



**REVIEW OF CONTRACT PRICE ADJUSTMENT
PRACTICES OF FOREIGN CONTRACTORS' ROAD
CONSTRUCTION PROJECTS IN ETHIOPIA**

By: Abduljelil Mohammed Hamza

Advisor: Girmay KahssaY (PhD)

**A Reserch Submitted to the School of Graduate Studies of Addis
Ababa Institute of Technolgy in Partial Fulfilment of the
requirements of Master os Science in Civil Engineering
(Construction Technology & Management)**

December, 2019

Addis Ababa, Ethiopia

Approved by Board of Examiners

Dr. Girmay Kahssay

(Advisor)

Date

Signature

(Internal Examiner)

Date

Signature

(External Examiner)

Date

Signature

(Chairman)

Date

Signature

Declaration

I declare that this thesis entitled “REVIEW OF CONTRACT PRICE ADJUSTMENT PRACTICES OF FOREIGN CONTRACTORS’ ROAD CONSTRUCTION PROJECTS IN ETHIOPIA” is my original work. This thesis has not been presented for any other university and is not concurrently submitted in candidature of any other degree, and that all sources of material used for the thesis have been duly acknowledged.

Candidate:

Name: Abduljelil Mohammed Hamza

Signature: _____

Place:

Addis Ababa University, Addis Ababa Institute of Technology,
School of Graduate Studies,
Department of Civil and Environmental Engineering

Date:

Acknowledgement

First and most of all I sincerely thank the Almighty for giving me the endurance to complete this research. Next I would like to express my deepest appreciation to my advisor Dr. Girmay Kahssay instructor at the Addis Ababa Institute of Technology, for his professional guidance, useful advice, continuous encouragement and support throughout the process of this research.

I am deeply grateful to all those who gave me assistance in obtaining the information and data related to this work. Especial thanks go to the experts and staff at the Ethiopian Roads Authority for their willingness to provide me with all the necessary data and apportioning their time to respond to many of my questions.

As always special recognition and deepest gratitude shall go to my wife and our beloved kids for their patience and support.

Contents

Declaration.....	i
Acknowledgement.....	ii
Table of Contents.....	iii
List of Tables.....	iv
List of Figures.....	vii
List of Charts.....	vii
List of Abbreviations.....	ix
Abstracts.....	xi
1.1 Background of the Research	- 1 -
1.2 Statement of the Problem.....	- 3 -
1.3 Key Questions	- 4 -
1.4 Objectives	- 4 -
1.5 Significance of the Research.....	- 4 -
1.6 Research Methodology	- 5 -
1.7 Research Technique.....	- 5 -
1.8 Scope and Limitations of the Research.....	- 6 -
1.9 Outline of the Research.....	- 6 -
2.1 General Overview of Road Construction Sector in Ethiopia Research	- 8 -
2.2 Road Sector Development Programs Inception.....	- 10 -
2.3 Achievements of Road Sector Development Programs.....	- 11 -
2.4 Participation of Foreign Contractors in Road Sector Development Programs	- 14 -
2.5 Road Construction Projects.....	- 15 -
2.6 Contracts for Road Construction Projects.....	- 18 -
2.7 Contracts and Allocation of Risk.....	- 20 -
2.8 Risk in International Contracts	- 24 -
2.9 Risks in Ethiopian Road Construction Projects.....	- 26 -
2.10 Bidding for Road Construction Contracts in Ethiopia.....	- 28 -
2.11 Pricing for Road Construction Contracts.....	- 32 -
2.12 Contract Prices	- 37 -
2.13 Contract Price Adjustments	- 38 -

