for price adjustments. Therefore, it is crucial that the currencies of payment and the indices' sources match. All highly developed nations create these indices, which are current and easily accessible, typically online. However, in cases when they are not created, proxy indices must be used. they are typically genuine material or product prices from reputable producers or manufacturers, such as central statistics, a cement factory, or the government's publicized minimum wage or gasoline price. Use of indices from a source other than the country of the currency of payment at the selling rate set by the country's central bank of this relevant currency on the aforementioned date for which the index is required to be applicable is an option in cases where even proxy indices are not accessible. But in this instance, the corresponding component factor in the calculation needs to have a correction factor Zo/Z applied to it.

Whereas, Z is the corresponding number of such currency units on the date of the current index, and Zo is the number of units of the index country's currency that correspond to one unit of the currency of payment on the base index date.

When employing this strategy (formula method), it is essential to take into account the following points:

- The engineer will determine a provisional index for the issuance of Interim Payment Certificates until each current cost index is available.

- 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. The adjustment will be computed in accordance with a current cost index when it becomes available.

- If the index's value changes after it has been used in a computation, the calculation will be adjusted and the subsequent payment certificate will reflect the new value. All cost changes resulting from cost fluctuations will be considered to be accounted for by the index value.

- In accordance with MDB FIDIC Clause 13.8, price adjustments will be made if the contractor does not finish the work by the deadline. These adjustments will be made using either (i) the price or index that was in effect 49 days before the deadline for finishing the work, or (ii) the current price or index, whichever is more advantageous to the employer.

- In accordance with PPA 2011 sub clause 62.6(b), if the contractor does not finish the work by the deadline, a price adjustment will be made if he is granted an extension of time for no fault of their own, appropriately approved by the public body, the price adjustment will be payable in full for the extended period.

- Adjustments will only be made to the weightings (coefficients) for each of the cost components included in the table(s) of adjustment data if variations have made them unreasonable, imbalanced, or inapplicable.

Number of Formula per project

If it is desired the formula can be more than one by dividing the work into distinct stages where the use of specific input resource may be over. For instance, in building construction the project work may be divided into earthworks, structural and blocks, and finishing works so that an adjustment regarding resources related to each division shall be over when the relevant work group is completed. Most road projects in ERA have price escalation formula per bill item of a project. Advantage and disadvantage of actual cost method/ formula method is shown in the Table 2.4 below.

Table 2.4: Advantages and Disadvantages of Actual Cost Method/Formula Method

Advantages	Disadvantages
Easy to compute the escalated amount	The escalated amount may not represent the actual model, if the weightings are not estimated well or if there are varied works
The indices are reliable as they are	Since indexes are based on

produced by trusted authorities as compared to invoice method	average values, the real worth of the materials may differ greatly from the reported index price in some situations.
When a supplier is unable or unwilling to issue a set price quote until the item is actually purchased, it is frequently the best course of action for the owner and contractor to reach an agreement.	

2.3.8. Regulatory framework and policy improvement

The primary goal of contract price adjustment is to reimburse the employer or contractor for changes in labor and/or material costs. It is, therefore, essential to make a proactive knowledgeable effort in identifying the risk associated to a contract, estimating the probable magnitude of the impact and the management of the same. Here, it should, however, be noted that it is not possible to foresee and identify all sorts of undesirable events right at the beginning. There may still be many more, which may surface out in duo course time. It is because of this fact that some define contract not simply as an exchange of legally bund promises of doing or not doing this and that, but it is also inherently, the sharing of risk to the contracting stakeholders as well. The principle to be applied in the allocation of these risks is to identify the party that can be able to successfully handle them so that the objective of the contract can be achieved as desired. If the contract is formulated with this in mind, then the agreement may be more or less be classified as fair.

Currently, the Governments are doing well to save the construction industry and the contractor to compensate their actual expenditure. They provide directive to the application of adjustment, by mentioning most of the public contract is subject to price adjustment as the Federal Democratic Republic of Ethiopia Ministry of Finance instructed all Public employers with the letter Ref. No. F/I/1/53/32 dated 25/6/2013 E.C (4th March, 2021 in G.C) and letter Ref. No. 7/2/1/53/49 dated 05/11/2013 E.C (12th July, 2021 in G.C) citing the analysis made and submitted by the Ministry of Construction and Urban Development regarding the price inflation of the construction by stating that " if previous construction work procurement contracts signed with the corporation /entity did not incorporate price adjustment provision, taking in to account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for cement, re-bar and finishing Materials in respect of the outstanding works by using the price adjustment formula". The price adjustment formula is taken from PPA 2002 Manual instead of PPA 2011 formula based on the direction set by public procurement and property Authority through a letter dated on 13/08/2014 Ref. No. መማንባ/መ-1/1/342. The average applicable base indices are taken from a FDRE Ministry of Urban and Infrastructure (letter Ref.no. 85/00200/195 on 15/09/2014) on base date and also current indices are derived from the same Ministry at the time of invoice submission. The

Government also instructed the concerned bodies to follow the application of price adjustment during bidding stage.

2.3.9. Local case studies and best practices

It is apparent that almost all construction works in Ethiopia are based on the unit price of items and the quantity of actual works executed. The provision of price adjustment for contractors due to market price fluctuations is not well addressed in the construction sector so far in Ethiopia especially for National Competitive Bidding (NCB). For asphalt road projects which are mostly done by International Competitive Bidding (ICB) have treated by the FIDIC and MDB (Multilateral Development Bank) condition of contract. These documents have price adjustment clauses that contain price adjustment formula and adjustment factor.

The adjustment factor such developed addresses all round coverage of price variation. By looking into the price adjustment provisions for NCB and ICB contracts, it can be observed that the contractors under ICB contracts are compensated with rational costs to cover their actual additional costs incurred due to variation of market prices. On the other hand, the local contractors with NCB contracts have been exposed to loses due to no or small price adjustment provision. The increases of costs of labor, cement, fuel, reinforcement bar, bitumen, etc have resulted in major changes in the cost of construction both in the above adjustable items and the balance costs. Since this adjustment has not been paid to local contractors in most cases, it resulted in stoppage, suspension, and even termination of contract of contracts. This left the local contractors not to build their capacity for long period of time. Besides, some contractors have been dropped out from the market and some are on the verge of it due to intolerable great loses due to the additional costs incurred since the market prices are fluctuating from time to time. Thus, to save the contractors from such disaster, it is vital to develop a reasonable and realistic index factor to compensate their actual cost expenditure in executing projects and discharging their contractual responsibilities.

Getu et al. (2022) talked on the rising concern in Ethiopia about public building development projects. The construction of hospitals, colleges, offices, institutions, and other public structures that address social challenges depends on these initiatives. However, the price adjustment provision has not been adequately implemented in Ethiopian building projects, which has hindered the anticipated results and applications of public building construction projects (Getu et al., 2022).

Kassa (2017) described that ERA uses formula method for the calculation of price adjustment with two different techniques, namely calculating adjustment factors for each bill number and calculating an adjustment factor for aggregated bill.

The Asian Development Bank (2023) highlighted the benefits of effectively using price adjustment provisions, which include increased efficiency, fitness for purpose, and value for money. It also highlights that these provisions can describe situations and conditions that require their application, enabling borrowers to maximize their resources. Additionally, they explain how price adjustment provisions are considered in procurement and contract

execution processes, thus improving the overall quality by mitigating risks related to price escalation. Additionally, they promote the growth of the domestic sector by safeguarding local contractors who are vulnerable to price increases during contract execution and guarantee fairness and transparency by offering standards for reasonable contract price changes resulting from cost fluctuations. Bidders are typically best positioned to determine the weight of each cost element, as they have better visibility of input costs, unlike borrowers. The chosen construction method can significantly affect the fixed and adjustable portions of the price adjustment formula. For instance, using heavy-duty scraper equipment instead of wheelbarrows for earthworks affects labor and fuel costs differently.

According to Admasu (2023), controlling price increases ought to be a priority at every phase of a project. Recognizing that escalation is a genuine risk to construction projects and programs is the first step. Project owners must acknowledge the realities of bid market volatility, even in the face of a propensity for optimistic budgeting, since material prices will continue to fluctuate (Gashaw, 2013). According to William and Peter (2006), sharing the risk is the most important thing project owners can do to lessen the impact of an unstable construction market. This strategy relieves bidders of the burden of charging premiums by shifting the risk of market volatility away from contractors and vendors.

The use of constant weighting coefficients over the course of the project, reliance on foreign country indices that might not accurately reflect local conditions and different estimators producing different weighting coefficients are common issues affecting price adjustment in construction contracts, according to Emiru (2017). Other problems include only extreme pricing being taken into account, fluctuations in project costs, fixed input material volumes, and the disregard for actual labor work time. After looking through contract records, contractor claims, and communication in the SNNPRS Construction Authority Archives, Dinkayehu (2019) discovered further issues pertaining to price escalation and adjustment. These issues include construction price indexes that might understate market circumstances, clients' unwillingness to abide by escalation contracts, and insufficient compensation provided by escalation clauses for price rises. A public database for recording and updating steel prices is lacking, contractors are not following the correct procedures for requesting price adjustments, special conditions of contracts limit the applications of price adjustment clauses, steel price escalation in projects with a contract duration of less than 18 months, and contractors fail to include the required basis cost index in their bidding documents for the engineer's approval.

2.3.10.Summary

This literature review extensively examines the intricate connection between inflation and the construction sector in Ethiopia. It commences by defining inflation and its diverse forms, elucidating its impact on price escalation within construction. The review navigates through the inflationary pressures on construction, stressing how inflation influences project costs, financing, and completion timelines. It also scrutinizes the broader Ethiopian economy,

spotlighting the construction sector's role in economic growth and development, notwithstanding challenges like inflation, unemployment, and budget deficits.

Furthermore, the review delves into the factors contributing to price escalation in construction projects, encompassing shortages of construction inputs, delays, government policies, and currency devaluation. It discusses how these factors lead to cost overruns, delays, and disputes within the construction industry.

The literature also sheds light on price adjustment and mitigation measures against price escalation, underscoring the critical significance of maintaining price stability in construction. It cites various scholars and institutions, emphasizing the necessity of price stability for economic growth and industry protection. Mitigation measures suggested include staff training, efficient resource planning, and incorporating price escalation clauses in contracts.

Governmental measures and policies aimed at countering construction sector challenges are discussed, along with recommendations for Ethiopia, encompassing controlling money supply growth, maintaining a balance between GDP growth and inflation rates, and ensuring transparent fiscal operations. The review also covers practical recommendations such as stabilizing currency exchange rates and enhancing project planning and scheduling.

Additionally, the review explores different contract standards and their provisions for managing price fluctuations effectively, underlining the importance of robust price adjustment mechanisms and comprehensive mitigation strategies to ensure economic stability and industry growth.

Moreover, it provides a detailed analysis of price adjustment mechanisms in the construction industry, including the items subjected to price adjustment, two main methods of price escalation, regulatory frameworks, local case studies, and best practices, offering a comprehensive overview of both the benefits and challenges associated with these methods.

While existing research provides insights into these areas, there's a notable gap regarding the identification of the degree of impact of inflation in the Ethiopian construction industry and degree of responsiveness of price adjustment practices in the construction industry of Ethiopia over the past ten years. Thus, the review concludes by emphasizing the need for further investigation to develop a comprehensive understanding and propose practical solutions for sustainable cost management amid inflationary pressures in Ethiopia.

2.3.11. Research gap

According to the overall literature analysis, numerous researchers have been carrying out various studies to determine the potential reasons and consequences of price increases and price adjustment practices in various building industry sectors.

The impact of rising steel prices on public building construction projects in SNNPRS has had a major impact on project delivery in terms of budget, schedule, and quality, according to Dinkayehu (2019), one of the researchers who conducted research in Ethiopia. The sole focus

was on the general impact of rising steel prices on public construction projects. Dinsa (2015) investigated the reasons behind and consequences of price increases for Ethiopian federal road contracts, with a particular emphasis on the tender stage. With an emphasis on project cost, Mossa (2013) also investigated the reasons behind price increases and their impact on federal road projects. Price escalation and its management in turnkey projects: the Ethiopian Railways Corporation issue was examined by Tarekegn (2017). The study focused on turnkey contracting. The evaluation of price escalation and adjustment issues on federal road construction projects was examined by Gashaw (2013). The causes, effects, and ways to improve price escalation in road construction projects in SNNPR were also examined by Getnet (2022). The assessment of construction material price inflation in building projects was examined by Admasu (2023) in the context of a few high-rise building projects in Addis Ababa. In addition to constructing on the road and railway sector outside of Admasu, the majority of the aforementioned researchers worked in other regions with distinct goals.

However, previous studies that evaluated the consequences of rising building material prices in various sectors used a variety of methodologies, including questionnaire surveys, interviews, document analyses, and descriptive statistics for data collecting and analysis. Nonetheless, this study used a quantitative and qualitative methodology to examine the extent of construction material price increases on building projects through focus groups, interviews, questionnaire surveys, descriptive statistics, and desk research. Four chosen projects will employ a qualitative data analysis tool to gain a deeper comprehension of the topic. Furthermore, while the previous study provides a general overview, the current research evaluated the current price escalation and adjustment practices in detail.

Moreover, nowadays the government has issued new directive for the incorporation of price adjustment clauses in their contract to all federal projects. The responsiveness of this directive has not been studied previously and this research will answer the responsiveness of this directive with respect to inflation and in meeting the objectives.

Furthermore, this investigation holds implications not only for academic research but also for industry practitioners, policymakers, and other stakeholders seeking insights into optimizing price adjustment practices within the construction sector. Through a thorough examination of the responsiveness of price adjustments in the local construction industry, this study aspires to contribute valuable knowledge that can inform strategic decision-making and foster resilience within the dynamic landscape of construction business operations.

CHAPTER THREE

3. METHODOLOGY

3.1. General

According to Kothari (2004), cited in Abraham (2008), "research methodology is a way to systematically solve the research problem and shall identify the research basis, research hypothesis or questions, research design, and research analysis."

Consequently, this chapter offers a broad overview of the research approach used for this thesis along with a rationale for the methodology.

3.2. Description of study area

The Federal Democratic Republic of Ethiopia's Ministry of Urban Development and Construction (2021) states that a medium sized building is no taller than fifteen stories and at least five stories above the ground.

3.3. The Method of research

Prior to developing the research design, the approach used in this study began with problem identification, which was accomplished through an unstructured literature review, archival research, and casual conversations with colleagues and industry professionals.

On the basis of the developed research strategy, data and information sources were then identified. The research tools were chosen based on the data and information sources, and the available documentary sources that were pertinent to the study were examined. Books, journals, articles, online resources, and archive document searches covering progress reports, completion reports, and contract documents for medium-sized building construction projects are all included in the review. Through random selection and concentrating on projects with higher price escalation values for additional research, the document search was primarily designed to gather price escalation values and their causes for completed or substantially completed and ongoing projects. This allowed for the identification of significant price escalation variables.

Following a thorough literature analysis and desk research, a questionnaire was created and sent to employers, consultants, and contractors to gather their professional opinions based on their experiences. Data has been checked and sorted after the desired data has been obtained. Following data analysis, the validity and conformance of the information gathered from the entire research project were cross-checked. Following this, in-depth talks were held in order to reach a conclusion and provide suggestions based on the study's findings.

In this study, a survey approach that was both exploratory and descriptive was employed. In order to assess how various stakeholders perceive price escalation, the ranking of project price escalation variables, its effects, and the current practice of price escalation administration/management in medium building construction projects, an effort was made to gather data from the pertinent population (clients, consulting firms, and contractors).

As seen in Figure 3.1 below, the entire research document is divided into five (5) main sections:

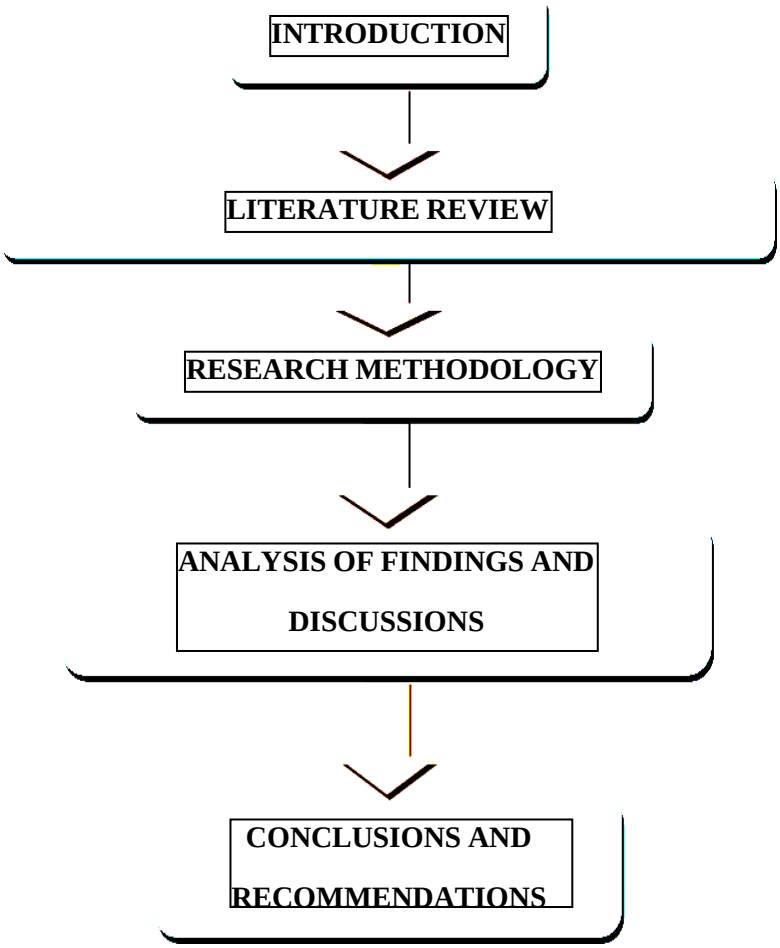


Figure 3.1: Flow chart of the research process

3.4. Data collection

3.4.1. Data source

Questionnaires and interviews were used to gather primary data, and archival records and literature (journals, reports, research, textbooks, and case studies) were used to gather secondary data.

3.4.2. Participants and population

The study's participants are local general contractors and consulting firms with over five years of experience in medium-sized building construction. According to the Federal Democratic Republic of Ethiopia Ministry of Urban Development and Construction (2021), a medium sized building is defined as one that is at least five stories high but no more than fifteen stories. The selection of these specific companies was based on the availability of documents and information, as well as the fact that price increases were more common in the

companies. The primary study participants in this case are the client (FDRE), consultants (general managers, project coordinators, resident engineers, and project supervisors), and contractors (project managers, project management teams, and general managers).

3.4.3. Method of sampling

A representative sample of the population was chosen for the questionnaire using a stratified random sampling technique followed by a systematic random sampling technique. Three strata are used to categorize the populations. Based on the expertise of the construction contractors (33), general contractors (28) and consulting firms (38), the strata are established. Systematic random sampling will be used to choose the sample from each stratum.

3.4.4. The size of the sample

The following elements are taken into account while choosing the right sample size:

- Time allotted for the research project;
- Funds available for the study;
- Sample statistics (i.e., population proportion);
- Confidence level;
- Minimum acceptable level of precision (standard margin of error);

Moore et al. (2003) demonstrated that Equations 3.1, 3.2, and 3.3 can be used to determine the sample size:

$$n = \frac{n^1}{1+\frac{n^1}{N}} \quad \text{[Equation 3.1]}$$

$$n^1 = \frac{S^2}{E^2} \quad \text{[Equation 3.2]}$$

$$S^2 = p\,(1-p) \quad \text{[Equation 3.3]}$$

Whereas, N is the total population (99), n is the sample size from a finite population, n1 is the sample size from an infinite population, S2 is the variance of the population elements, P is the percentage of population items that fall into the specified category and E is the sampling distribution's standard error.

Assumptions:

- Confidence level = 95%
- Population proportion (P) = 0.5
- Margin of error (E) = ±5% = ±0.05

Hence solving for n is as shown in Equation 3.4, 3.5, 3.6 and 3.7 below.

$S^2 = p\,(1-p)$..... [Equation 3.4]

$S^2 = 0.5(0.5) = 0.25$

$E^2 = 0.05^2 = 0.0025$……..... [Equation 3.5]

$$n^1 = \frac{S^2}{E^2} = \frac{0.25}{0.0025}$$ .....[Equation 3.6]

$n^1 = 100$

$$n = \frac{n^1}{1+\frac{n^1}{N}} = \frac{100}{1+\frac{100}{99}} = 49.75 \approx 50$$..... [Equation 3.7]

n = 50

The aforementioned sample size formula indicates the bare minimum of replies that must be received. 10% of the sample size was added in order to account for the non-response rate. Three projects were chosen and examined for the desk study.

3.4.5. Data collection tools

In order to gather all the pertinent information needed to address the study issue, a variety of data collection methods were employed, including case studies, self-administered questionnaires with both closed-ended and open-ended questions, and informal interviews.

The researcher created a questionnaire with thirty questions divided into six sections in order to get the required data from the studied population. The first section asks about the respondent's general information; the second asks about factors that are driving up prices; the third discusses the potential consequences of price increases and the extent to which dynamic fluctuations in the construction industry are affecting the price escalation; the fourth asks about price escalation adjustment; the fifth asks about difficulties and ways to improve price adjustment; and the final section asks for additional information from the respondent. The sampled group received and completed over sixty-four self-administered questions.

CHAPTER FOUR

4. ANALYSIS OF FINDINGS AND DISCUSSIONS

4.1. Introduction

In this section, the data collected from the desk study and questionnaire survey is analyzed and discussed. In medium-sized building construction projects, it covers problems, price escalation adjustment strategies, and ways to manage or administrate price escalation. It also evaluates the sources and extent of price escalation's effects.

4.2. Questionnaires finding and discussion

In order to look at price increases for medium-sized building construction projects in Ethiopia, 64 self-administered questionnaires were distributed to individuals and organizations in the sample area. Respondents provided answers to 57 of those. Respondents were given a series of questions intended to investigate the factors that lead to price escalation, the extent of its effects, difficulties in its adjustment, price adjustment practice, and strategies or tools to manage/administer price escalation, even though the results listed below might not be representative of all medium-sized building projects in the nation.

The internal consistency of the scale was assessed using Cronbach's alpha, which yielded a value of $\alpha = 0.891$. This indicates a high level of reliability, suggesting that the items in the scale have strong internal consistency.

Items/question/component	62
Sum of item variances	66.21114
Variance of total scores	536.4475
Cronbach's ά	0.890945

4.2.1. Respondent's profile

The sample description addresses a number of significant topics that are directly related to the goal of the current study. It aids in predicting the general correctness and dependability of the information gathered from the participants. Responses from highly experienced participants who work for various sized businesses across the nation are included in the data. Additionally, all of the respondents have experience with medium-sized building construction projects, so they may be able to offer pertinent information to address research questions.

A respondent's kind or place of origin within the business, the number of medium-sized building construction projects they have worked on, and the number of stories they have contributed to these projects are all included in their profile.

Due to the relatively small number of medium building constructions supported by the Federal Government, only 16 surveys were delivered to clients, as indicated in Table 4.1 below. As a result, the researcher comes to the conclusion that the 16 questionnaires might reflect how the client feels about these research issues. Although both consultants and contractors complete the same number of questions (24 total), the sample is impartial since

each sample project includes one consultant and one contractor, and an equal percentage of those respondents complete the questionnaires.

Table 4.1: Questionnaire distribution

S.N	Participants	Distributed	No. of response	Percent	Cumulative	Response rate (%)
1	Clients	16	14	25.00	25%	87.50
2	Contractors	24	22	38.60	63.16%	91.67
3	Consultants	24	21	36.84	100%	87.50
Total		**64**	**57**	**100**		**89.06**

The survey had an overall response rate of 57 (89.06%). 14 clients (87.50%), 21 consultants (87.50%), and 22 contractors (91.67%) responded to the survey. As illustrated in Figure 4.1, out of the 57 questionnaire respondents, 14 (25%) were clients, 21 (36.84%) were consultants, and 22 (38.60%) were contractors. As seen in Figure 4.1 below, contractors made up the majority of the respondents.

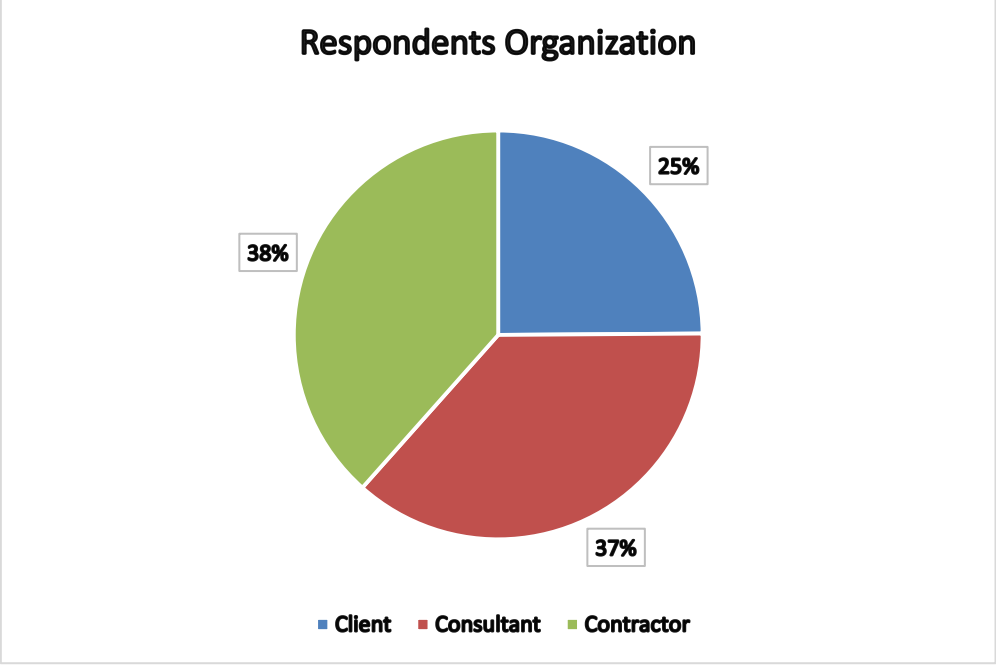


Figure 4.1: Type of respondents` organization

Respondents experience on number of projects involved

In medium building construction, 4% (2) of respondents complete fewer than three projects, 32% (18) complete three to six projects, 40% (23) complete seven to ten projects, and 25% (14) complete more than ten projects, according to Table 4.2.

Table 4.2: Respondents experience on number of projects involved

Project Involved (No)	Client		Consultant		Contractor		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 3			2	10			**2**	**4**
3 - 6	4	29	6	29	8	36	**18**	**32**
7 - 10	5	36	8	38	10	45	**23**	**40**
10	5	36	5	24	4	18	**14**	**25**
Total							**57**	**100**

According to Table 4.3, 53% (30) of the respondents in this survey completed building construction projects with five to ten stories, and 47% (27) completed projects with ten to fifteen stories.

Table 4.3: Respondent's experience on number of stories of the projects executed

Stories of Building Involved (Story)	Client		Consultant		Contractor		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 5								
5 - 10	8	57	10	48	12	55	30	53
10 - 15	6	43	11	52	10	45	27	47
Greater than 15								
Total							**57**	**100**

4.2.2. Factors causing price escalation

The information obtained from the questionnaire survey is analyzed in this section, together with the frequency of occurrences of the factors driving price increases. Internal and external causes are the two categories into which the factors were divided. The respondents were given lists of reasons that contribute to price increases, and they were given a score on a scale of 0 to 4 based on how frequently they occurred. The Relative Importance Index (RII), as viewed by all respondents, was calculated for the overall analysis under each of the individual components contributing to price escalation.

The most significant elements influencing price increases in medium-sized building construction projects in Ethiopia were determined by rating each of the components that contribute to price increases.

4.2.2.1. Internal causes of price escalation

The purpose of this section of the survey is to first ascertain the respondent's viewpoint of the internal factors contributing to price increases. The following Table 4.4 displays the numerical rankings of internal factors that lead to price increases, as determined by the respondents (clients, consultants, and contractors).

Using their relative relevance index, the statistical study of internal variables driving price increases in Ethiopia's medium-sized building construction projects was conducted. Correlations between respondents' rankings of the components were also computed.

The statistical results of respondents' ranking of internal elements contributing to price escalation and relative relevance index with their corresponding rank are displayed in Table 4.4 below.

Table 4.4: The results of internal factors causing price escalation

Internal factors causing price escalation	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Delivery/procurement approach	0.80	3	0.77	5	0.69	2	0.67	7
Project schedule changes	0.80	3	0.80	3	0.65	6	0.71	5
Engineering & construction complexities	0.79	4	0.68	6	0.66	5	0.73	4
Poor estimating	0.82	2	0.83	2	0.68	3	0.88	1
Inconsistent application of contingencies	0.82	2	0.77	5	0.73	1	0.69	6
Ambiguous contract provisions	0.77	5	0.76	4	0.67	4	0.78	3
Improper planning and/or improper implementation of proper planning	0.86	1	0.84	1	0.69	2	0.87	2

Poor estimating, with a RII of 0.88, is the main internal factor responsible for price escalations that have occurred on the projects, as can be seen from the combined result displayed in Figure 4.2. The fact that this outcome is the same for both clients and consultants in terms of order shows how important this aspect is.

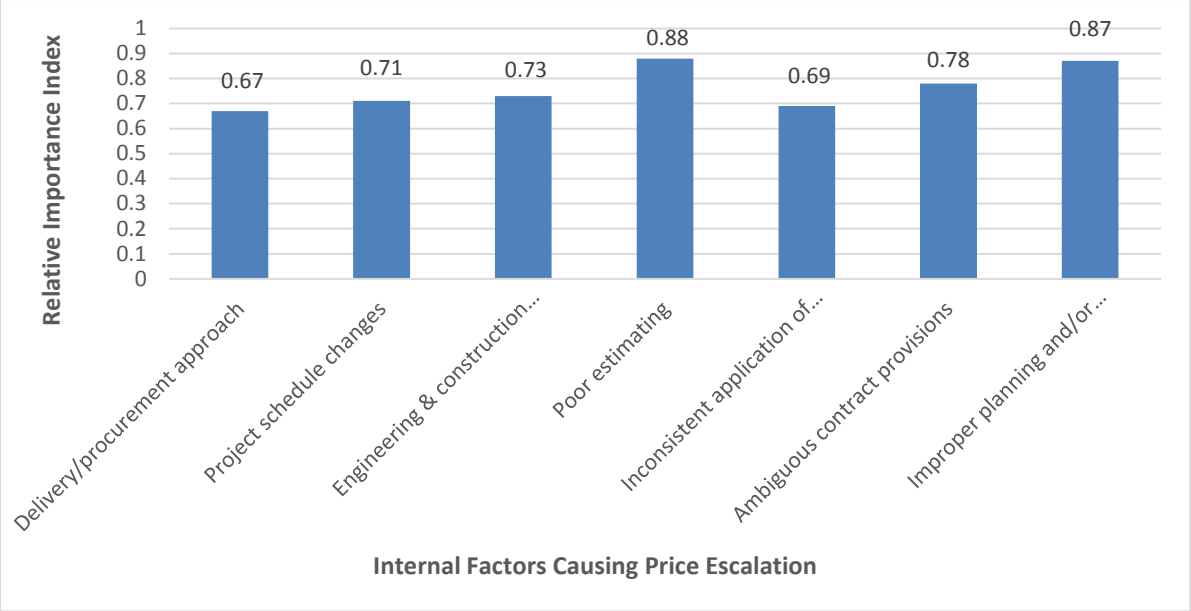


Figure 4.2: Internal factors causing price escalation and their relative importance index

Estimating construction costs is difficult. To reach consistent levels of comfort, thorough exercise based on precise and in-depth knowledge is necessary. Precise project cost estimates are a crucial component of a sound foundation for management choices and oversight. This outcome is consistent with what Hester et al. (1991) found. One of the key elements influencing a construction project's overall success is cash flow predictions, which contractors can generate with more accuracy if they have more precise estimates. Additionally, owners will also generate more accurate forecasts for their projects' budgetary allocations. It is convenient that the owners' main objective when estimating project costs should be to make sure that the procedures used will result in a project that is completed within the allocated budget. Estimating the amount of time and resources needed is a crucial and significant risk. As a result, accurate project estimation is essential to the building sector.

The second significant internal causes of price escalation, with a RII value of 0.87, were identified as inadequate planning, inappropriate execution of proper planning, and modifications to the project schedule. The success of a project has been found to be significantly impacted by appropriate planning for the client organization during the feasibility study preparation of alternatives for successfully achieving specified objectives in terms of time and cost, as well as reasonable work planning (activity + allocated time) and strategies used for the contractor's organization during the project's implementation phase. Similar to the findings of this study, research by Flyvbjerg et al. (2002) and Molenaar (2005) also demonstrated that effective planning was a key contributing element. Throughout construction, planning and scheduling are ongoing procedures that align with available resources and time to advance the project and reduce disputes and price increases.

Inconsistent use of contingencies ranks second from the bottom with a RII rating of 0.69, while the delivery/procurement method ranks last with a RII value of 0.67. Nonetheless, the

majority of the respondents' projects are delivered or procured using the design-bid-build method, and they have taken this delivery method into account in their responses. The purpose of contingency budgeting is to supply money for small change orders without requiring the client to ask for more money or reallocate funds from other projects. At project award, a contingency sum can be budgeted for and prepared for.

Spearman's rank correlation coefficient has been used to calculate the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in ranking the internal components.

The Spearman's rank correlation coefficient in Table 4.5 below indicates that, when it comes to ranking internal factors that lead to price increases for medium-sized building projects in Ethiopia, there is comparatively moderate positive agreement between clients and consultants and very weak positive agreement between clients and contractors. The client and consultants' modest association suggests that their answer ranks on some internal source of price escalation are somewhat similar.

Their responses about the ranking of internal causes of price escalation are the source of the extremely low positive agreement between consultants and contractors as well as between clients and contractors. Resentment stemming from misunderstandings between consultants and contractors as well as between clients and contractors may be one of the causes. The other explanation might be because clients-contractors and consultant-contractors in building projects are not equally exposed to or feel the same way about the risks of price escalation.

Table 4.5: Correlations among respondents in ranking internal factors causing price escalation

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.60	0.04
Consultants	0.60	1	0.01
Contractors	0.04	0.01	1

4.2.2.2. External Causes of Price Escalation

Under this heading, nine (9) external elements were found to be responsible for a project's price increase. The respondents' relative importance index was used to rank these factors (Table 4.6). The external sources of price increases, their relative relevance index, and their rankings among respondents who are clients, contractors, and consultants are displayed in the table below.

Spearman's correlation coefficient was used to measure respondents' agreement in ranking the external factors, and the relative relevance index was used to statistically analyze the external sources of price increases in building projects.

The findings of the relative relevance index of the external factors driving price increases are displayed in Figure 4.3. A comparatively high relative relevance index of 0.92, which demonstrates the significant importance of materials in the project, suggests that increases in material cost (material price fluctuation) are a major contributing factor to price escalation. One of the most obvious causes of project price escalation is an increase in material costs (material price variation). This finding is consistent with ACAF's (2008) finding that one of the primary drivers of price escalation is rising material costs, or fluctuations in material prices.

The location of the project nation, the state of the economy, and the quantity of materials needed all affect how much building materials cost. Each country has a different outcome from this element. Ethiopia has small marketplaces, which makes material issues worse.

With a RII of 0.91, respondents ranked fluctuations in currency exchange rates as the second key factor. This demonstrated that the cost of all goods and services has been rising ever since the exchange rate was deregulated. A nation's balance of payments status may be impacted by fluctuations in foreign currency rates, which can also have an effect on international trade patterns.

However, with a relative relevance index of 0.66, changes in legislation were regarded as one of the least external sources of price rise.