2.14	Triggers for Contract Price Adjustments	- 42 -
2.15	Legal Perspective on Contract Price Adjustments	- 45 -
2.16	Contractual Perspective on Contract Price Adjustments	- 48 -
2.17	General Frameworks for Contract Price Adjustments	- 54 -
2.18	Methods for Contract Price Adjustments.....	- 55 -
2.19	International Financiers' and Donors' Guidelines on Contract Price Adjustments.....	- 72 -
2.20	Other Countries Experiences in Contract Price Adjustments	- 74 -
2.21	Contract Price Adjustment Provisions during Design and Tender Stages.....	- 78 -
2.22	Effects of Contract Price Adjustment Amounts.....	80
2.23	Summary of Literature Review.....	82
3.1	Introduction.....	85
3.2	Description of the Study	85
3.3	Research Type.....	86
3.4	Research Design.....	86
3.5	Scope and Limitation of the Study.....	89
3.6	Validation of the Case Studies.....	89
4.1	General Description of the Projects	90
4.2	Risk Allocation Related to Contract Price Adjustments.....	91
4.3	Consistency of the Contract Price Adjustment Frameworks	99
4.4	The Non Adjustable or Fixed Portion.....	101
4.5	Sources of Indices and Costs/Prices	105
4.6	Reliability and Appropriateness of Indices or Costs/Prices.....	107
4.7	Weightings or Coefficients Ranges	116
4.8	Contract Weightings or Coefficients	123
4.9	Foreign Indices versus Domestic Market Lease Price Trends.....	136
4.10	Change of Indices and Costs/Prices.....	139
4.11	Consistency of Contract Price Adjustment Practices.....	140
4.12	Summary of Findings.....	140
4.13	Validation of the Study	142
4.1	Research Questions and Objectives Revisited.....	143
4.2	Concluding Remarks.....	144

4.3	Recommendations.....	146
4.4	Further Study	148
	References.....	149
	Annex A.....	153
	Annex B.....	161

List of Tables

Table 2.1	RSDP Disbursements
Table 2.2	Risk Allocation of FIDIC GCC (4 th edition, 1992)
Table 2.3	Risk Allocation of FIDIC GCC (1995)
Table 2.4	Prices of Fuel and Cement in Addis Ababa
Table 2.5	Example of Range of Weightings and Non Adjustable Portions per Bill Group
Table 2.6	Example of Percentage Range of Weightings and Non Adjustable Portion
Table 2.7	Recommended Standard Coefficients Range (Source: SMEC, 2018)
Table 2.8	Weightings of Construction Inputs (Source, Unpublished ERA (2009) Study)
Table 2.9	Coefficients for Various Types of Road Works (Source, Aurecon (2013))
Table 2.10	Comparison of Characteristics of Prices and Indices
Table 2.11	Price Adjustment Amounts of Some Federal Road Projects
Table 2.12	Comparison of Major Parameters against ERA's Practices related to CPA
Table 3.1	Research Instrument Documents
Table 3.2	Projects Selected for Case Study
Table 4.1	Additional Details of the Case Study Projects
Table 4.2	FIDIC Sub Clause Summary Related to Price and Price Adjustments
Table 4.3	SCC/CoPA Sub Clauses Stipulations Related to CPA
Table 4.4	Price Adjustment Frameworks of ERA Projects
Table 4.5	Non Adjustable/Fixed Portions of Case Study Projects (%)
Table 4.6	Non Adjustable/Fixed/ Portions
Table 4.7	Recommended Ranges of Non Adjustable Portions
Table 4.8.1	Sources of Indices and Prices Applicable for Local Currency Payment CPA
Table 4.8.2	Sources of Indices and Prices Applicable for Foreign Currency Payment CPA
Table 4.9	Measure of Indices or Prices for CPA
Table 4.10	Evaluation of the Sources of Indices of the Local Currency Portion CPA

Table 4.11	Evaluation of the Sources of Indices of the Foreign Currency Portion CPA
Table 4.12.1	Weighting Rages Provided in the Contract for the Purpose of CPA (Project 1, Source the Contract Document)
Table 4.12.2	Weighting Rages Provided in the Contract for the Purpose of CPA (Project 2, Source the Contract Document)
Table 4.12.3	Weighting Rages Provided in the Contract for the Purpose of CPA (Project 3, Source the Contract Document)
Table 4.12.4	Weighting Rages Provided in the Contract for the Purpose of CPA (Project 4, Source the Contract Document)
Table 4.12.5	Weighting Rages Provided in the Contract for the Purpose of CPA (Project 5, Source the Contract Document)
Table 4.13	Equipment/Fuel Ration of Major Group of Works
Table 4.14.1 (a)	Contract Weightings for Local Currency Portion of CPA (Project 1, Source: the Contract Document)
Table 4.14.1 (b)	Contract Weightings for Foreign Currency Portion of CPA (Project 1, Source: the Contract Document)
Table 4.14.2 (a)	Contract Weightings for Local Currency Portion of CPA (Project 2, Source: the Contract Document)
Table 4.14.2 (b)	Contract Weightings for Foreign Currency Portion of CPA (Project 2, Source: the Contract Document)
Table 4.14.3 (a)	Contract Weightings for Local Currency Portion of CPA (Project 3, Source: the Contract Document)
Table 4.14.3 (b)	Contract Weightings for Foreign Currency Portion of CPA (Project 3, Source: the Contract Document)
Table 4.14.4 (a)	Contract Weightings for Local Currency Portion of CPA (Project 4, Source: the Contract Document)
Table 4.14.4 (b)	Contract Weightings for Foreign Currency Portion of CPA (Project 4, Source: the Contract Document)
Table 4.14.5 (a)	Contract Weightings for Local Currency Portion of CPA (Project 5, Source: the Contract Document)

Table 4.14.5 (b)	Contract Weightings for Foreign Currency Portion of CPA (Project 5, Source: the Contract Document)
Table 4.15	4.15 E/F Ratio of Case Study Projects
Table 4.16	Remarks on Accuracy of Weightings of Equipment and Fuel
Table 4.17	Comparison of Weightings of Bitumen, Cement and Reinforcing Steel
Table 4.18	Remarks on the Contract Weightings of Bitumen, Cement and Reinforcing Steel

List of Figures

Figure 2.1 Project Phases of ERA

List of Charts

- Chart 2.1 Amounts of Projects Awarded to Domestic Contractors, Foreign Contractors and ERA Own Force from 1997 to 2010
- Chart 2.2 Amounts of Consultancy Contracts Awarded to Domestic Consulting Firms and Foreign Consulting Firms from 1997 to 2010
- Chart 2.3 Comparison of % change in Prices of Fuel, Cement and Country Level CPI (Sources of data NOC Ethiopia, Muger Cement S.C and CSA (20119)
- Chart 2.4 Comparison of % Change Trend CPI (Ethiopia) and PPI Construction Machinery & Equipment (USA) (Sources of raw data: CSA (Ethiopia) and <https://data.bls.gov>)
- Chart 4.1 Domestic Lease Price Trends of Major Construction Machineries
- Chart 4.2 Comparisons of Cumulative Percentage Changes of Equipment Indices of Hong Kong, China and USA

List of Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
BoQ	Bill of Quantities
CIDB	Construction Industry Development Board
CoPA	Conditions of Particular Application
CPA	Contract Price Adjustment
CPI	Consumer Price Index
CSA	Central Statistical Agency
DB	Design Build
DBB	Design Bid Build
DMO	District Maintenance Offices
DPER	Department of Public Expenditure Reform
EFY	Ethiopian Fiscal Year
ERA	Ethiopia Roads Authority
ETB	Ethiopian Birr
EU	European Union
FDRE	Federal Democratic Republic of Ethiopia
FIDIC	International Federation of Consulting Engineers
GCC	General Conditions of Contract
GDP	Gross Domestic Product
GoE	Government of Ethiopia
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IDA	International Development Agency
MDB	Multilateral Development Banks
MoT	Ministry of Transport
MOWUD	Ministry of Works and Urban Development
NBE	National Bank of Ethiopia
NCB	National Competitive Bidding