Table 4.6: The result of external factors causing price escalation

External factors causing price escalation	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Local concerns and requirements	0.80	5	0.62	8	0.76	4	0.71	8
Force Majeure	0.80	3	0.63	7	0.70	7	0.76	6
Change in Legislation	0.79	9	0.77	2	0.75	5	0.66	9
Fluctuation in money exchange rates	0.82	2	0.70	5	0.84	1	0.91	2
Increase in global demand for construction	0.82	6	0.61	9	0.75	5	0.83	3

materials								
Limited capacity of material producers	0.77	7	0.75	3	0.73	6	0.81	4
Local or municipal regulations	0.86	4	0.79	1	0.57	7	0.73	7
Increase in material cost (material fluctuation)	0.88	1	0.69	6	0.77	3	0.92	1
Shortage of labors / skilled workers	0.71	8	0.74	4	0.82	2	0.76	5

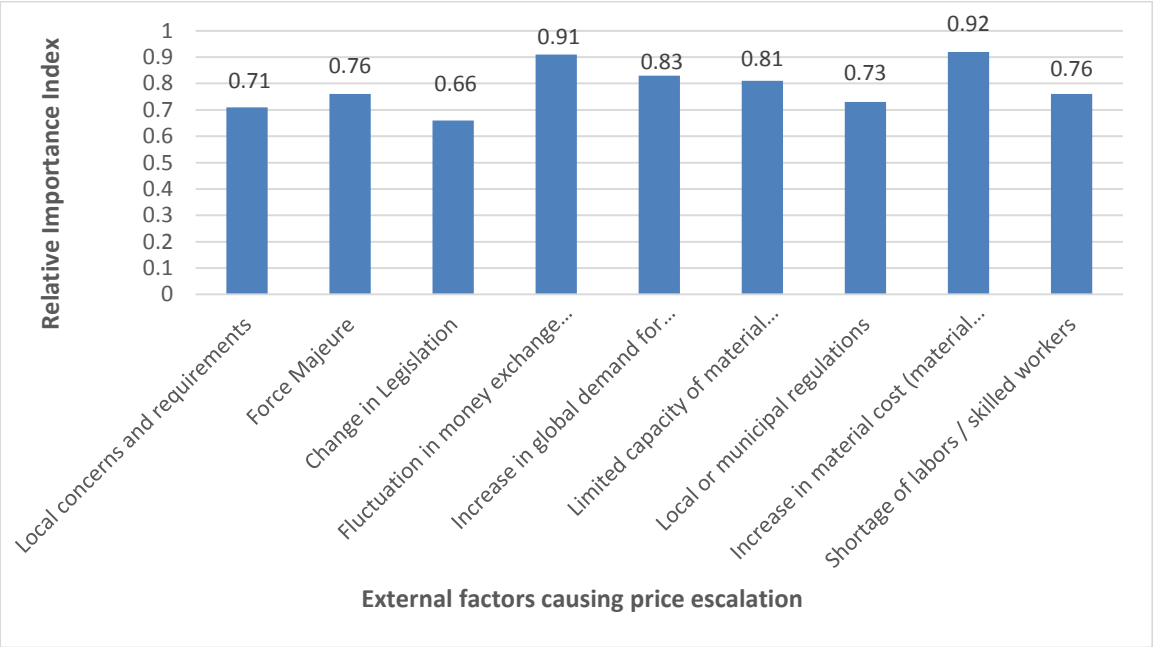


Figure 4.3: External factors causing price escalation and their relative importance index

Spearman's rank correlation coefficient was used to calculate the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in rating the external factors.

Table 4.7: Correlations among respondents in ranking external factors causing price escalation

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.90	0.23
Consultants	0.90	1	0.40
Contractors	0.23	0.40	1

When it comes to ranking external factors that cause price escalation on medium-sized building projects in Ethiopia, the Spearman's rank correlation coefficient in the above table (Table 4.7) indicates that there is, on average, very strong positive agreements between clients and consultants and weak positive agreements between clients and consultants. The extremely high connection between consultants and contractors suggests that they have a common perspective on the outside factors driving price increases.

The poor relationship between contractors and consultants and clients suggests that contractors' attitudes toward owners and consultants are too dissimilar. Because the cause of price inflation occurred, the contractor was the primary party under challenge.

4.2.3. Effects of price escalation

All parties involved in the building sector are impacted by price escalation, however the extent of these effects varies. Economic fluctuations have a very major impact on the construction business, according to 35.71% of respondents, 21.43% significantly, 21.43% moderately, and 14.29% somewhat. According to consultant ratings, economic fluctuations have a very substantial impact on the construction business (38.10%), a strong impact (23.81%), a moderate impact (9.52%), and a modest impact (14.29%). Economic fluctuations have a considerable impact on the construction business in 31.82% of cases, 22.73% in significant cases, 18.18% in moderate cases, and 13.64% in small cases, according to contractor rates. Most customers, advisors, and contractors (35.71%, 38.10%, and 31.82%) reply Changes in the economy have a big impact on construction.

The survey found that clients, consultants, and contractors think that regulatory changes have a big impact on projects at rates of 21.43%, 23.81%, and 22.73%, respectively. Changes in material costs are common, according to most clients (42.86%), consultants (33.33%), and contractors (36.36%). On the other hand, 28.57% of consultants, 27.27% of contractors, and 7.14% of clients said that changes in labor costs have an effect. In general, every responder concurs that pricing changes significantly impact the building sector.

The project owner would be the first to suffer from price increases because he has set a budget and timeline for his construction project. In addition to the individuals directly

involved in a project's development, price increases also have an impact on the construction industry as a whole and, in turn, the nation's economy.

Respondents were shown a component of the questionnaire that included possible impacts found in the literature. Based on their experience assessing the frequencies of the effects in medium building construction projects, respondents were asked to rank the most frequent effects of price escalation from the list of potential effects on a 5-point Likert scale, with 0 representing less significant effects and 4 representing extreme significant effects.

To determine the significant effects among the possible consequences of price escalation, the results of each of these responses were examined. The analysis's outcome was determined by the survey's participants' relative relevance index.

Price escalation's effects on medium-sized building construction projects in Ethiopia have been statistically analyzed using their relative importance index, and correlations between respondents' rankings of the effects have been computed.

The most significant consequences of price increases on Ethiopia's medium-sized building development projects were discernible from the rankings given to each effect. The arithmetical ranking of the effects, as determined by the respondents (customers, consultants, and contractors), is displayed in Table 4.8 below. The relative relevance index value given to each consequence determined the rank.

Table 4.8: The result of effects of price escalation

Effects of price escalation	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Delay	0.68	5	0.69	4	0.79	1	0.95	1
Cancelled Projects	0.68	5	0.65	6	0.36	4	0.77	5
Reduced Numbers of Bidders	0.57	6	0.64	7	0.48	3	0.70	7
Higher Project Costs	0.73	4	0.70	3	0.78	2	0.91	3
Cash flow (project financing) problem of the projects	0.84	1	0.67	5	0.33	5	0.94	2
Dispute among parties	0.82	2	0.83	1	0.33	5	0.86	4
Labour Shortage	0.77	3	0.82	2	0.58	4	0.71	6

Delays, cash flow (project financing) issues, disputes between parties, higher project costs, cancelled projects, labor shortages, and fewer bidders are all ranked from high to low in order of significance based on the results of statistical analysis using the relative importance index.

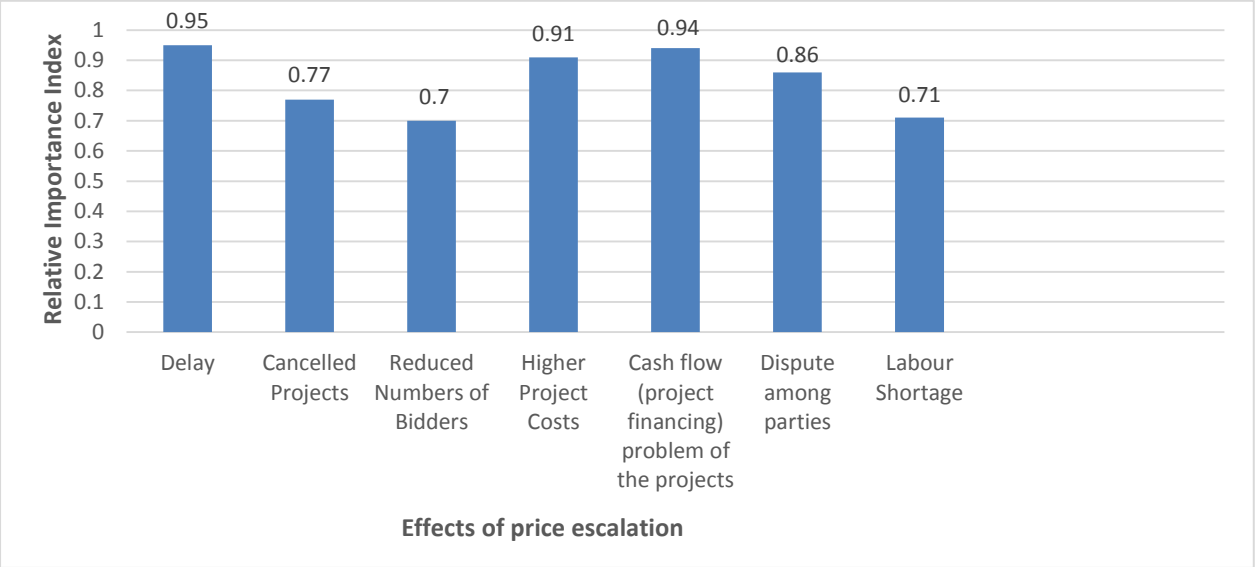


Figure 4.4: Effects of price escalation and their relative importance index

With a RII value of 0.95, the statistical calculations in Figure 4.4 above showed that delay ranks best. Delays are a regular consequence of price increases, and they have an impact on both clients and contractors. Price increases could happen if there is a delay because the cost of necessary supplies or machinery might go up, or these products might run out of stock in the local marketplaces. Long-term delays also significantly raise cost escalations.

With a RII value of 0.94, the cash flow (project financing) issue of the projects, or the contractor's cash flow (cash in and cash out), was identified as the second significant effect. This demonstrates how crucial money is to the project's advancement. Any financial shortfall for the contractor will result in a number of issues, including sluggish progress and a drop in productivity. Additionally, the contractors won't be able to buy the tools and supplies they need for their jobs.

A greater project cost, with a RII score of 0.91, ranks third. Excessive cost increases necessitate more funding, which depletes the nation's limited financial resources and results in a further budget deficit for building projects. This hinders the anticipated rise in the production of real estate and services, which has a detrimental effect on the pace of national growth.

Table 4.8 shows that, with a RII value of 0.86, the conflict between the parties is classified as the fourth one. Large-scale projects typically included intricate financial, legal, and phase-plan and design elements. There was typically overlap and interaction between the parties. As a result, there were more disagreements and associated expenses between the project owner and the main contractor.

Price increases will also cause disagreements among stakeholders and foster hostile relationships amongst project participants. It takes more time to resolve these conflicts, which impacts the project timeline and, ultimately, the project's overall duration. Price increases may have negative effects on the sector as a whole, including a decline in building activity, a damaged reputation, and difficulty obtaining project finance from government agencies in the future. The construction industry's capacity and sustainability are threatened by all of these consequences.

In order to rank the impacts, the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) were computed using Spearman's rank correlation coefficient.

In terms of ranking the effects of price escalation on medium building construction projects in Ethiopia, the Spearman's rank correlation coefficient in the table below (Table 4.9) indicates that there is, on average, very strong positive agreements between clients and consultants as well as between clients and contractors, as well as perfect positive agreements between consultants and contractors. The subsequent impacts, which are directly tied to who is impacted, may be the cause of the extremely high level of agreement.

Table 4.9: Correlations among respondents in ranking effects of price escalation

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.54	0.54
Consultants	0.54	1	1.00
Contractors	0.54	1.00	1

4.2.4. Price escalation assessment

Construction projects frequently experience price increases due to a variety of variables linked to the rising cost of essential building supplies.

The pricing of materials on the market has been extremely variable in Ethiopia in recent years due to the country's rapid economic growth. The cost of everything has gone up significantly and continues to do so. One of the industries hurt by this significant increase in input costs is the building industry.

The expenses of materials, labor, and equipment are the main factors that directly affect construction costs. Additionally, these elements can be separated into subcategories and ultimately into individual objects.

The questionnaire was created so that respondents could respond by choosing and enumerating the items that demonstrated price increases. Additionally, the main materials that demonstrated price increases for medium-sized building construction projects were chosen and identified by the respondents. With 31.17%, 29.87%, 28.57%, and 10.39

unpredictable increases in fuel, rebar, cement, and ceramics, the respondents stated that the main construction inputs they experienced price increases for in medium building construction projects were cement (22.79%), fuel (22.06%), imported ceramics (17.65%), and reinforcement (13.24%).

In Ethiopian construction, the contractor can receive payment for rising cement, gasoline, reinforcing bar, and ceramic costs. Price increases for other items are not reimbursable to contractors unless expressly noted in the special circumstances of the contract.

It is evident from the questionnaire survey responses of respondents (customers, consultants, and contractors) that price increases for construction inputs, particularly for building materials, are frequent.

4.2.5. Ability of contractors to apply price adjustment

Among the respondents 21.43%, 4.76% and 4.55% of clients, consultants and contractors believe the ability of contractors participating in medium building projects with regard to the application of price adjustment is excellent. While 35.71%, 14.29% and 27.27% of client, consultant and contractors rates the ability of contractors participating in medium building projects is very good. The majority of clients, consultants and contractors (42.86%, 33.33% and 36.36%) respond the ability of contractors participating in medium building projects is good. 28.57% of consultant and 13.64 % of contractor rated satisfactory for the ability of contractors participating in medium building projects. And 19.05% of consultant and 18.18% of client rates the ability of contractor is participating in medium building project is poor.

Among the respondents for the ability of contractors is excellent, very good and good is that 28.26% believes that the contractors are using reliable sources of construction materials, 23.91% believes that the price index are including in the contract agreement, 10.87% believes that there is a use of published indices as ministry of finance letter, risk factors are introduced to estimate price and contractors are adopting high profit margin and 15.22% believes that using more accurate price indices.

On the other hand, for the respondent's reason for the contractor's ability to say satisfactory and poor is 21.95% of respondents rates that there is due to lack of contractors awareness on price adjustment system and contractors knowledge gap on the effect of price fluctuation, 19.51% of respondents believe that the rule limit sources of construction materials and there is unavailability of data/lack of documentation to match indices and 17.07% of respondents believed that there is observation limits to compile indexes.

Therefore, most of the respondents believes the ability of contractors participating in medium building construction with regard to the applications of price adjustment is excellent.

4.2.6. Price escalation compensation system

The expenses of materials, labor, and equipment are the main factors that directly affect construction costs. Provisions offer price adjustment clauses in the event that the costs of certain direct cost components increase or decrease. However, in the local context, only four

material components cement, imported ceramics, reinforcement bar, and fuel are subject to price adjustments.

Among the respondents 7.14%, 4.76% and 9.09% of client, consultant and contractors' rates fairness of coefficient ranges assigned to adjustable elements by the contractor is very fair. 50%, 42.86% and 40.91% of client, consultant and contractor rates the fairness of coefficient ranges assigned to adjustable elements by contractor is fair. While 28.57%, 23.81% and 36.36% of client, consultant and contractors rates the fairness of coefficient ranges assigned to adjustable elements by the contractor is satisfactory. And 9.52% of consultants and 13.64% of contractor rates fairness of coefficient ranges assigned to adjustable elements by the contractor is poor. The fairness of coefficient ranges assigned to the contractor is rated fair by most of respondents.

In addition, among the respondent's representativeness of fuel, cement, rebar and ceramics 9.52% and 4.55% of consultant and contractors are rated extremely high. 64.29% and 33.33% of client and contractor have rated representativeness of the four elements as very high. 35.71%, 28.57% and 36.36% of client, consultant and contractors rated high for the representativeness of the four elements for the projects. While, 28.57% and 31.82% of consultant and contractor rated fair poor for the representativeness of the four elements. And 9.52% of consultant and 27.27% of contractors rated not fair for the representativeness of the four elements. As most of the client and contractors rated the representativeness of cement, imported ceramics, fuel and rebar as very high 27.27% of contractor have also rated very poor for the representativeness of thus four elements for the construction of medium building projects.

4.2.7. Sources of data on price of major construction inputs

From the perspectives of clients, consultants, and contractors, five sources of information on the cost of main building inputs were found and ranked. The findings of the relative relevance index and the ranking of the sources of information on the cost of main construction inputs among respondents who were clients, contractors, and consultants are displayed in Table 4.10.

Table 4.10: The result of sources of data on price of major construction inputs

Sources of data on price of major construction inputs	Client		Consultant		Contractor		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Simple Market survey	0.61	5	0.64	4	0.86	1	0.72	4
Ethiopian Statical Service	0.93	2	0.83	2	0.58	4	0.62	5
Letter of Ministry of Finance	0.95	1	0.90	1	0.69	2	0.98	1
Magazines, Such as National Construction Magazine	0.64	4	0.61	5	0.65	3	0.88	2

Their own historical data, Receipts,	0.75	3	0.76	3	0.65	3	0.77	3

Figure 4.5 shows the result of survey study of sources of data on price of major construction inputs. The statistical analysis of sources of data on price of major construction inputs has been done using their relative importance index.

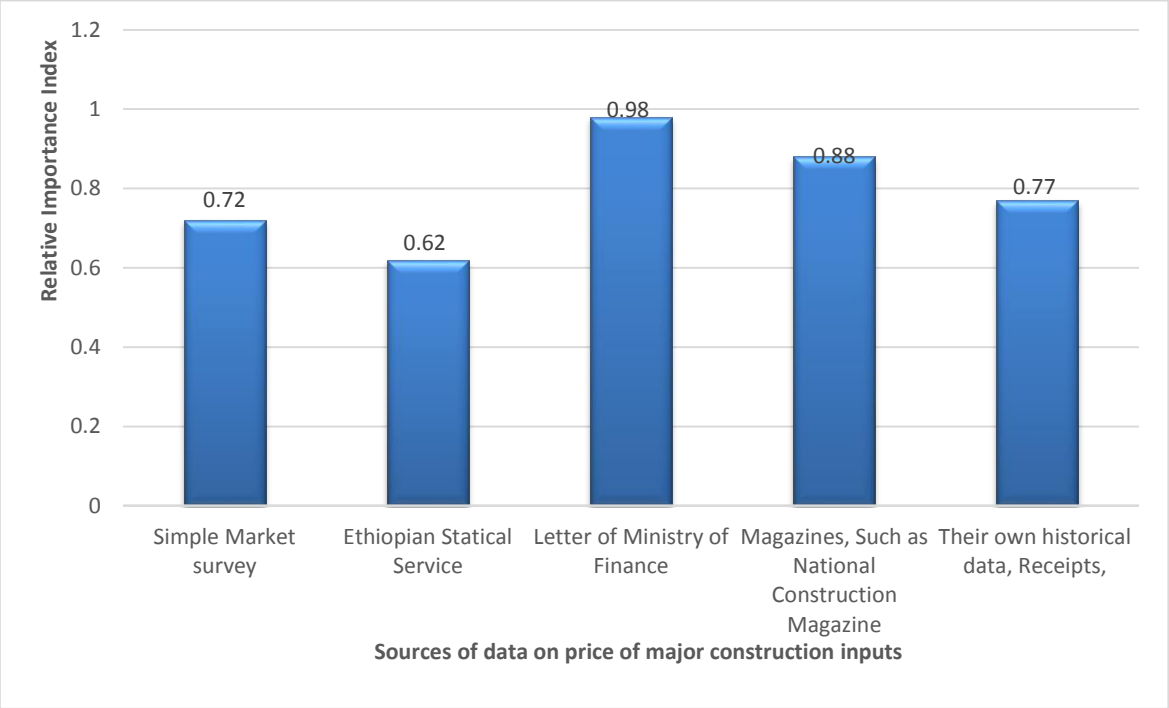


Figure 4.5: Sources of data on price of major construction inputs and their relative importance index

Based on result of analysis letter of ministry of finance, magazines, such as national construction magazine, their own historical data, receipts, simple market survey and Ethiopian statical service ranked on their degree of importance respectively.

Based on the combined relative important index and rank as shown on figure 4.5, the important and top ranked sources of data on price of major construction inputs are discussed below.