NCHRP	National Cooperative Highway Research Program
PMI	Project Management Institute
PPA	Public Procurement Agency
PPI	Producer Price Index
RRA	Rural Road Agencies
RRGRO	Regional Government Rural Road Organizations
RSDP	Road Sector Development Program
SAFEC	South African Federation of Engineering Contractors
SAICE	South African Institution of Civil Engineering
SCC	Special Conditions of Contract
SEIFSA	Steel and Engineering Industries Federation of South Africa
SMEC	Snowy Mountain Engineering Company
UNDB	United Nations Development Business
USD	United States Dollar
WB	World Bank

Abstract

It is known that road construction projects are executed over spans of years in the country. In consideration of the long years of execution, and in recognition of the risk of rise or fall of cost of construction inputs from the time of tendering to the time of execution, contracts for most of projects afford a mechanism to administer the risk of change in the cost of construction inputs.

Therefore, this research project study the practices of contract price adjustments (CPA) resulting from the rise or fall of costs of construction inputs of road construction projects administered by the Ethiopian Roads Authority (ERA) focusing on exclusively on contracts awarded to foreign contractors through purposive selection of five case study projects from the five contract administrative regions of ERA.

Comparison of the practices of case study projects of ERA against literature recommendations and prior research works indicates that the practices have wide room for speculative choices of indices and prices which are important elements of adjusting contract prices using formula method of adjustment. Moreover, the research noted that the practice is not guided by institutional wide recognized framework thus letting loose a wide variety of practices and choices which would compromise the purpose of CPAs.

Findings from the case study projects studied revealed that the practices has uneven problems, gaps in terms of appropriateness of indices or prices in use and inaccuracy of the weightings. The inaccuracies are both upward or downward figures well beyond any acceptable ranges except very few of the weightings which are found within the acceptable ranges of estimates.

The research covers wide areas related to CPA starting from risk allocation through verification of accuracy of the weightings. In this course experience of few countries and international financial institutions guidelines and recommendations serve as a reference for the purpose of comparing ERA's practices.

Keywords: Contract Price Adjustment, Cost, Indices, Prices, Foreign Contractors, Road Projects

Chapter One

Introduction

1.1 Background of the Research

In recognition of the importance of road transport has in supporting social and economic growth and its role as an impetus to sustain economic growth, the Government of the Federal Democratic Republic of Ethiopia (FDRE) placed increased attention on improvement of the quality, size and distribution of road infrastructure in the country. To improve the poor state of roads in the country following long years of civil war, the Government formulated and launched Road Sector Development Program I (RSDP I) in 1997. The first and subsequent programs named RSDP II to RSDP V run for a period of five years each except RSDP III which run for 3 years and RSDP V which is under implementation. The RSDPs have been implemented over a period of nearly two decades in five successive phases as follows (MoT/ERA, 2015):

- RSDP I - Period from July 1997 to June 2002
- RSDP II - Period July 2002 to June 2007
- RSDP III - Period July 2007 to June 2010 (3 years plan)
- RSDP IV - Period July 2010 to June 2015
- RSDP V – Period July 2015 +

These programs provided comprehensive approach of integrating the implementation of key road investments with major policy and institutional reforms. Therefore, great numbers of road projects have been executed throughout the country in line with the RSDPs launched in 1997 (ERA, 2015). The benefits of these development programs are clear in terms of improved connectivity across the country, job opportunities created, local construction capacities created, institutional capacities developed and economic growth stimulus sustained. However, the benefits mentioned are not earned without the effort of various stakeholders, and without substantial amount of national budget allocation which would otherwise have been invested on

other national necessities (MoT/ERA, 2015).

The Government of Ethiopia's (GoE) allocation of substantial amount of the national budget for the construction of roads in various parts of the country is an indication of its commitment to the RSDPs, which according to the National Bank of Ethiopia (NBE) Annual Report (2018) consumed ETB 33.94 and ETB 33.2 billion for the Ethiopian Fiscal Year (EFY) 2009 (2016/2017) and EFY 2010 (2017/2018) respectively.