Letter of ministry of finance with a relative importance index of 0.98 became the main important sources of data on price of major construction inputs. This is because of ministry of finance has issued rates for the major inputs through their directives. All the parties are using the source of ministry of finance for the purpose of price adjustment as base price and current price of their projects.

Using magazines, such as national construction magazine and their own historical data, Receipts, with RII value of 0.88 and 0.77 became the important sources of data on price of major construction inputs next to letter of Ministry of Finance. Additionally, with a RII value

of 0.62, Ethiopian Stastical Service came in last. The lack of compiled data gathered by statisticians in recent years may be the cause of this.

Spearman's rank correlation coefficient was used to calculate the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in order to rank the sources.

Table 4.11: Correlations among respondents in ranking Sources of data on price of major construction inputs

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.90	1
Consultants	0.90	1	0.90
Contractors	1	0.90	1

The Spearman's rank correlation coefficient in Table 4.11 above demonstrates that, when it comes to ranking sources of information on the cost of major construction inputs for medium-sized building construction projects in Ethiopia, there is perfect agreement between clients and contractors and a very strong positive agreement between clients and consultants.

4.2.8. Benefits of using price adjustment clauses

The benefits of implementing price adjustment clauses in medium-sized building construction projects have been statistically analyzed using their relative importance index, and the Spearman's correlation coefficient has been used to measure the respondents' agreement in rating the benefits.

The findings of the relative relevance index of the advantages of utilizing price adjustment clauses are displayed in Figure 4.6. According to statistical results, with a relative relevance index of 0.98, the majority of respondents concurred that lower bid prices was an advantage of utilizing price adjustment clauses. Table 4.12 shows that both clients and consultants identify a lower bid price as the main reason to include price adjustment provisions. A higher number of bidders, on the other hand, was evaluated as the least advantageous application of price adjustment clauses, with a relative relevance index of 0.86. There is full agreement between consultants and contractors when it comes to ranking this factor (Table 4.12).

Table 4.12: The result of benefits of using price adjustment clauses

Benefits of using price adjustment clauses	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Increase efficiency, fitness for purpose and value for money	0.80	7	0.81	6	0.91	1	0.79	8

Lower bid prices	0.95	1	0.96	1	0.61	6	0.98	1
Allows the contractor to calculate the true cost of the project	0.89	4	0.82	5	0.83	4	0.93	3
Better market stability	0.93	2	0.90	2	0.91	1	0.94	2
Increased number of bidders	0.70	8	0.70	8	0.84	3	0.86	7
More consistent contractor profit margins	0.86	6	0.79	7	0.80	5	0.92	4
More bidders and few contract retractions	0.88	5	0.86	4	0.86	2	0.91	6
Better reliability in the supply chain	0.91	3	0.89	3	0.42	7	0.92	5

Figure 4.6 was created to illustrate the relative advantages of utilizing price adjustment clauses based on the results in the table above. The statistical results of the relative relevance index and ranks of the advantages of applying price adjustment clauses are displayed in Table 4.12. It can be seen from the table that several advantages have comparable relative importance indices, and the ranks of those approaches correspond to the same degree of significance.

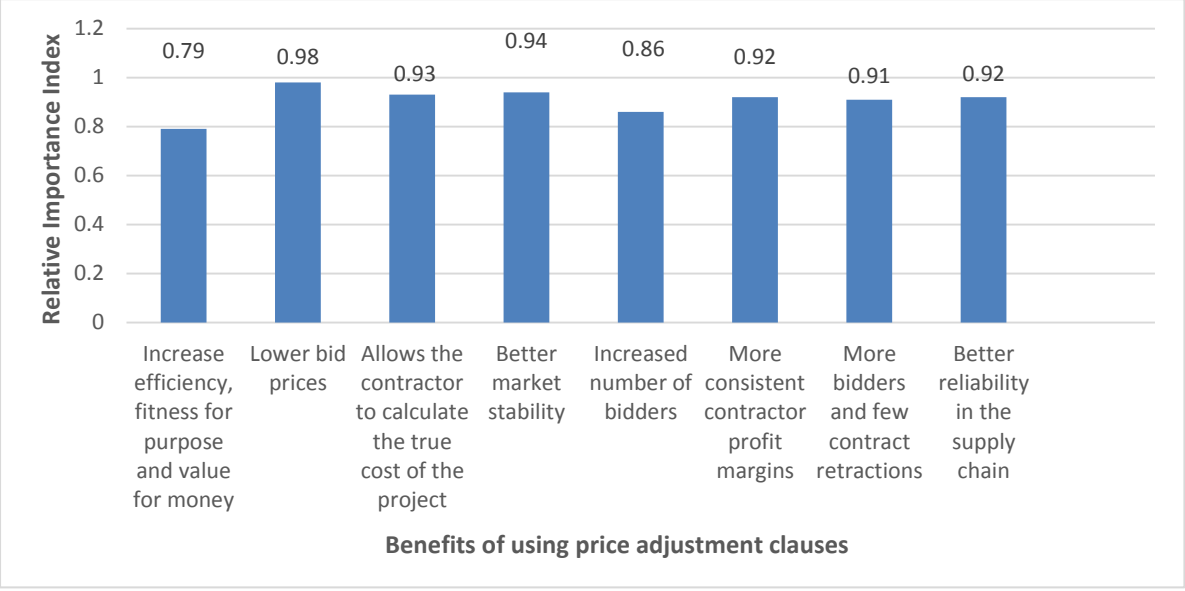


Figure 4.6: Benefits of using price adjustment clauses and their relative importance index

Spearman's rank correlation coefficient has been used to calculate the agreements among respondents (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in ranking the benefits.

In terms of ranking the advantages of using price adjustment clauses, which significantly contribute to the successful completion of medium building construction projects in Ethiopia, the Spearman's rank correlation coefficient in the table (Table 4.13) indicates that there is, on the whole, perfect agreement between consultants and contractors as well as a strong positive agreement between clients and consultants.

Table 4.13: Correlations among respondents in ranking benefits of using price adjustment clauses

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.95	0.95
Consultants	0.95	1	1
Contractors	0.95	1	1

4.2.9. Risks of using price adjustment clauses

Spearman's correlation coefficient was used to measure the respondents' agreement in rating the approaches, and their relative relevance index was used to statistically analyze the risks of implementing price adjustment clauses in medium-sized building construction projects.

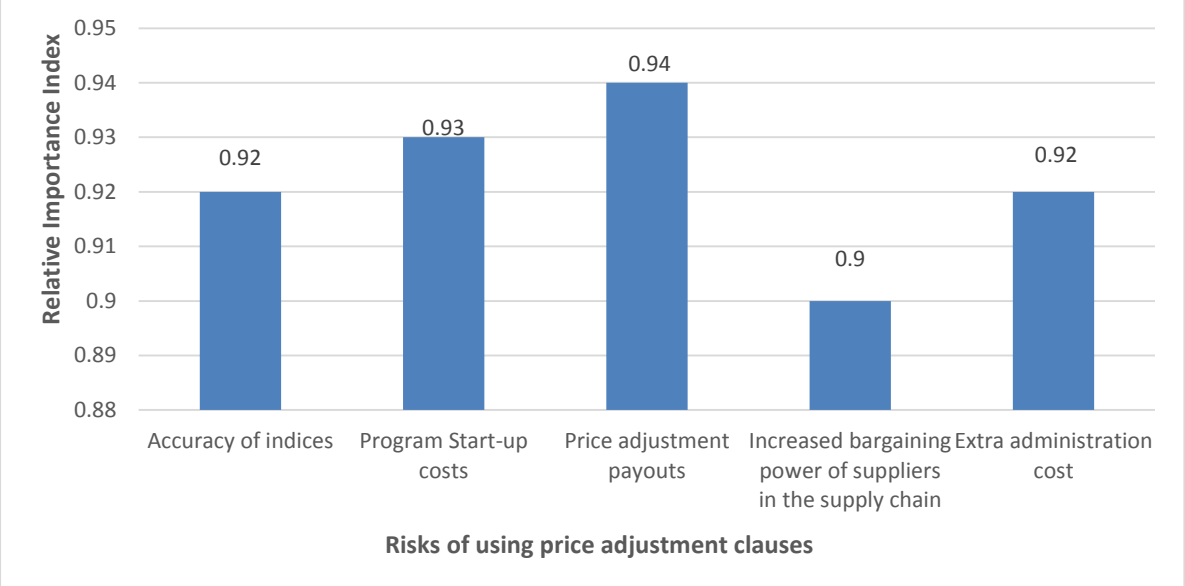
The results of the relative relevance index of the risks associated with using price adjustment clauses are displayed in Figure 4.6. According to the statistical results, the majority of respondents concurred that price adjustment payouts with a relative relevance score of 0.94 are the risks associated with utilizing price adjustment clauses. Table 4.12 shows that contractors, consultants, and customers view price adjustment payouts as the top, second, and third risks associated with implementing price adjustment clauses. With a relative relevance rating of 0.90, the usage of price adjustment clauses was found to provide the least risk due to the improved negotiating strength of supply chain suppliers. There is full agreement between consultants and contractors when it comes to ranking this factor (Table 4.14).

Table 4.14: The result of risks of using price adjustment clauses

Risks of using price adjustment clauses	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Accuracy of indices	0.96	2	0.62	4	0.95	2	0.92	3
Program Start-up costs	0.80	5	0.74	1	0.88	5	0.93	4
Price adjustment payouts	0.95	3	0.70	2	0.97	1	0.94	1

Increased bargaining power of suppliers in the supply chain	0.98	1	0.60	3	0.92	3	0.90	5
Extra administration cost	0.93	4	0.57	5	0.89	4	0.92	2

The following Figure 4.7 was created to illustrate the levels of risks associated with implementing price adjustment clauses based on the results in the table above. The statistical findings of the relative relevance index and corresponding ranks of the risks associated with the application of price adjustment clauses are displayed in Table 4.14. It can be seen from the table that several advantages have comparable relative importance indices, and the ranks of those approaches correspond to the same degree of significance.



Price adjustment clause risks and their relative relevance index are shown in Figure 4.7.
Using spearman's rank correlation coefficient, the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) regarding risk rating were computed.
The Spearman's rank correlation coefficient in Table 4.15 indicates that, in terms of ranking the risks of using price adjustment clauses, there is a strong positive agreement between the client and the consultant and between the client and the contractor, as well as perfect agreement between the consultants and the contractor. These factors significantly contribute to the successful completion of medium-sized building construction projects in Ethiopia.

Table 4.15: Correlations among respondents in ranking Risks of using price adjustment clauses

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.6	0.6

Consultants	0.6	1	1
Contractors	0.6	1	1

4.2.10.Drawback of using formula method of price adjustment

The domestic construction sector often uses two ways of price adjustments: indices (formula) and proved (base price). prior initiatives that used tried-and-true base pricing adjustment techniques. Sub-clause 47.1 of PPA 2006, Sub-clause 13.8 of FIDIC 1999 and FIDIC 2006 MDB and clause 62 of PPPAA 2011 edition provide price indices/formula method for adjustment. Because all of the respondents' projects are covered by the PPPAA 2011 condition of contract, the formula technique is employed for this study.

48% of the respondents think that excluding the sources of the information in the contract document at the time of contract signing is the main disadvantage of employing the formula technique in their agreement. This indicates that the parties to the contract typically did not cite sources of information in their contract when they signed it. However, 41.33% of respondents think that the disadvantage of adopting the formula method is the need to create local pricing indexes and update them on a regular basis. Additionally, 10.67% of respondents think that using currency correction and using foreign price indexes to balance inflation is a disadvantage of the formula method. There are no recognized domestic pricing indices, as is well known. Thus, who voted in favor of it said that local pricing indices should be established and updated on a regular basis. Conversely, the majority of respondents recommend using foreign indices and mentioning the source of resources in the contract document when it is signed.

4.2.11.Price escalation administration system

42.11% of respondents said that the PPA form of contract was a good fit for managing price adjustments in the medium-sized building construction industry. However, 33.33% of respondents believe that PPA contracts are a very good way to manage price adjustments in the medium-sized building construction industry. 15.79% of the respondents gave it an excellent rating. Only 8.77% of respondents gave it a satisfactory unsatisfactory rating.

According to the respondents, 61.40% believe that the price adjustment amount paid to contractors for fluctuations in major construction inputs for medium buildings should be between 50-60%. Additionally, 21.05% think it should be 30-50%, while 7.02% suggest 10-30%. The remaining respondents indicate less than 10% (5.26%) or greater than 60% (5.26%). This indicates that the majority of respondents believe contractors should receive compensation for price fluctuations in major construction materials, with the most common adjustment amount being 50-60%.

In terms of the accuracy of work quantities and unit rates prepared by engineers at the tender stage, 64.91% of respondents feel this accuracy falls within the 50-75% range. Additionally, 21.05% believe it is below 50%, while 14.04% think it exceeds 75%. This suggests that most

respondents view the accuracy of these quantities and rates as primarily in the 50-75% range, which is consistent with the previously discussed adjustable amounts during construction.

4.2.12.Difficulties associated with using price indices

The relative relevance index was used to statistically analyze the challenges of employing pricing indices in medium-sized building construction projects, and spearman's correlation coefficient was used to measure respondents' agreement in rating the challenges.

Figure 4.8 shows the results of relative importance index of the difficulties associated with using price indices. Based on statistical result late release of published data in using Foreign/local indices is very frequently difficulties associated with using price indices of a project with relatively high relative importance index of 0.92. From table 4.16, it can observe that Late release of published data in using Foreign/local indices is ranked by both contractors itself and consultants as a primary difficulty associated with using price indices. While Human error ranked as a least difficulty with relative importance index of 0.87.

Table 4.16: The result of methods to manage/administer price escalation

Difficulties associated with using price indices	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Late release of published data in using Foreign/local indices	0.96	2	0.98	1.00	0.99	1.00	0.99	1
Inadequate recovery of costs	0.91	5	0.92	3.00	0.92	4.00	0.95	4
Particular work item of interest will not be included in the published indices	0.95	3	0.90	5.00	0.90	5.00	0.93	5
Non familiarity with computation	0.98	1	0.93	4.00	0.94	2.00	0.98	2
Indices based on historical data	0.79	10	0.89	6.00	0.89	6.00	0.97	3
High subscription fees	0.84	7	0.85	7.00	0.86	7.00	0.92	6
Obsolete methods and components	0.93	4	0.94	2.00	0.93	3.00	0.89	9
Human error	0.80	9	0.82	9.00	0.81	10.00	0.87	10
Average Data	0.82	8	0.83	8.00	0.85	8.00	0.91	7
Limited observations to compile indexes	0.89	6	0.80	10.00	0.84	9.00	0.90	8

From the result in table above the following Figure 4.8 was developed to show the ranks of difficulties associated with using price indices. Table 4.16 shows, the statistical results of difficulties associated with using price indices relative importance index and their respective ranks.

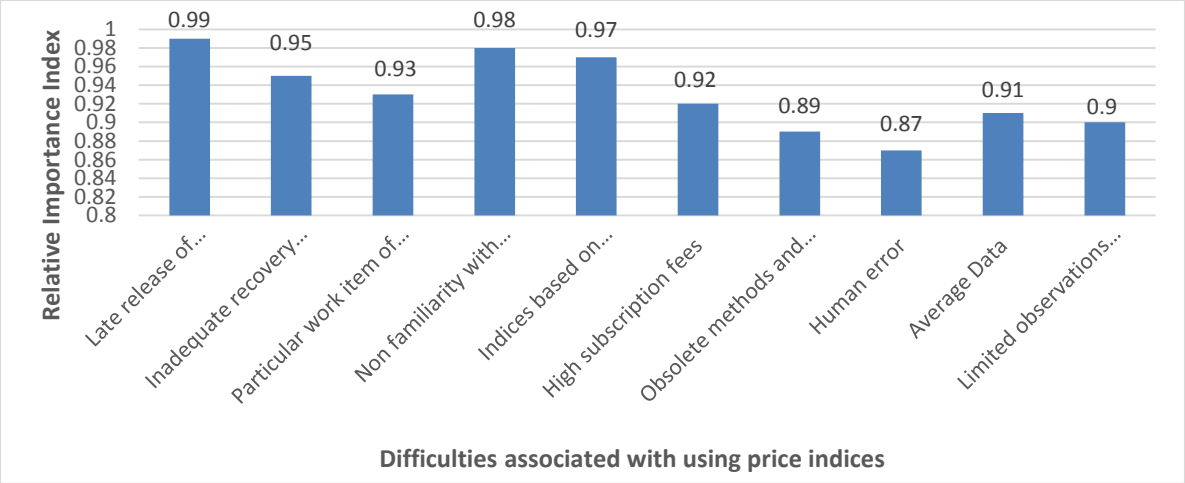


Figure 4.8: Difficulties associated with using price indices and their relative importance index

Spearman's rank correlation coefficient was used to calculate the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in ranking the challenges.

When it comes to ranking the challenges of using price indices, which are common in medium-sized building construction projects in Ethiopia, there is a comparatively strong positive agreement between contractors and consultants, clients and consultants, and contractors and consultants, according to the Spearman's rank correlation coefficient in Table 4.17.

Table 4.17: Correlations among respondents in ranking difficulties associated with using price indices

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.67	0.79
Consultants	0.67	1	0.95
Contractors	0.79	0.95	1

4.3. Challenges of using indices method of price adjustment

The statistical analyses of challenges of using indices method of price adjustment in medium building construction projects have been done using their relative importance index and agreements between respondents in ranking the challenges has been done through spearman's correlation coefficient.

Figure 4.9 shows the results of relative importance index of the challenges of using indices method of price adjustment. Based on statistical result unavailability of data is strongly agreed by challenges of using indices method of price adjustment of a project with relative importance index of 0.99. From Table 4.18, it can observe that Unavailability of data is ranked by all the respondents as a primary difficulty associated with using price indices. While limited list of basic item headings or classes ranked as a least difficulties with relative importance index of 0.92.

Table 4.18: The result of challenges of using indices method of price adjustment

Challenges of using indices method of price adjustment	**Client**		**Consultant**		**Contractor**		**Combined**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Change in reliable sources	0.93	2	0.92	3.00	0.91	3.00	0.97	3
Unavailability of data	0.98	1	0.96	1.00	0.98	1.00	0.99	1
Change in project costs	0.91	3	0.95	2.00	0.92	2.00	0.98	2
Use of constant weighting/Coefficients throughout the project life time	0.89	4	0.86	5.00	0.88	4.00	0.95	4
Limited list of basic item headings or classes	0.88	5	0.89	4.00	0.85	5.00	0.92	5

From the result in table above the following Figure 4.9 was developed to show the ranks of challenges associated with using price indices. Table 4.18 shows, the statistical results of challenges of using indices method of price adjustment indices relative importance index and their respective ranks.

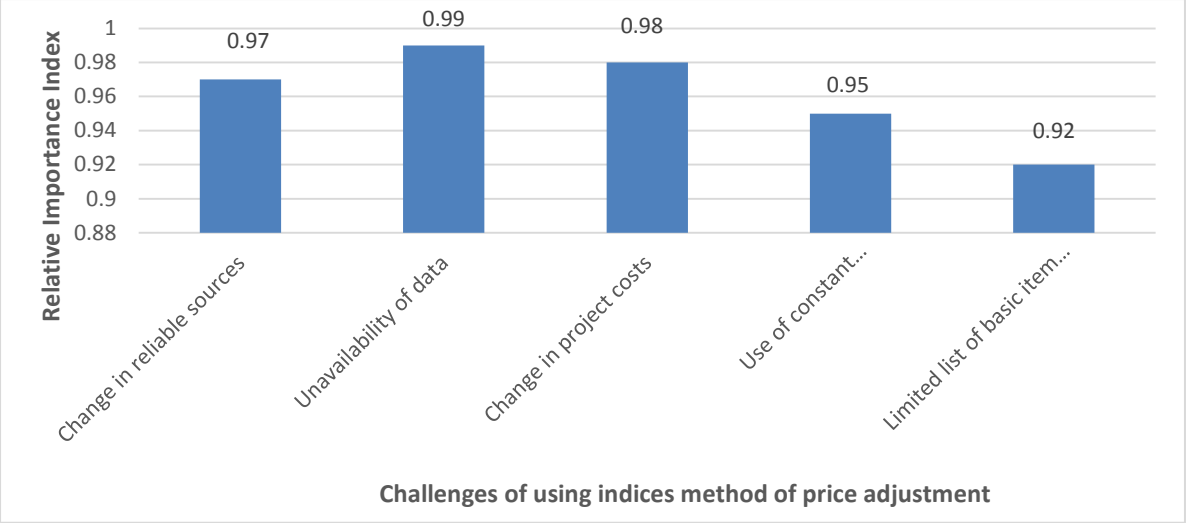


Figure 4.9: Challenges of using indices method of price adjustment and their relative importance index

Spearman's rank correlation coefficient was used to calculate the respondents' agreements (i.e., between clients and consultants, clients and contractors, and contractors and consultants) in ranking the challenges.

The Spearman's rank correlation coefficient in Table 4.19 indicates that, in terms of ranking the difficulties of using the indices method of price adjustment, which is highly agreed upon in medium building construction projects in Ethiopia, there is comparatively strong positive agreement between contractors and consultants, clients and consultants, and contractors and contractors.

Table 4.19: Correlations among respondents in ranking challenges of using indices method of price adjustment

	Spearman's rank correlation coefficient (r's)		
Respondents	Clients	Consultants	Contractors
Clients	1	0.8	0.9
Consultants	0.8	1	0.9
Contractors	0.9	0.9	1

4.2.6. *Suggestions to reduce challenges of price adjustment and mitigate adverse effect of price fluctuation on building construction projects*

In order to lessen the difficulties associated with price adjustment and lessen the negative effects of price fluctuations on medium-sized buildings, 27.78% of respondents recommended that the contractor follow advantageous regulations and offer necessary adjustments to the existing price adjustment techniques. To lessen price adjustment difficulties and lessen the negative impact of price fluctuations on medium-sized building construction projects, 26.98% of respondents advise the contractor to appropriately incorporate price adjustment clauses. In order to lessen the difficulties associated with price adjustment and lessen the negative impact of price fluctuations on medium-sized building construction projects, 24.6% of the respondents advise the contractor to create their own price database and use it to estimate bids. In order to lessen the difficulties associated with price adjustment, 20.63% of respondents advise the contractor to enhance their capacity to forecast price fluctuations and recommend reasonable coefficients for project life-time adjustable elements.

According to the responses, 33.64% advise creating precise estimates of quantities and unit pricing at the tender stage, and 35.51% advise consultants to include price adjustment clauses in their contracts. Furthermore, 30.84% of respondents think that in order to handle issues with price adjustments and lessen the effect of price swings on medium-sized building construction projects, consultants ought to establish their own price databases.

To help manage price adjustment challenges and lessen the negative effects of price fluctuations, 45.83% of respondents advise clients to include price adjustment clauses in their contract documents, 28.13% suggest creating their own price databases, and 26.04% recommend consistently requesting firm prices.

Additionally, 26.62% of respondents think the regulating authority should create a robust and trustworthy price database, and another 26.62% recommend routinely checking on how the current regulations are being applied. Furthermore, 20.86% stress the significance of continuously regulating and controlling the market to lessen the difficulties of price adjustments and the effects of price fluctuations on medium building construction projects, and 25.90% suggest that the regulatory body review rules and regulations on a regular basis.

4.4. Selected desk studies finding and discussion

4.4.1. Introduction

The desk studies were gathered from three medium-sized building construction projects that were chosen from the population. Archival records, such as completion and progress reports, payment certificates, contract documents, and unstructured interviews, were employed as data sources to gather all the pertinent information.

By examining the payment certificates, progress reports, and completion reports for a few chosen medium building construction projects, the desk study examined the degree of price escalation.

In this paper specifically try to understood and to have forward-looking for the impacts of inflation on the projects, degree of responsiveness of price adjustment practices related to escalation of construction cost of projects and to create common understanding on the application, drawbacks, awareness and implementation problems of price adjustment in the construction sector. This industry is big sector with different stakeholders and with different interests. Therefore, all the stakeholders have to understand the problem and ready for proper response in this regard to share unforeseen situations during the construction phase. Hence, this case study is a sample representative of the actual situation in our country. I hope that after reading this case study the reader will have a common understanding on the impact of inflation, responsiveness of price adjustment practice and government involvement in application of it.

4.4.1.1. Project 1: The Construction of B+G+ 7 Kolefe Justice Body Secretaries Building

The total original contract amount of the B+G+7 Kolefe Justice Body Secretary Building construction work project is ETB 241,306,514.01 including 15% VAT (Birr Two Hundred Forty-One Million Three Hundred Six Thousand Five Hundred Fourteen and cents 01/100). The project commencement date was April 30, 2020 and the original time for completion is October 30, 2021, with a contract period of 548 calendar days. Based on justified EOT, the project revised completion date has become on May 1, 2025 G.C.

Both structural and finishing work are included in the contract value. As of right now, the project is 90.83% complete, and the contract value has increased by 136%. As previously said, in accordance with the contract agreement, the project will complete its work by October 30, 2021, with an approximate 100% completion rate anticipated on this date. But now that five and a half years have gone by, the project is nearing its conclusion with 90.83% of the work completed and a significant delay.

The Public Procurement and Property Administration Agency's (FPPAA) general contract conditions (Version 1, August 2011) govern the project. The following describe how inflation affects the project and how pricing adjustments are applied:

History related to cost and Income of the project

After the signing of the Contract the contractor faces inflation of construction resources basically on major materials categorized on cement, rebar, diesel and finishing materials. Due to this case, the contractor is unable to execute the work as per the planned schedule and the cash flow of the project is totally disturbed. It is understood that the market in our country's construction industry is highly dynamic where the price of most of the construction material escalates rapid. The impact of price escalation gets even very risky and threating to the contractor on project with longer duration due to high possibility of material price changes risking the contractor's profitability and even which may lead the company to liquidation. Comparison of basic materials as of the project start, after 12 months of the project start date,

after 18 months of the project start date and as of current status of the project is shown in Table 4.20 below.

Table 4.20: Comparison of basic materials as of the project start, after 12 months of the project start date, after 18 months of the project start date and as of current status of the project

S. N	Description of the Item	Unit	Unit Price in November 11, 2019 G.C (project start date) (Birr)	Unit Price in November 10, 2020 G.C (after 12 months) (Birr)	increment %	Unit Price in May 4,2021 G.C (after 18 months) (Birr)	incrnt %	Unit Price as of current status (December,2024) (Birr)	increment %
1	PPC Cement	Qtl	204.35	216.94	6 %	253.47	24%	887.83	334%
2	Re- Bar	kg	31.37	41.14	31 %	55	75%	130.73	317%
3	Ceramic	m2	295.80	301.62	2%	336.66	14%	3250	999%
4	Fuel	lit	18.03	19.09	6%	23.18	29%	90.28	401%

Execution vs. Contract

The value of the executed amount up to the end of December 2024 indicates that 90.83 % of the project gets completed. The remaining volume of work (9.17%) is yet to be accomplished within the remaining contract durations. Execution Vs, Contract is shown in Table 4.21 below.

Table 4.21: To date execution with respect to the contract amounts

Project Name	Contract Amount before VAT ETB	Executed Amount before VAT ETB	Remaining Amount	Execution vs. Contract Amount	Time Elapsed %
2B+G+7Kolfekeraniyo Sub-City Justice	209,831,751.31	190,590,179.71	19,241,571.60	90.83%	337%

Body Secretary Building					

Table 4.22: Revenue categorized by execution and material on site before price adjustment

Project	Advance	Execution	Mos	Exec. +Mos	Total
2B+G+7 Kolfe keraniyo Sub-City Justice Body Secretary Building	62,949,525.39	190,590,179.71	NA	190,590,179.71	190,590,179.71

As can be understood from Table 4.22 herein above there were no actual record of material on site up to the end of December 2024 at the project.

Contract Time Vs, Execution of the project

Contract time with respect to execution of the selected project is shown in Figure 4.10 below.

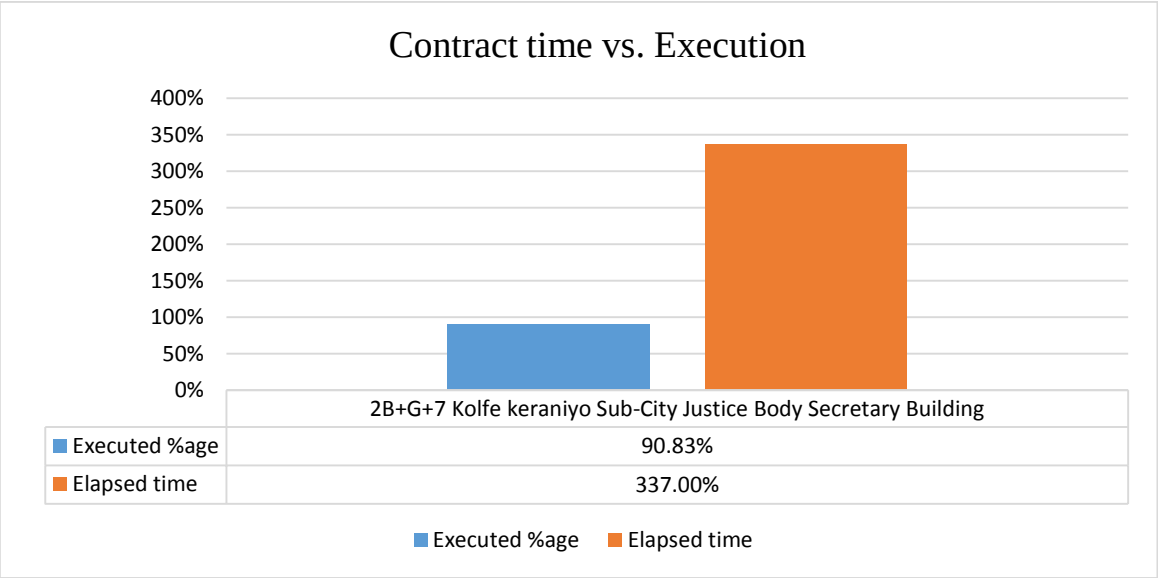


Figure 4.10: Linear projects slippage, contract time vs. Execution

Contract time elapse information of the project is shown in the Table 4.23 below.

Table 4.23: Contract Time elapse information

No	Project Name	Commencement Date	Original completion Date	Approved EOT	Revised completion date	Original completion period	Elapsed time	Elapsed time %

1	2B+G+7 Kolfe keraniyo Sub-City Justice Body Secretary Building	30-Apr-20	30-Oct-21	1279	01-May-25	548	1848	337%

Revenue analysis

As discussed and shown in Table 4.24 below, to date revenue of ETB 190,590,179.71 has been generated. Out of this total sum, the employer's representative has approved 93 % or ETB 175,342,965.33 at the end of December 2024 from the total revenue collected to date. (The detail can be referred in the Table 4.24 herein below)

Table 4.24: Revenue generated to date before price adjustment

Project	**Advance**	**Certified Execution**	**Net Mos. advance**	**Price Adj.**	**Total Certified Amount by the Employer (Gross Income)**
2B+G+7 Kolfe keraniyo Sub-City Justice Body Secretary Building	62,949,525.39	190,590,179.71	NA	NA	175,342,965.33

Expense Analysis

In this section, the cost incurred up to the end of December 2024 is presented along with relevant statistical analysis. Finance Department's expense report is used for compares and further analysis to show profit/loss of the projects as shown in detail in the table 4.25 and 4.26. Cost archive of projects categorize expense in to number of cost accounts such as; Construction material, Labor, Equipment and overhead expense among others. As such, for easy of analysis we grouped the detailed cost in to four major categories as shown in Table 4.25 herein below. Hence, up to the end of this December 2024, according to Finance Department's report of the Company consumed 302.1 million birrs for running the project.

Table 4.25 Expense category

No	**Year**	**Expense (Amount)**	**% age (%)**

1	Material	211,101,678.82	69.87%
2	Labour	36,575,394.23	12.11%
3	Equipment	37,193,626.14	12.31%
4	Overhead	17,252,796.69	5.71%
		302,123,495.88	

Out of the total spending; Material, labour, equipment and overhead cost, material costs takes up the higher rank in the list. These statistics indicates that care shall be exercised for construction material management as to their effectiveness and efficacy. On the other hand, equipment, labor, and overhead cost turn out to be 12.31%, 12.11% and 5.71% respectively according to Finance department's report of the company.

Moreover, the net cash flow as profitability measurement that represents the amount of money produced or lost up to the end of December 2024 is calculated from the difference between cash inflows and cash outflows. This metric is typically an indicator of the project's financial strength. Here the loss shown according to finance department is due to the inflation which affects the projects progress.

In this section, the cost incurred up to the end of December 2024 is presented along with relevant statistical analysis. Finance Department's expense report is used for compares and further analysis to show profit/loss of the projects as shown in detail in the Table 4.25 and 4.26.

Table 4.26: Gross revenue and Expense up to end of May 2024

No	**Description**	**Income**	**Expense**	**Loss**
1	Income and Expense according to finance department report	190,590,179.71	302,123,495.88	(111,533,316.17)
	Total	**190,590,179.71**	**302,123,495.88**	**(111,533,316.17)**

Encountered issues and measures taken on the project as shown in Table 4.27 below.

Table 4.27: Encountered Issues and Measures Taken on the Project

NO.	**ENCOUNTERED ISSUES**	**MEASURES TAKEN**

1.	Cement scarcity	Purchase with extra cost, Supporting letters has been collected from clients to get Cement in priority.
2.	Fuel shortage	Keep on with stock
3.	Difficulties to get key personnel	Request for Price Adjustment
4.	Budget Limitation	The project has implemented "Pay when paid principle"
5.	Cash Flow Shortage	Request for Price Adjustment
6.	Dispute Among Parties	Arranging different meeting to solve problems
7.	Poor performance of subcontractors	
8.	Delay	Requesting for EOT and PA

Hence, as can be seen from the above Table 4.27 the impact of inflation goes beyond reasonable control of the contractor. The Impact of inflation leads to unavailability of cement and fuel, shortage of cash flow, delay of the project. As per the companies' representatives have informed, the impact of the inflation has very significantly affected the projects performance to accomplish with the planned budget and time. Then, as per the Government's consideration for application of price adjustment due to significant amount of market inflation and to resolve problems related to the impact of the project arise from inflation, the contractor considers price adjustment to support the project's cash flow and request the employer for price adjustment.

Price adjustment practice of the project

As per the Government's consideration for application of price adjustment due to significant amount of market inflation and to resolve problems related to the impact of the project arise from inflation and as per the contract agreement, the contractor considers price adjustment to support the project's cash flow and request the employer for price adjustment. Price adjustment considers the fluctuation of cost of materials, labor and equipment due to currency fluctuation, inflation, shortage of materials due to some other on-going project, or any other circumstances that varies the cost. It can result in increase or decrease of actual cost, depending on the fluctuation of current indices comparing to base indices. In this project, the project is subjected to price adjustment as stated in special condition of contract GCC clause 62.1 and the payment on Price adjustment is prepared by the contractor incompliance to the contractual entitlements stipulated under the contract in order to compensate losses incurred due to escalation of material prices for the works executed from IPC 1 up to IPC 17 of the project.

Challenges faced to apply price adjustment of the project

Price adjustment has been dealt differently. Price Adjustment methods have their own inherent limitations. Besides the contract provisions add their own problems. The problems become even worse when price adjustment is put in practice. The problems faced on the project are discussed as follows;

Problem 1- Improper representative material selection

One of the challenges during application of the price adjustment is that the project's contract under special condition of contract GCC clause 62 provides stipulations enabling entertainment of price adjustment of the contract price. But, even though the contract GCC clause 62.13 postulates to determine in the SCC the fraction for each specified element and exact combination of elements that will be applied in the formula for price adjustment; these important conditions were included but Bitumen was one of the basic materials lists instead of Fuel. Talking in short, since the project is building project Bitumen cannot represents any item and the contractor is forced to take Fuel null or in short Fuel is considered as nonadjustable item. Thus, no compensation is made for the Fuel categories of inputs for the contractor. As the observation indicates, this problem is mainly arisen from lack of contractor's knowledge gap on the effect of price fluctuations and stakeholders' observation limits to compile indexes.

Problem 2- Lack of awareness of contractual stakeholders on the application of price adjustment

In the application of the price adjustment besides the contracting party's other stakeholder are involved. Those parties are mainly the public body, the consultant, and regulatory body. All those stakeholders have their own interest in accomplishing a project. The public body mainly interested in finalizing the project without major increment in cost since they are the bodies who invest money in the project. This is normal thinking. However, experts and officials involved in such projects do not well understand the principle behind the application of the price adjustment in the industry. They just look only it increases their expense. But the reality is unless price adjustment is administered properly it will lead the project to failure. Consequently, it may be re-bid and its cost may rise intensely. The contractors also lack understanding on how to use their right at the time of bidding as well as at the time of construction. Notices and gathering information to help for price adjustment is not enough in most of the contractors. The consultants also lack on how to handle and practice a fair adjustment of price to help not the parties but the project itself. Most of the time they do not understand the rights and responsibilities of the public body and the contractor in application of price adjustment. The regulatory body to some extent tries to change the thinking of price adjustment in the recent times as it is described below.

Problem 3-Unavailability of accurate data and information related to current price

The project has predetermined base indices during bidding stage for specific representative materials from well-known local producer and competent foreign institution. However, the producers have been shown lack of interest to give current price every time 28 days after payment certificate is issued due to internal and business-related interests of the companies. This situation puts the contractor to create lack of trust between the stakeholders of the project in gathering current price index and lengthy process in price adjustment payment approval.