Information obtained from Ethiopian Roads Authority's (ERA) official website (www.era.gov.et) on the 25th March, 2019 indicates that the authority has 129 ongoing road constructions, rehabilitation and upgrading projects excluding maintenance and study projects whose total contract amounts equals ETB 137.75 billion. These projects which are at various stages of construction are being executed by local and foreign construction companies financed from proceeds of government, international donors and lenders. Foreign construction companies are executing contract works worth ETB 79.36 billion while domestic companies take up the remaining share which is ETB 58.39 billion.

Contracts awarded to foreign contractors entail payments in national and foreign currency in certain proportion for the construction works executed and for Contract Price Adjustments (CPA) emanating from the rise in the cost of construction inputs. Hence, it is not doubtful that portion of the national budget is allocated to finance CPAs which are not uncommon in all construction contracts executed with both domestic and foreign construction companies.

The construction, upgrading and rehabilitation of federal road infrastructures require substantial quantities of machineries and materials the cost of which fluctuates during periods of construction contracts, sometimes abruptly. The proceeds to finance the rising costs/prices of construction inputs entails an average CPA of 31.0% of the contract prices according to internal review of six completed projects sponsored by the World Bank (WB) (2015); hence studying the practices including contract provisions and associated method of calculation of CPAs is relevant and important. From the practices so far, it is known that ERA uses formula method for the purpose of determining CPA arising out of fluctuation of prices of construction inputs. Hence,

based on the above brief background, this research case studies CPA practices of ERA administered federal road construction projects, which are awarded to foreign construction companies through ICB procurement methods and are under construction.

The research focuses exclusively on contracts awarded to foreign contractors because of their dominant position on the construction of federal roads. Therefore, the research studies gaps, key problems, shortcomings or deficiencies of the practice through case study of selected projects.

1.2 Statement of the Problem

Significant amount of Ethiopia's budget is allocated to economic development programs through financing for infrastructure developments including development of educational facilities, power projects, construction of railways and road projects (MoWUD, 2015). Public construction projects consume an average 58.2% of the government's capital budget NBE (2013) and construction and maintenance of road infrastructure remain one of the key investments of the government over the past decade (NBE, 2018). The road projects, which consume huge portion of capital budget (www.era.gov.et), are under ERA's administration having a proportionally huge budget contingency for CPAs arising out of fluctuations of costs of construction inputs.

ERA contracts for the construction of road projects use formula method to determine CPA arising out of the rise or fall of cost of construction inputs. However, the parameters contained in the formula have certain degree of variation and inconsistency. Similarly, some of the reference prices or indices in use may not represent the market situation in the country thereby posing a doubt about their reasonable representation and purposefulness. Therefore, this research studies the practice of CPAs to identify gaps, key problems, shortcomings or deficiencies of the practices through case studies with the aim of recommending measures that would improve the current practices.

1.3 Key Questions

1. How are the risks allocated related to rise or fall of construction costs?
2. Are the weightings or coefficients in the formula method reasonably correct and reflective of their share of the inputs they are thought to have represented?
3. How much the reference indices and costs/prices are appropriate and effective for their purpose?
4. How much the reference costs/prices and indices correspond with the market price trends?

1.4 Objectives

The objectives of this research are:

1. To assess the practices in terms of risk allocations and associated CPAs,
2. To assess the reasonable accuracy of the weightings or coefficients and to evaluate the appropriateness and effectiveness of the reference costs/prices and indices,
3. To identify gaps, key problems and shortcomings in the practices of CPAs,

1.5 Significance of the Research

Inconsideration of the volatility of prices of construction inputs in the country and the associated huge budget provision for CPAs, this research studies the current practices to identify gaps, key problems, shortcomings and deficiencies of the practices of CPA of federal road projects awarded to foreign contractors.