Problem 4- Lack of consistency in grouping

Due to the complexity of price adjustment formula method and lack of awareness of how price adjustment could compensate for the occurred inflation in construction resources there were dispute in deciding grouping for the representative materials. There is no consistent grouping mentioned in the contract or procurement announced it is leaved open for the concerned stakeholders.

Solutions and responses given to settle the problems

The contract form used in this project is PPA 2011.The contract allows the application of price adjustment clause as the project contract duration were more than 12 months. Hence, it is subjected to price adjustment as of the special condition of the contract and as of Federal Democratic Republic of Ethiopia Ministry of Finance instructed all clients with the letter Ref. No. F/I/1/53/32 dated 25/6/2013 E.C (4th March, 2021 in G.C) and letter Ref. No. 7/2/1/53/49 dated 05/11/2013 E.C (12th July, 2021 in G.C) citing the analysis made and submitted by the Ministry of Construction and Urban Development regarding the price inflation of the construction by stating that " if previous construction work procurement contracts signed with the corporation /entity did not incorporate price adjustment provision, taking in to account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for cement, re-bar and finishing Materials in respect of the remaining works by using the PPA 2002 price adjustment formula". Hence, the contractor based his claim based on the directive made by Federal Democratic Republic of Ethiopia Ministry of Finance and special condition of the contract. Conditions for the application of the price adjustment are discussed as follows;

Amendment of the contract

First as per the directive given by Federal Democratic Republic of Ethiopia Ministry of Finance that states "if previous construction work procurement contracts signed with the corporation/entity did not incorporate price adjustment provision, taking into account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for Cement, re-bar and finishing Materials in respect of the remaining works by using the price adjustment formula" the consultant provided contract amendment document for the employer.

Basic material list

The average applicable base indices are taken from an FDRE Ministry of Urban and Infrastructure (letter Ref.no. 85/00200/195 on 15/09/2014) on base date and also current indices are derived from the same Ministry at the time of invoice submission. Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure lists major inputs Cement, Fuel, Re-Bar and Imported Ceramic (finishing materials as per Federal Democratic Republic of Ethiopia Ministry of Finance directive to represent ceramic) with their base price to the project.

Classification under representative input materials

As the Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure only lists the major inputs and the classification to be represented by the major inputs as per the contract GCC clause 62.7 the consultant in collaboration with the employer presents classification under each representative input materials. There was discussion between the classification under representative input materials since the classification didn't consider Fuel. And also, the contractor proposes to represent labour, equipment on activity and equipment on transportation by fuel stating high inflation of labor cost both direct and indirect labor and fuel in the local market. The contractor also addresses that the labor resource is the most major resource for successful realization of the project. And, the effect of inflation of labor cost and fuel cost has major impact on the cash flow and progress of the project. Then, after long discussions the employer and the consultant disagreed on the contractors request.

Formula

In this case the price adjustment formula is taken from PPA 2002 Manual based on the direction set by public procurement and property Authority through a letter dated on 13/08/2014 Ref. No. _ ሙግንባ/ሙ-1/1/342. The Formula derived for this project were as per the directive by Public Procurement Property Authority to change the formula for determination of the adjustment of GCC clause 62.12 with PPA 2006. And it is shown in the equation 4.11 below.

$$\mathbf{Pn} = A + B\frac{Cn}{Co} + C\frac{Rn}{Ro} + D\frac{Crn}{Cro} + E\frac{Fn}{Fo}$$

..... equation 4.11

Whereas:

Pn is a price adjustment factor to be applied to the amount for each payment certificate;

A is a constant representing the nonadjustable portion in contractual payments;

B, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Fuel.

C, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Cement.

D, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by reinforcement steel/ bar.

E, is weighting or coefficient representing the estimated proportion of of the cost of inputs represented by Ceramic

Co, Ro, Fo & Cro are the base cost indices of reference prices of the cost elements at the date 28 days prior to the deadline for bid submission; and

Cn, Rn, Fn & Crn are the current cost indices of reference prices corresponding to the above cost elements at the date 28 days prior to Interim Payment Certificate Approval Date.

During the development of the formula for the project, First, the cost breakdown of each item in the contract document is prepared. Then, the sum of total quantity of each item in the contract document is identified by adding the contract quantity from cost breakdown for similar items. From the obtained total quantity of work, the quantity of each component material for each item of work is identified. For each type of materials their price 28 days prior to bid closing date is considered as base price. (As stipulated in GCC clause 62). Using the material price 28 days prior to the bid closing date the value of the material cost is calculated by multiplying with the total required quantity. The weightage of each material cost from the total contract amount is calculated. The adjustable items are grouped based on their type and interrelation in the market. The material cost of each group is calculated by adding the cost of each individual item within that group. The weightage of that group from the total contract amount is calculated to identify the coefficient that represents the weight of the group. Representative item is selected for each group so that its base price can be taken to represent the market price change for that specific group. Then these data is summarized in to the price adjustment formula.

The following formula is then developed as per equation 4.12 below,

$$\mathbf{Pn} = 0.2997 + 0.0928\frac{Cn}{Co} + 0.3904\frac{Rn}{Ro} + 0.2171\frac{Crn}{Cro} + 0.0000\frac{Fn}{Fo}$$

……. [Equation 4.12]

Application of the formula

After development of the formula, the application for the project is summarized in the table below. The amount of price escalation paid to the contractor is 285,104,813.83 ETB up to IPC 17 including VAT which is 136 % of the contract amount as shown in the Table 4.28, 4.29.4.30, 4.31, 4.32 and 4.33.

Table 4.28: Price adjustment payment number one

Pn= A + b*PPC /PPC0 +c*R40/R40$_0$+d*IP/IP$_0$+ e* IF/IF$_0$

Price Adjustment start if the IPC is paid after one year of the Commencement date

It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion-A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date	Adjustable Portion (Actual Gross Value of Work before VAT)	Gross Value After Adustment	Expected amount Before VAT
				b	c	d	e	PPC	PPCo	R40	R40o	IP	Ipo	IF	Ifo				
1	IPC-1	4/10/2021	0.3472	0.09279	0.3429	0.2171	0.0000	253.5	204.35	57.29	31.37	319.8	295.8	23.18	18.03	1.3232	12,476,154.31	16,508,958.56	4,032,804.25
2	IPC-2	5/18/2021	0.3472	0.0928	0.3429	0.2171	0.0000	253.5	204.35	55	31.37	336.7	295.8	23.18	18.03	1.3106	8,341,913.62	10,932,781.96	2,590,868.34
3	IPC-3	7/28/2021	0.3472	0.0928	0.3429	0.2171	0.0000	257.2	204.35	58	31.37	352.7	295.8	23.18	18.03	1.3569	3,976,821.91	5,396,120.88	1,419,298.97
4	IPC-4	9/20/2021	0.3472	0.0928	0.3429	0.2171	0.0000	303.5	204.35	75.07	31.37	421.4	295.8	23.18	18.03	1.6149	7,300,802.99	11,790,042.13	4,489,239.14
5	IPC-5	11/30/2021	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	85	31.37	426.3	295.8	28.94	18.03	1.7936	2,855,183.88	5,120,915.77	2,265,731.89
6	IPC-6	12/20/2021	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	85	31.37	426.3	295.8	28.94	18.03	1.7936	3,824,267.45	6,859,015.86	3,034,748.41
7	IPC-7	3/16/2022	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	475	295.8	28.94	18.03	2.1026	3,619,379.45	7,610,122.61	3,990,743.16
8	IPC-8	3/16/2022	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	475	295.8	28.94	18.03	2.1026	4,661,467.50	9,801,221.37	5,139,753.87
9	IPC-9	5/4/2022	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	493.7	295.8	28.94	18.03	2.1163	9,427,360.43	19,951,479.82	10,524,119.39
10	IPC-10	3/10/2022	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	493.7	295.8	28.94	18.03	2.1163	5,315,907.20	11,250,255.67	5,934,348.48
11	IPC-11	11/29/2022	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	493.7	295.8	28.94	18.03	2.1163	3,953,304.05	8,366,527.03	4,413,222.99
12	IPC-12	2/15/2023	0.3472	0.0928	0.3429	0.2171	0.0000	450	204.35	110	31.37	493.7	295.8	28.94	18.03	2.1163	9,427,360.43	19,951,479.82	10,524,119.39
																		Total Expected amount	58,358,998.27
																		With VAT	8,753,849.74
																		Total Expected amount with VAT	67,112,848.01

Table 4.29: Price adjustment payment number two

$Pn = A + b*Cn/C0 + c*R40/R40_o + d*IP/IP_0 + e*IF/IF_0$																				
Price Adjustment start if the IPC is paid after one year of the Commencement date																				
It.No.	**IPC No.**	**Measurement Period or Month and Year**	**Non-Adjustable Portion-A**	**Factor of Contribution / Adjustment Coefficient**				**Current and Bench Mark Price Index**								**Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date**	**Amount certified in each payment after advance & retention deduction**	**Adjustable Portion (Actual Gross Value of Work before VAT)**	**Gross Value After Adustment**	**Expected amount Before VAT**
				b	**c**	**d**	**e**	***Cn***	**Co**	***R40***	***R40o***	***IP***	***Ipo***	***IF***	***Ifo***					
1	**IPC-13**	**5/25/2023**	**0.2997**	**0.0928**	**0.3904**	**0.2171**	**0.0000**	**692.12**	**204.35**	**134.88**	**31.37**	**2200**	**295.82**	**71.15**	**18.03**	**3.907**	**8,741,734.21**	**14,642,074.71**	**57,211,053.23**	**42,568,978.52**
2	**Previous Price adjustment payment from IPC-1 to IPC 12**																			**64,662,771.29**
3	**Aluminium Work Price adj. Deduction from IPC1-12**	**2/15/2023**	**0.2997**	**0.0928**	**0.3904**	**0.2171**	**0.0000**	**450**	**204.35**	**110**	**31.37**	**493.74**	**295.82**	**28.94**	**18.03**	**2.235**	**8,741,734.21**	**958,992.12**	**2,143,646.25**	**(1,184,654.13)**
																			Total Expected amount	**106,047,095.68**
																			With VAT	**15,907,064.35**
																			Total Expected amount with VAT	**121,954,160.04**

Table 4.30: Price adjustment payment number three

Pn= A + b*PPC /PPC0 +c*R40/R40$_o$+d*IP/IP$_0$+ e* IF/IF$_0$																			
Price Adjustment start if the IPC is paid after one year of the Commencement date																			
It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date	Amount certified in each payment after advance & retention deduction	Adjustable Portion (Actual Gross Value of Work before VAT)	Gross Value After Adustment	Expected amount Before VAT
				b	c	d	e	*C*	Co	*R40*	*R40o*	*IP*	*Ipo*	*IF*	*Ifo*					
1	Previous Price Adjustment payment from IPC -IPC 13																			104,444,926.45
2	Current Price Adjustment payment from IPC 14	10/8/2023	0.2997	0.0928	0.3904	0.2171	0.0000	692.12	204.35	134.78	31.37	772.96	295.82	71.15	18.03	2.8586	7,735,229.00	16,082,801.71	45,973,928.70	29,891,126.99
																			Total Expected amount	134,336,053.44
																			With VAT	20,150,408.02
																			Total Expected amount with VAT	154,486,461.46

Table 4.31: Price adjustment payment number four

Pn = A + b*PPC /PPC0 +c*R40/R40$_o$+d*IP/IP$_0$+ e* IF/IF$_0$																			
Price Adjustment start if the IPC is paid after one year of the Commencement date																			
It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date	Amount certified in each payment after advance & retention deduction	Adjustable Portion (Actual Gross Value of Work before VAT)	Gross Value After Adustment	Expected amount Before VAT
				b	c	d	e	*PPC*	PPCo	*R40*	*R40o*	*IP*	*Ipo*	*IF*	*Ifo*					
1	Previous Price Adjustment payment from IPC -IPC 14																			134,336,653.85
2	Previous Unpaid amount due to advance from IPC1-12																			29,392,168.77
3	Current Price Adjustment payment from IPC 15	10/7/2023	0.2997	0.0928	0.3904	0.2171	0.0000	692.12	204.35	117.39	31.37	848	295.82	79.85	18.03	2.6973	7,735,229.00	13,692,644.09	36,932,760.54	23,240,116.45
																			Total Expected amount	186,968,939.07
																			With VAT	28,045,340.86
																			Total Expected amount with VAT	215,014,279.93

Table 4.32: Price adjustment payment number five

$Pn = A + b*PPC /PPC0 +c*R40/R40_o+d*IP/IP_o+ e* IF/IF_o$

Price Adjustment start if the IPC is paid after one year of the Commencement date

It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date	Amount certified in each payment after advance & retention deduction	Adjustable Portion (Actual Gross Value of Work before VAT)	Gross Value After Adustment	Expected amount Before VAT
				b	c	d	e	C	Co	R40	R40o	IP	Ipo	IF	Ifo					
1	Previous Price Adjustment payment from IPC -IPC 15																			172,055,759.48
2	Current Price Adjustment payment from IPC 16	10/1/2024	0.2997	0.0928	0.3904	0.2171	0.0000	692.76	204.35	111.30	31.37	956.522	295.82	79.75	18.03	2.7012	7,735,229.00	38,337,261.32	103,555,870.37	65,218,609.05
																			Total Expected amount	237,274,368.53
																			With VAT	35,591,155.28
																			Total Expected amount with VAT	272,865,523.81

Table 4.33: Price adjustment payment number six

It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date	Amount certified in each payment after advance & retention deduction	Adjustable Portion (Actual Gross Value of Work before VAT)	Gross Value After Adustment	Expected amount Before VAT
				b	c	d	e	C	Co	R40	R40o	IP	Ipo	IF	Ifo					
1	Previous Price Adjustment payment from IPC -IPC 16																			237,274,368.53
2	Current Price Adjustment payment from IPC 17	6/22/2024	0.2997	0.0928	0.3904	0.2171	0.0000	692.76	204.35	111.30	31.37	2173.91	295.82	79.75	18.03	3.5947	17,512,053.80	18,433,740.84	66,264,186.15	47,830,445.31
																			Total Expected amount	285,104,813.84
																			With VAT	42,765,722.08
																			Total Expected amount with VAT	327,870,535.92

4.4.1.2. Project 2: The Construction of G+5 Teacher Residence Building Project

The total original contract amount of G+5 Teacher Residence Building construction work project is ETB 193,069,823.77 including 15% VAT (Birr One Hundred Ninety-Three Million Sixty-Nine Thousand Eight Hundred Twenty-Three and cents 77/100). The project commencement date was May 29, 2021 and the original time for completion is November 19, 2022, with a contract period of 540 calendar days. Based on justified EOT, the project revised completion date has become on January 3, 2025 G.C.

The contract amount includes both structural and finishing work. The current work progress of the project is 33.65%. As mentioned above as per the contract agreement the project shall accomplish the work on November 19, 2022 which is expected nearly 100% accomplishment of the work on this date. However, currently after two years and nine months has passed it's on structural works of the work having 33.65% of work progress and experienced a huge delay.

The project is governed by the general condition of contract issued by Public Procurement and Property Administration Agency (FPPAA), (Version1, and August 2011). How the project is impacted by inflation and how the application of price adjustment is handled are as follows,

History related to cost of the project

After the signing of the contract the contractor faces inflation of construction resources basically on major materials categorized on cement, rebar, diesel and finishing materials. Due to this case, the contractor is unable to execute the work as per the planned schedule and the cash flow of the project is totally disturbed. As can been referred from literature review the market in our country's construction industry is highly dynamic where the price of most of the construction material escalates rapid. The impact of price escalation gets even very risky and threaten to the contractor on project with longer duration due to high possibility of material price changes risking the contractor's profitability and even which may lead the company to liquidation. Comparison of basic materials as of the project start, after 12 months of the project start date, after 18 months of the project start date and as of current status of the project is shown in the Table 4.34 below.

Table 4.34: Comparison of basic materials as of the project start, after 12 months of the project start date, after 18 months of the project start date and as of current status of the project

Description of the Item	**Unit**	**Unit Price in May 29,2021 G.C (project start date) (Birr)**	**Unit Price in May 24, 2022 G.C (after 12 months)(Birr)**	**increment %**	**Unit Price in November 20, 2022 G.C (after 18 months)(Birr)**	**increment %**	**Unit Price in December, 2024 G.C (current)(Birr)**	**increment %**
Cement	Qtl	253.47	450	78%	800	216%	887.83	250%
Reinforcement Bar	kg	56	110	96%	115	105%	130.73	133%
Fuel	lit	23.18	28.94	25%	59	155%	90.28	289%

Execution vs. Contract

The value of the executed amount up to the end of December 2024 indicates that 33.65% of the project gets completed as shown in Table 4.35 below. The remaining volume of work (66.35%) is yet to be accomplished within the remaining contract durations.

Table 4.35: To date execution with respect to the contract amounts

Project Name	Contract Amount before VAT ETB	Executed Amount before VAT ETB	Remaining Amount	Execution vs. Contract Amount	Time Elapsed %
The Construction of G+5 Teacher Residence Building Project	167,886,802.28	56,498,929.41	111,387,872.87	33.65%	45%

Table 4.36: Revenue categorized by execution and material on site before price adjustment

Project	Advance	Execution	Mos as Executed	Exec. +Mos	Total
The Construction of G+5 Teacher Residence Building	33,577,360.66	56,498,929.41	NA	56,498,929.41	56,498,929.41

Project					

As can be understood from Table 4.36 herein above there were no actual record of material on site up to the end of December 2024 at the project.

Contract Time

Despite the contractors effort for successful realization of the project, too many obstacles are affecting the project progress. To mention some of the events are delay in release of advance payment, delay due to scarcity of cement and fuel, delay due to adverse weather condition, delay due to variation works and delay due to design change. Due to concurrent effect of this delay events the contractor were unable to execute the work and the contract completion date is extended to January 3, 2025 from original contract completion date November 19, 2022 with 45 % elapsed time. The contract time elapse information is shown in the Table 4.37 below.

Table 4.37: Contract time elapse information

No	Project Name	Commencement Date	Original completion Date	Approved EOT	Revised completion date	Original completion period	Elapsed time	Elapsed time %
1	The Construction of G+5 Teacher Residence Building Project	29-May-21	19-Nov-22	1315	03-January-25	540	1302	45%

Contract Time vs. Execution

Contract time verses execution of the project is shown in the Figure 4.11 below.