It is the researcher's opinion that the findings from this research benefits contractors, consultants and ERA by indicating gaps, key problems, and shortcomings of the practice of CPA and proposing recommendation for fair risk allocations, avoidance of undue risk speculation, unfair competition and undue benefit or undue loss and standardize the process of CPA in road construction projects.

This research may also serve as a reference for other researchers and may initiate others who are pursuing studies on relevant subjects to further work on the limitations of this research and make it more comprehensive.

1.6 Research Methodology

This case study research compares the practices of ERA contracts against literary recommendations. As mentioned above the objectives of this research includes assessment of the practices of risk allocations and associated CPAs and questions the purposefulness and effectiveness of reference costs/prices and indices which calls for exploring the current practices to identifying the major characteristics of ERA projects awarded to foreign contractors selected for the study with the aim of improving the current practices. These objectives, call for descriptive explorations of the practices of ERA.

Hence, the research is a descriptive and exploratory research establishing the cause and effect relationships arising out of increase or decrease of price/costs of construction inputs through case studying selected projects.

1.7 Research Technique

Yin (2003) notes that a case study research can be used for exploratory, descriptive as well as explanatory studies. In consideration of the research methodology selected and keeping in mind the research objectives, the most suitable research technique that combines describing and exploring the practices of ERA related to CPA of foreign contractors' road projects to identify key gaps, key problems and shortcomings is case study. Selection for the case study is done

through purposive sampling method. This method is selected because of the limited number of population size and the presumption that this method of sampling would enable in depth focusing which is one reason case studies are favored . Yin (2003) notes that while a larger case number may be needed for theoretical replication, when fit; even two cases may be enough for literal replication.

1.8 Scope and Limitations of the Research

The scope of this research covers selected projects out of many projects currently under construction in the country which are awarded to foreign contractors under the administration of ERA. In addition, assessment of the accuracy of weightings of equipment, cement, fuel, reinforcement bars and bitumen is within the scope of the study. The limitations of this research include exclusion of contracts awarded to domestic contractors whose total contract amount is 42.2% of the total amounts of contracts ERA is administering based on information obtained from www.era.gov.et as of 28th March, 2019. Moreover, the case study involves 5 numbers of projects out of a total of 26 number projects under execution by foreign contractors.

1.9 Outline of the Research

The research work is organized into five chapters the contents of which are briefly described as follows:

Chapter 1: it is an introductory part which offers background information, states the research problem, significance of the research, the objectives and limitations of the research. The research methodology describes that it is a case study of projects through review of appropriate documents.

Chapter 2: is a literature review from professional journals, books, internet searches, publications, previous research works and study of contract documents. This chapter provides a literary background related to construction contract risk allocation, pricing, and tendering in

Ethiopia. It also provides literary background in the subject of contract price adjustment including the methods and the constituents of contract price adjustment.

Chapter 3: discusses the research methodology followed in order to achieve the objectives of the study.

Chapter 4: describes the findings of case studies of projects selected for the research and appropriate discussions is made with reference to the literary findings covered under chapter 2.

Chapter 5: concludes based on the findings of the case studies and forwards recommendations and further research area suggestions.

Chapter Two

Literature Review

2.1 General Overview of Road Construction Sector in Ethiopia Research

In Ethiopian context, the term construction is not defined directly by law. It is broadly known as “works” according to Proclamation No. 649/2009. Article 2(3) of Proclamation No. 649/2009, defined it as all work associated with the construction, reconstruction, upgrading, demolition, repair or renovation of a building, road, or structure, as well as services incidental to works and includes build-own-operate, and build-own operate-transfer and build-operate-transfer contracts.

By reference to article 2(3) of proclamation no. 649/2009 the construction industry includes products and services brought about by the construction, reconstruction, upgrading, demolition, repair or renovation of buildings, roads, or structures, as well as services incidental to works. This construction industry and the associated steady growth of domestic construction companies in Ethiopia in the 1950's and 1960's was curtailed following the nationalization of many private construction companies in the aftermath of the military coup in 1974 and subsequent civil war and political turmoil ensured in the country Wubshet (2005).