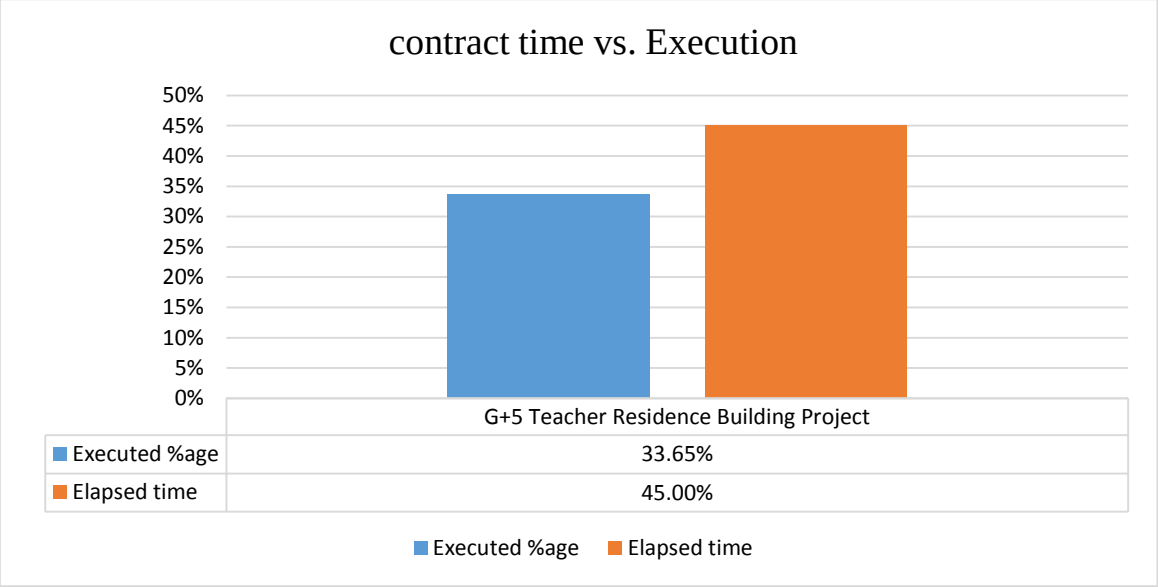


Figure 4.11: Linear projects slippage, contract time vs. Execution

Revenue analysis

As discussed and shown in Table 4.38 below, to date revenue of ETB 47,634,315.83 has been generated. (The detail can be referred in the table herein below)

Table 4.38: Revenue Generated to date before price adjustment

Project	Advance	Certified Execution	Net Mos. advance	Price Adj.	Total Certified Amount by the Employer (Gross Income)
The Construction of G+5 Teacher Residence Building Project	33,577,360.66	56,498,929.41	NA	NA	56,498,929.41

Expense Analysis

In this section, the cost incurred up to the end of December 2024 is presented along with relevant statistical analysis. Finance Department's expense report are used for compares and further analysis to show profit/loss of the projects as shown in detail in the Table 4.39 and 4.40.

Cost archive of projects categorize expense in to number of cost accounts such as; Construction material, Labor, Equipment and overhead expense among others. As such, for easy of analysis we grouped the detailed cost in to four major categories as shown in table 4.39 herein below. Hence, up to the end of this December 2024, according to Finance Department's report of the Company consumed 80.5 million birrs for running the project.

Table 4.39: Expense category

No	Year	Expense (Amount)	% age (%)
1	Material	45,424,215.26	56.41%
2	Labour	13,263,627.25	16.47%
3	Equipment	12,576,376.09	15.62%
4	Overhead	9,256,496.49	11.50%
		80,520,715.09	

Out of the total spending; Material, labour, equipment and overhead cost, material costs takes up the higher rank in the list. These statistics indicates that care shall be exercised for construction material management as to their effectiveness and efficacy. On the other hand, labor, equipment and overhead cost turn out to be 16.47%, 15.62% and 11.50% respectively according to Finance department's report of the company.

Moreover, the net cash flow as profitability measurement that represents the amount of money produced or lost up to the end of December 2024 is calculated from the difference between cash inflows and cash outflows. This metric is typically an indicator of the project's financial strength. Here the loss shown according to finance department is due to the inflation which affects the projects progress.

Table 4.40: Gross revenue and expense up to end of May 2024

No	Description	Income	Expense	Loss
1	Income and Expense according to finance department report	56,498,929.41	80,520,715.09	(24,021,785.68)
	Total	**56,498,929.41**	**80,520,715.09**	**(24,021,785.68)**

Encountered issues and measures taken on the project is shown in the Table 4.41 below.

Table 4.41: Encountered issues and measures taken on the project

NO.	ENCOUNTERED ISSUES	MEASURES TAKEN
1.	Cement scarcity	Purchase with extra cost, Supporting letters has been collected from clients to get Cement in priority.
2.	Fuel shortage	Keep on with stock
3.	Difficulties to get key personnel	Request for Price Adjustment

4.	Budget Limitation	The project has implemented "Pay when paid principle"
5.	Cash Flow Shortage	Request for Price Adjustment
6.	Dispute Among Parties	Arranging different meeting to solve problems
7.	Poor performance of subcontractors	
8.	Delay	Requesting for EOT and PA

As per the representatives of the stake holders of the project the above impacts are mainly driven from inflation. As can be seen from the above table 8 the impact of inflation goes beyond reasonable control of the contractor. The Impact of inflation leads to unavailability of cement and fuel, shortage of cash flow, delay of the project. As per the companies representatives have informed, the impact of the inflation have very significant effect on the projects performance to accomplish with the planned budget and time. Then, as per the Government's consideration for application of price adjustment due to significant amount of market inflation and to resolve problems related to the impact of the project arise from inflation, the contractor considers price adjustment to support the project's cash flow and request the employer for price adjustment.

Price Adjustment Practice of the Project

Price adjustment considers the fluctuation of cost of materials, labor and equipment due to currency fluctuation, inflation, shortage of materials due to some other on-going project, or any other circumstances that varies the cost. It can result in increase or decrease of actual cost, depending on the fluctuation of current indices comparing to base indices. The payment on Price adjustment is prepared by the contractor is incompliance to the contractual entitlements stipulated under the contract in order to compensate losses incurred due to escalation of material prices for the works executed from IPC 1 up to IPC 4 of the project.

Challenges faced to apply reasonable solution

Problem1- SCC of the contract doesn't entertain Price adjustment

One of the challenges during application of the price adjustment is that the project's contract under GCC clause 62 provides stipulations enabling entertainment of price adjustment of the contract price. But, even though the contract GCC clause 62.13 postulates to determine in the SCC the fraction for each specified element and exact combination of elements that will be applied in the formula for price adjustment; these important conditions were not included. Talking In short, the Special Condition of the above-mentioned Contract is not subjected to price adjustment.

Problem 2- Lack of awareness of contractual stakeholders on the application of PA

In the application of the price adjustment besides the contracting party's other stakeholder are involved. Those parties are mainly the public body, the consultant, and regulatory body. All those stakeholders have their own interest in accomplishing a project. The public body mainly interested in finalizing the project without major increment in cost since they are the bodies who invest money in the project. This is normal thinking. However, experts and officials involved in such projects do not well understand the principle behind the application of the price adjustment in the industry. They just look only it increases their expense. But the reality is unless price adjustment is administered properly it will lead the project to failure. Consequently, it may be re-bid and its cost may rise intensely. The contractors also lack understanding on how to use their right at the time of bidding as well as at the time of construction. Notices and gathering information to help for price adjustment is not enough in most of our contractors. The consultants also lack on how to handle & practice a fair adjustment of price to help not the parties but the project itself. Most of the time, they don't understand the rights and responsibilities of the public body and the contractor in application of PA.

Problem 3-Availability of accurate data and information related to price

The contractor did not incorporate base price as the contract is not subjected to price adjustment. There were challenges while adjusting new unit rate like timely recorded data were not available at central statistical agency to collect market price at different time. This creates dispute among parties in getting base price and in lack of trust between them in the application of the price adjustment payment.

Problem 4- Lack of Consistency in Grouping

Due to the complexity of price adjustment formula method and lack of awareness of how price adjustment could compensate for the occurred inflation in construction resources there were dispute in deciding grouping for the representative materials. There is no consistent grouping mentioned in the contract or procurement announced it is leaved open for the concerned stakeholders.

Problem 5- Disputes among parties

The Owner, managing multiple projects, has informed the contractors that price adjustments will only be granted only for the remaining works (not after 12 months have passed as per the contract agreement), as directed by the Ministry of Finance. The contractors are disappointed by this decision, especially since the contractor involved in this project is nearing completion of the structural works while others are still at the foundation stage. They argue that the situation should be managed more fairly.

Solutions and responses given to settle the problems

The Contract is subject to price adjustment as the Federal Democratic Republic of Ethiopia Ministry of Finance instructed all clients with the letter Ref. No. F/I/1/53/32 dated 25/6/2013 E.C (4th March, 2021 in G.C) and letter Ref. No. 7/2/1/53/49 dated 05/11/2013 E.C (12th July, 2021 in G.C) citing the analysis made and submitted by the Ministry of Construction

and Urban Development regarding the price inflation of the construction by stating that " if previous construction work procurement contracts signed with the corporation /entity did not incorporate price adjustment provision, taking in to account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for cement, re-bar and finishing Materials in respect of the remaining works by using the price adjustment formula". Hence, the contractor based his claim based on the directive made by Federal Democratic Republic of Ethiopia Ministry of Finance. Conditions for the application of the price adjustment are discussed as follows;

Amendment of the contract

First as per the directive given by Federal Democratic Republic of Ethiopia Ministry of Finance that states "if previous construction work procurement contracts signed with the corporation/entity did not incorporate price adjustment provision, taking into account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for Cement, re-bar and finishing Materials in respect of the remaining works by using the price adjustment formula" the consultant provided contract amendment document for the employer.

Basic material list

The average applicable base indices are taken from an FDRE Ministry of Urban and Infrastructure (letter Ref.no. 85/00200/195 on 15/09/2014) on base date and also current indices are derived from the same Ministry at the time of invoice submission. Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure lists major inputs Cement, Fuel, Re-Bar and Imported Ceramic (finishing materials as per Federal Democratic Republic of Ethiopia Ministry of Finance directive to represent ceramic) with their base price to the project.

Classification under representative input materials

As the Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure only lists the major inputs and the classification to be represented by the major inputs as per the contract GCC clause 62.7 the consultant in collaboration with the employer presents classification under each representative input materials. (Please refer Annex 2 we have attached the correspondences). There were discussions between the classifications under representative input materials since the classification didn't consider Fuel on transportation since most of the materials are mobilized from Addis Ababa to the project site which is around 668km far. And also, the contractor proposes to represent labor by fuel stating high inflation of labor cost both direct and indirect labor in the local market. The contractor also addresses that the labor resource is the most major resource for successful realization of the project. And, the effect of inflation of labor cost has major impact on the cash flow and

progress of the project. Then, after long discussions the employer and the consultant agreed on the contractors request and proposal and instruct the contractor to proceed as planned.

Price adjustment formula

In this case the price adjustment formula is taken from PPA 20026 Manual based on the direction set by public procurement and property Authority through a letter dated on 13/08/2014 Ref. No. መግንባ/ሙ-1/1/342. The Formula derived for this project were as per the directive by Public Procurement Property Authority to change the formula for determination of the adjustment of GCC clause 62.12 with PPA 2006 as per Equation 4.13 shown below.

$$\mathbf{Pn} = A + B\frac{Cn}{Co} + C\frac{Rn}{Ro} + D\frac{Crn}{Cro} + E\frac{Fn}{Fo}$$

…….[Equation 4.13]

Whereas:

Pn is a price adjustment factor to be applied to the amount for each payment certificate;

A is a constant representing the nonadjustable portion in contractual payments;

B, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Fuel.

C, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Cement.

D, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by reinforcement steel/ bar.

E, is weighting or coefficient representing the estimated proportion of of the cost of inputs represented by Ceramic

Co, Ro, Fo & Cro are the base cost indices of reference prices of the cost elements at the date 28 days prior to the deadline for bid submission; and

Cn, Rn, Fn & Crn are the current cost indices of reference prices corresponding to the above cost elements at the date 28 days prior to Interim Payment Certificate Approval Date.

During the development of the formula for the project, First, the cost breakdown of each item in the contract document is prepared. Then, the sum of total quantity of each item in the contract document is identified by adding the contract quantity from cost breakdown for similar items. From the obtained total quantity of work, the quantity of each component material for each item of work is identified. For each type of materials their price 28 days prior to bid closing date is considered as base price. (As stipulated in GCC clause 62). Using the material price 28 days prior to the bid closing date the value of the material cost is

calculated by multiplying with the total required quantity. The weightage of each material cost from the total contract amount is calculated. The adjustable items are grouped based on their type and interrelation in the market. The material cost of each group is calculated by adding the cost of each individual items within that group. The weightage of that group from the total contract amount is calculated to identify the coefficient that represents the weight of the group. Representative item is selected for each group so that its base price can be taken to represent the market price change for that specific group. Then these data is summarized in to the price adjustment formula.

The following formula is then developed as per equation 4.14 below,

$$\mathbf{Pn} = 0.3163 + 0.1504\frac{Cn}{Co} + 0.2579\frac{Rn}{Ro} + 0.1737\frac{Crn}{Cro} + 0.1017\frac{Fn}{Fo}$$

…… [Equation 4.14]

Application of the formula

After development of the formula, there is no payment to the contractor since the client have decided not to pay for the executed works and the contractor are preparing payment during this research paper.

4.4.1.3. Project 3: The Construction of Two Blocks G+6 and G+7 Apartment Building

The total original contract amount of Two Blocks G+6 and G+7 Apartment Building construction work project is ETB 1,388,132,359.43 including 15% VAT (Birr One Billion Three Hundred Eighty-Eight Million One Hundred Thirty-Two Thousand Three Hundred Fifty-Nine and cents 43/100). The project commencement date was 28th of March 2022 and the original time for completion is 12th of March 2025, with a contract period of 1080 calendar days.

The contract amount includes both structural and finishing work of two blocks. The current work progress of the project is 3.84% and experienced 2.77% price escalation of the contract amount. As mentioned above as per the contract agreement the project should be completed the work on March 12, 2025 which is expected nearly 100% accomplishment of the work on this date. However, currently after two years and two months has passed it is only on backfill works of the work having 3.84% of work progress and experienced a huge delay.

The project is governed by the general condition of contract issued by Public Procurement and Property Administration Agency (FPPAA), (Version1, and August 2011). How the project is impacted by inflation and how the application of price adjustment is handled are as follows,

History related to cost of the project

After the signing of the Contract the contractor faces inflation of construction resources basically on major materials categorized on cement, rebar, diesel and finishing materials. Due to this case, the contractor is unable to execute the work as per the planned schedule and the cash flow of the project is totally disturbed. As can been referred from literature review the market in our country's construction industry is highly dynamic where the price of most of the construction material escalates rapid. The impact of price escalation gets even very risky and threatens to the contractor on project with longer duration due to high possibility of material price changes risking the contractor's profitability and even which may lead the company to liquidation. Comparison of basic materials as of the project start, after 12 months of the project start date, after 18 months of the project start date and as of current status of the project is shown in the Table 4.42 below.

Table 4.42: Comparison of basic materials as of the project start, after 12 months of the project start date, after 18 months of the project start date and as of current status of the project

Description of the Item	Unit	Unit Price in March 28,2022 G.C (project start date) (Birr)	Unit Price in March 28, 2023 G.C (after 12 months) (Birr)	increment %	Unit Price in September 19, 2023 G.C (after 18 months) (Birr)	increment %	Unit Price in December,2024G.C(current) (Birr)	increment %
Cement	Qtl	450	855.75	190%	855.75	190%	887.83	91.3%
ReBar	kg	95	139.13	146%	134	141%	130.73	38%
Fuel	lit	28.94	79.75	276%	79.75	276%	90.28	13%

Execution vs. Contract

The value of the executed amount up to the end of December 2024 indicates that 3.84 % of the project gets completed as shown in Table 4.43 below. The remaining volume of work (96.16%) is yet to be accomplished within the remaining contract durations.

Table 4.43: To date Execution with respect to the contract amounts

Project Name	Contract Amount before VAT ETB	Executed Amount before VAT ETB	Remaining Amount	Execution vs. Contract Amount	Time Elapsed %
The Construction of Two Blocks G+6 and G+7 Apartment Building	1,207,071,616.89	46,328,226.67	1,160,743,390.22	3.84%	96.20%

Table 4.44: Revenue categorized by Advance, Execution and Material on site before price adjustment

Project	Advance	Execution	Mos as Executed	Exec. +Mos	Total
The Construction of Two Blocks G+6 and G+7 Apartment Building	NA	46,328,226.67	NA	46,328,226.67	46,328,226.67

As can be understood from Table 4.44 herein above there were no actual record of material on site up to the end of December 2024 at the project.

Contract time

Despite the contractors effort for successful realization of the project, too many obstacles are affecting the project progress. To mention some of the events are delay due to adverse weather condition, delay due to security problem and public unrest, delay due to late release

of interim payment, delay on suspension of work due to change in location of working site, delay due to due to variation works, delay due to due to additional works, delay on giving work order to undertake rock excavation found on G+7 apartment and delay due to late provision of G+6 apartment's basement retaining wall. Due to concurrent effect of this delay events the contractor were unable to execute the work and he have requested for extension of time with the total of 585 calendar days which extends the project completion date up to October 15, 2026. The contract time elapse information is shown in the Table 4.45 below.

Table 4.45: Contract time elapse information

No	Project Name	Commencement Date	Original completion Date	Original completion period	Elapsed time	Elapsed time %
1	The Construction of Two Blocks G+6 and G+7 Apartment Building	28-March-22	12-March 25	1080	1039	96.20%

Contract Time vs. Execution

Contract time verses execution of the project is shown in the Figure 4.12 below.

Figure 4.12: Linear projects slippage, contract time vs. Execution

Revenue analysis

As discussed, and shown in table 4.46 below, to date revenue of ETB 33,448,744.81has been generated. (The detail can be referred in the table herein below)

Table 4.46: Revenue generated to date before price adjustment

Project	**Advance**	**Certified Execution**	**Net Mos. advance**	**Price Adj.**	**Total Certified Amount by the Employer (Gross Income)**
The Construction of Two Blocks G+6 and G+7 Apartment Building	NA	46,328,226.67	NA	NA	46,328,226.67

Expense Analysis

In this section, the cost incurred up to the end of December 2024 is presented along with relevant statistical analysis. Finance Department's expense report are used for compares and further analysis to show profit/loss of the projects as shown in detail in the table 4.47 and 4.48.

Cost archive of projects categorize expense in to number of cost accounts such as; Construction material, Labor, Equipment and overhead expense among others. As such, for easy of analysis we grouped the detailed cost in to four major categories as shown in Table 4.47 herein below. Hence, up to the end of this December 2024, according to Finance Department's report of the company consumed 48.3 million birr for running the project.

Table 4.47 Expense category

No	**Year**	**Expense (Amount)**	**% age (%)**
1	Material	23,316,207.46	48.26%
2	Labour	7,202,622.25	14.91%
3	Equipment	13,767,262.15	28.50%
4	Overhead	4,026,302.12	8.33%
		48,312,393.98	

Out of the total spending; Material, labour, equipment and overhead cost, material costs takes up the higher rank in the list. These statistics indicates that care shall be exercised for construction material management as to their effectiveness and efficacy. On the other hand, equipment, labor and overhead cost turn out to be 28.5%, 14.91% and 8.33% respectively according to Finance department's report of the company.

Moreover, the net cash flow as profitability measurement that represents the amount of money produced or lost up to the end of December 2024 is calculated from the difference between cash inflows and cash outflows as shown in Table 4.48 below. This metric is typically an indicator of the project's financial strength. Here the loss shown according to finance department is due to the inflation which affects the projects progress.

Table 4.48: Gross revenue and expense up to end of December 2024

No	Description	Income	Expense	Loss
1	Income and Expense according to finance department report	46,328,226.67	48,312,393.98	(1,984,167.31)
	Total	46,328,226.67	**48,312,393.98**	**(1,984,167.31)**

Encountered issues and measures taken on the project are shown in Table 4.49 below.

Table 4.49 Encountered issues and measures taken on the project

NO.	ENCOUNTERED ISSUES	MEASURES TAKEN
1.	Cement scarcity	Purchase with extra cost, Supporting letters has been collected from clients to get Cement in priority.
2.	Fuel shortage	Keep on with stock
3.	Difficulties to get key personnel	Request for Price Adjustment
4.	Budget Limitation	The project has implemented "Pay when paid principle"
5.	Cash Flow Shortage	Request for Price Adjustment
6.	Lack of knowledge	
8.	Delay	Requesting for EOT and PA

As per the representatives of the stake holders of the project the above impacts are mainly driven from inflation. As can be seen from the above table 8 the impact of inflation goes beyond reasonable control of the contractor. The Impact of inflation leads to unavailability of cement and fuel, shortage of cash flow, delay of the project. As per the companies representatives have informed, the impact of the inflation have very significant effect on the projects performance to accomplish with the planned budget and time. Then, as per the Government's consideration for application of price adjustment due to significant amount of market inflation and to resolve problems related to the impact of the project arise from inflation, the contractor considers price adjustment to support the project's cash flow and request the employer for price adjustment.

Price Adjustment practice of the selected project

Price adjustment considers the fluctuation of cost of materials, labor and equipment due to currency fluctuation, inflation, shortage of materials due to some other on-going project, or any other circumstances that varies the cost. It can result in increase or decrease of actual cost, depending on the fluctuation of current indices comparing to base indices. The payment on Price adjustment is prepared by the contractor is incompliance to the contractual entitlements stipulated under the contract in order to compensate losses incurred due to escalation of material prices for the works executed from IPC 3 up to IPC 6 of the project.

Challenges faced to apply reasonable solution

Problem 1- Lack of awareness of contractual stakeholders on the application of PA

In the application of the price adjustment besides the contracting party's other stakeholder are involved. Those parties are mainly the public body, the consultant, and regulatory body. All those stakeholders have their own interest in accomplishing a project. The public body mainly interested in finalizing the project without major increment in cost since they are the bodies who invest money in the project. This is normal thinking. However, experts and officials involved in such projects doesn't well understand the principle behind the application of the price adjustment in the industry. They just look only it increases their expense. But the reality is unless price adjustment is administered properly it will lead the project to failure. Consequently, it may be re-bid and its cost may rise intensely. The contractors also lack understanding on how to use their right at the time of bidding as well as at the time of construction. Notices and gathering information to help for price adjustment is not enough in most of our contractors. The consultants also lack on how to handle and practice a fair adjustment of price to help not the parties but the project itself. Most of the time, they don't understand the rights and responsibilities of the public body and the contractor in application of PA.

Problem 2-Availability of accurate data and information related to price

The contractor did not incorporate base price as the contract is not subjected to price adjustment. There were challenges while adjusting new unit rate like timely recorded data

were not available at central statistical agency to collect market price at different time. This creates dispute among parties in getting base price and in lack of trust between them in the application of the price adjustment payment.

Problem 3- Lack of consistency in grouping

Due to the complexity of price adjustment formula method and lack of awareness of how price adjustment could compensate for the occurred inflation in construction resources there were dispute in deciding grouping for the representative materials. There is no consistent grouping mentioned in the contract or procurement announced it is leaved open for the concerned stakeholders.

Problem 5- Disputes among parties

The Owner, managing multiple projects, has informed the contractors that price adjustments will only be granted only for the remaining works (not after 12 months have passed as per the contract agreement), as directed by the Ministry of Finance. The contractors are disappointed by this decision, especially since the contractor involved in this project is nearing completion of the structural works while others are still at the foundation stage. They argue that the situation should be managed more fairly.

Solutions and responses given to settle the problems

The Contract is subject to price adjustment as per the contract agreement and as the Federal Democratic Republic of Ethiopia Ministry of Finance instructed all clients with the letter Ref. No. F/I/1/53/32 dated 25/6/2013 E.C (4th March, 2021 in G.C) and letter Ref. No. 7/2/1/53/49 dated 05/11/2013 E.C (12th July, 2021 in G.C) citing the analysis made and submitted by the Ministry of Construction and Urban Development regarding the price inflation of the construction by stating that " if previous construction work procurement contracts signed with the corporation /entity did not incorporate price adjustment provision, taking in to account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for cement, re-bar and finishing Materials in respect of the remaining works by using the price adjustment formula". Hence, the contractor based his claim based on the signed contract agreement and the directive made by Federal Democratic Republic of Ethiopia Ministry of Finance. Conditions for the application of the price adjustment are discussed as follows;

Amendment of the contract

First as per the directive given by Federal Democratic Republic of Ethiopia Ministry of Finance that states "if previous construction work procurement contracts signed with the corporation/entity did not incorporate price adjustment provision, taking into account the contract amendment provisions included in Article 29/4 of the implementation directive and it is possible to make contract amendment in the application of price adjustment for Cement, re-bar and finishing Materials in respect of the remaining works by using the price

adjustment formula" the consultant provided contract amendment document for the employer.

Basic material list

The average applicable base indices are taken from an FDRE Ministry of Urban and Infrastructure (letter Ref.no. 85/00200/195 on 15/09/2014) on base date and also current indices are derived from the same Ministry at the time of invoice submission. Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure lists major inputs Cement, Fuel, Re-Bar and Imported Ceramic (finishing materials as per Federal Democratic Republic of Ethiopia Ministry of Finance directive to represent ceramic) with their base price to the project.

Classification under representative input materials

As the Federal Democratic Republic of Ethiopia Ministry of Urban and Development Infrastructure only lists the major inputs and the classification to be represented by the major inputs as per the contract GCC clause 62.7 the consultant in collaboration with the employer presents classification under each representative input materials. (Please refer Annex 2 we have attached the correspondences). There were discussions between the classifications under representative input materials since the classification didn't consider Fuel on transportation since most of the materials are mobilized from Addis Ababa to the project site which is around 668km far. And also, the contractor proposes to represent labor by fuel stating high inflation of labor cost both direct and indirect labor in the local market. The contractor also addresses that the labor resource is the most major resource for successful realization of the project. And, the effect of inflation of labor cost has major impact on the cash flow and progress of the project. Then, after long discussions the employer and the consultant agreed on the contractors request and proposal and instruct the contractor to proceed as planned.

Price adjustment formula

In this case the price adjustment formula is taken from PPA 20026 Manual based on the direction set by public procurement and property Authority through a letter dated on 13/08/2014 Ref. No. ሙግንባ/ሙ-1/1/342. The Formula derived for this project were as per the directive by Public Procurement Property Authority to change the formula for determination of the adjustment of GCC clause 62.12 with PPA 2006 as shown in Equation 4.15 below.

$$\mathbf{Pn} = A + B\frac{Cn}{Co} + C\frac{Rn}{Ro} + D\frac{Crn}{Cro} + E\frac{Fn}{Fo}$$

…… [Equation 4.15]

Where:

Pn is a price adjustment factor to be applied to the amount for each payment certificate;

A is a constant representing the nonadjustable portion in contractual payments;

B, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Fuel.

C, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by Cement.

D, is weighting or coefficient representing the estimated proportion of the cost of inputs represented by reinforcement steel/ bar.

E, is weighting or coefficient representing the estimated proportion of of the cost of inputs represented by Ceramic

Co, Ro, Fo & Cro are the base cost indices of reference prices of the cost elements at the date 28 days prior to the deadline for bid submission; and

Cn, Rn, Fn & Crn are the current cost indices of reference prices corresponding to the above cost elements at the date 28 days prior to Interim Payment Certificate Approval Date.

During the development of the formula for the project, First, the cost breakdown of each item in the contract document is prepared. Then, the sum of total quantity of each item in the contract document is identified by adding the contract quantity from cost breakdown for similar items. From the obtained total quantity of work, the quantity of each component material for each item of work is identified. For each type of materials their price 28 days prior to bid closing date is considered as base price. (As stipulated in GCC clause 62). Using the material price 28 days prior to the bid closing date the value of the material cost is calculated by multiplying with the total required quantity. The weightage of each material cost from the total contract amount is calculated. The adjustable items are grouped based on their type and interrelation in the market. The material cost of each group is calculated by adding the cost of each individual items within that group. The weightage of that group from the total contract amount is calculated to identify the coefficient that represents the weight of the group. Representative item is selected for each group so that its base price can be taken to represent the market price change for that specific group. Then these data is summarized in to the price adjustment formula.

The following formula is then developed as Equation 4.16 below,

$$\mathbf{Pn} = 0.3040 + 0.2008\frac{Cn}{Co} + 0.2482\frac{Rn}{Ro} + 0.1226\frac{Crn}{Cro} + 0.1245\frac{Fn}{Fo}$$

…….. [Equation 4.16]

Application of the formula

After development of the formula, the application for the project is summarized in the table below. The contractor have prepared price adjustment payment for IPC 3 to IPC 6 (since IPC

1 and IPC 2 is executed within 12 months) with the amount of 33,439,522.11 ETB including VAT which is 2.41 % of the contract amount but not paid during this research period. The application of the formula and payment generated from price adjustment is shown in Table 4.49 and 4.50 below.

Table 4.50: Price adjustment payment number one

Pn = A + b*PPC /PPC0 +c*R40/R40o+d*IP/IP0+ e* IF/IF0																		
Price Adjustment start if the IPC is paid after one year of the Commencement date																		
It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date (A)	Adjustable Portion (Actual Gross Value of Work before VAT) (B)	Gross Value After Adustment (C)= A*B	Expected amount Before VAT (C-B)
				b	c	d	e	*C*	Co	*R40*	*R40o*	*IP*	*Ipo*	*IF*	*Ifo*				
1.00	IPC-3	June 6, 2023	0.3040	0.2008	0.2482	0.1226	0.1245	999.50	450.00	139.13	95.00	2250.00	475.28	79.95	28.94	2.04	4,597,315.66	9,367,172.05	4,769,856.39
2.00	IPC-4	April 15, 2024	0.3040	0.2008	0.2482	0.1226	0.1245	999.50	450.00	134.00	95.00	2250.00	475.28	79.95	28.94	2.02	4,346,871.73	8,798,628.77	4,451,757.04
3.00	IPC-5	June 3, 2024	0.3040	0.2008	0.2482	0.1226	0.1245	1129.44	450.00	117.39	95.00	2250.00	475.28	79.95	28.94	2.04	9,489,864.06	19,347,243.06	9,857,379.00
																		Total Expected amount	19,078,992.44
																		15% VAT	2,861,848.87
																		Grand Total	21,940,841.30

Table 4.51: Price adjustment payment number two

It.No.	IPC No.	Measurement Period or Month and Year	Non-Adjustable Portion- A	Factor of Contribution / Adjustment Coefficient				Current and Bench Mark Price Index								Price Adjustment Factor-Pn after 12 months of the Signing of the agreement Date (A)	Adjustable Portion (Actual Gross Value of Work before VAT) (B)	Gross Value After Adustment (C)= A*B	Expected amount Before VAT (C-B)
				b	c	d	e	*C*	Co	*R40*	*R40o*	*IP*	*Ipo*	*IF*	*Ifo*				
1.00	Previous Price Adjustment payment from IPC 3 -IPC 5																		19,078,992.44
2.00	IPC-6	December 26, 2024	0.3040	0.2008	0.2482	0.1226	0.1245	887.83	450.00	126.09	95.00	2860.00	475.28	90.28	28.94	2.1554	8,654,312.52	18,653,165.40	9,998,852.88
																		Total Expected amount	29,077,845.32
																		15% VAT	4,361,676.80
																		Grand Total	33,439,522.11

The chosen projects for the research's desk study experienced price increases during their implementation.

According to data from the desk study, some of the factors that lead to price increases in Ethiopian medium building construction projects include fluctuations in currency exchange rates, poor estimation, improper planning and/or improper implementation of proper planning, a lack of labor, unforeseen ground conditions, a shortage of materials like cement and fuel, a lack of cash flow, unfavorable weather, and a shortage of professionals and skilled labor.

The desk study's findings indicate that delays are a common consequence of price increases, which impacts both clients and contractors. Long-term delays also significantly raise the project's cost.

Excessive price increases necessitate more funding, which depletes the nation's limited financial resources and causes a further budget deficit for building projects.

Price increases because unnecessary delays in projects, which in turn cause further price increases. As a project's duration increases, the cost of materials will also increase, resulting in additional expenses.

The results of desk studies are summed up as follows:

Causes of price escalation

- Poor estimation
- Improper planning and/or improper implementation of proper planning
- Fluctuation in money exchange rates
- Shortage of labors
- unforeseen ground conditions
- Shortage of materials like cement, fuel and etc.
- Adverse weather conditions
- Shortage of professionals and skilled man power

Effects of price escalation

- Delay
- Higher project costs
- Shortage of cash flow

Responsiveness of Price Adjustment

Except Project 2 which is not compensable for the loss the contractor is incurred Project 1 and Project 3 are compensated for the loss the contractors are incurred. The reason for Project 2 is that the client is granted to include price adjustment only for the remaining works. Hence, the compensation system is fair.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This chapter summarizes the findings and recommendations derived from the data analysis and discussions presented earlier. The research aimed to evaluate the impact of price escalation, assess price adjustment practices, examine the existing price escalation administration system, and propose enhancements for managing price escalation in medium building construction projects. The study employed a combination of literature review and questionnaire surveys, analyzing the data using the relative importance index and Spearman's correlation coefficient.

Key findings are outlined as follows:

The first objective focused on understanding the extent of price escalation's impact. Survey responses highlighted significant internal factors such as poor estimating, inadequate planning, and vague contract terms. External factors included rising material costs, currency fluctuations, and increased global demand. Notably, price escalations for essential materials were identified, with significant increases in cement (22.79%), fuel (22.06%), imported ceramics (17.65%), and reinforcement (13.24%). The impacts of these escalations primarily included project delays, cash flow issues, increased costs, and disputes among stakeholders, with a consensus that economic fluctuations considerably affect the construction sector.

The second objective evaluated the responsiveness of price adjustment practices and the current administration system. A substantial portion of respondents rated the PPA contract form positively, with 42.11% deeming it good and 33.33% very good for managing price adjustments. Additionally, 61.40% believed that price adjustments adequately compensated for 50-60% of price fluctuations. Respondents expressed confidence in the accuracy of quantity estimates and unit rates prepared during the tendering phase. However, challenges persist, such as limited awareness of price adjustment mechanisms and data accessibility issues.

Data sources for construction material pricing were identified, with lower bid prices and market stability seen as advantages of using price adjustment clauses, while administrative costs and accuracy of indices posed risks. Notably, 48% of respondents pointed to the exclusion of material sources in contracts as a significant drawback of the formula method for price adjustments, emphasizing the need for reliable local price indices and better contract documentation.

Lastly, recommendations for improving price escalation management included various strategies from contractors, consultants, clients, and regulatory bodies. Key suggestions involved adhering to best practices, accurately implementing price clauses, developing independent price databases, and enhancing market monitoring. These comprehensive recommendations aim to foster a more resilient framework for managing price adjustments in the construction industry.

5.2. Recommendations

Through a desk study and questionnaire survey, the research aimed to produce findings from the hypothesized issues addressed in the literature review. Furthermore, one of the goals of this thesis was to provide suggestions for bettering the management of price increases in medium-sized building construction projects based on the study's findings. As a result, the recommendation will concentrate on resolving the primary issues found during the study procedures.

For the successful execution of medium building construction projects, the other guideline is for contracting parties to concentrate on and regularly discuss those elements and issues throughout their construction progress meetings. Building construction management ability should also be a top priority if they want to achieve management success, which is defined as completing a project on schedule, within budget, and in accordance with technical specifications.
Key actors in construction projects are required to make the following recommendations in light of the research's findings.

5.2.1. For clients

- Invest in Planning: clients should invest significant effort in the planning phase of projects, ensuring that time, cost, quality, and resource planning are thoroughly addressed. All necessary resources should be well-organized before construction begins.
- Set Realistic Durations: clients should determine and impose realistic project durations to avoid time and cost overruns.
- Incorporate Price Adjustment Clauses: clients should include price adjustment clauses in their contract documents.

5.2.2. For consultants

- Anticipate Price Escalation: consultants should study the potential for price escalation and devise mitigation plans before the project is affected.
- Prepare Contract Documents: consultants should prepare contract documents that allow for price adjustments.
- Accurate Estimates: consultants should develop accurate estimates of quantities of works and unit prices at the tender stage to ensure reliability and accuracy.

5.2.3. For contractors

- Material Awareness: contractors should purchase construction materials on time and have a time schedule for material delivery to the site to avoid shortages.
- Financial Preparedness: contractors should have sufficient cash reserves before starting any project to avoid financial problems. Monitoring financial spending and payments is essential to prevent delays and cost escalations.
- Price Escalation Consideration: contractors should critically assess the effects of price escalation before tender submission and agree on fair provisions for price escalation effects in the contract conditions.

- Time Scheduling: contractors should maintain a time schedule that clarifies the needs for equipment and materials on site to ensure availability without delays, enabling them to monitor performance and adhere to the schedule continuously.

5.2.4. For Regulatory bodies:

- Develop Clear Policies for Price Escalation: Establish consistent guidelines and advanced techniques for monitoring, forecasting, and calculating price indices to ensure a more definitive approach to price escalation.
- Ensure Fair and Consistent Price Adjustment: Facilitate collaboration among all parties to recover the compensation system and ensure that the methods for price adjustment calculation are fair and consistent.
- Establish a Strong Price Database: Develop a robust and reliable price database for reference.
- Control and Regulate the Market: Maintain consistent market control and regulation to prevent discrepancies and ensure fairness.

5.2.5. For further study

In addition current research, the followings are some areas recommended for further studies.

- Impact of Foreign currency fluctuation on construction price

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