The construction industry whose growth had been curtailed in the 1970's and 1980s' is now in the process of transformation based on improving its competitiveness and enhancing its ability to fulfill the national development demands Wubishet (2005). Segment of the construction industry, the road construction sector, is establishing foothold partly through huge government investment on infrastructure development which gave way for domestic construction companies to thrive and be able to execute works worth ETB 65.0 billion over 18 years of RSDP implementation from 1997 to 2015 while foreign contractors executed ETB 89.7 billion contracts during the same period (ERA, 2015).

According to NBE (2013) the construction industry is one of the main economic driving sectors supporting the national economy and it contributes 5.3% to the Gross Domestic Product (GDP) and public construction projects consume an average 58.2% of the government's capital budget.

The road construction sector's players including domestic contractors and consultants, as per MoT/ERA (2015) assessment, are regarded as insufficiently competent in project management causing poor quality of designs and other related problems. Despite uncomfoting assessment of MoT/ERA (2015), domestic construction and consulting companies executed various works and offered services worth billions over the 18 years of RSDP implementation between 1997 and 2015; nonetheless, the dominance of foreign contractors is not overtaken.

NBE's (2018) report indicates that the construction industry accounted for 71.4% of the industrial output and expanded by 15.7% in 2017/2018 compared against the previous year signifying the leading role of the industry both in terms of contribution to the national economy and in terms of expanding roads, railways, dams and residential houses. However, the growth rate showed a decline since 2014/15 and investment on road projects subsided by 2.4% at least for the year 2017/2018 compared against the year 2016/2017.

According to ERA's website on the 25th March, 2019 the authority administers a total of 129 contracts for the construction, upgrading and rehabilitation of federal road projects whose contract price is ETB 137.54 billion in total. Out of these projects 55 number representing 42.6% of the projects are contracted to foreign contractors whereas the remaining 74 number projects representing 57.4% of the projects are contracted to domestic contractors. In terms of amount, foreign contractors' are contracted for total contract price of ETB 79.36 billion while the remaining 58.39 billion ETB is domestic contractors' share indicating that domestic contractors are executing greater number of projects but lesser contract amounts.

Domestic contractors' capacity limitations are because of various reasons including limited years of experience, shortage of capital, equipment and human resources according to an assessment conducted by ERA (2015). Moreover, ERA (2015) identified that Rural Roads Agencies (RRAs) and District Maintenance Offices equally have limited capacities both in terms of human

resources and technical competence to play a significant role in the process of improving the sector.

The construction industry, in general and the road construction sector in particular are constrained by challenges including budget constraints, domestic capacity limitations, foreign exchange shortages and price increase of construction input which may affect the Government's desire to allocate substantial portion of the national budget (ERA/MoT, 2015).

2.2 Road Sector Development Programs Inception

Assessment of the state of road infrastructure in the country according to ERA (1996) was characterized by markedly deteriorated roads linking urban centers to rural communities which are widely dispersed and scattered in small rural communities producing crops at considerable distance from each other posing difficulty for the distribution of or collection of agricultural inputs and excess produce.

In addition, ERA (1996) identified that two third of the regional roads were virtually impassable, imposing significant penalties on agricultural activities through their effect on vehicle operating costs, delayed evacuation and damage to crops thereby causing significant cost to the economy. Furthermore, the road networks had deteriorated substantially to the extent that only 11 percent of the paved roads and 19 percent of the gravel roads were in good condition.

The government of FDRE in its desire to improve the performance of the agriculture sector in particular and to ensure sustainable economic growth of the country in general identified the need to improve road networks. The government recognized the crucial role road infrastructure play to improve the performance of the economy and devised a Road Sector Development Program (RSDP) with the aim of improving and expansion of the road network (ERA, 1996).

Subsequently, RSDP I is launched in July 1997 and run for a period of five years up to June 2002 with the main target of increasing the road density to 0.46 km per 1,000 population and to 27 km per 1,000 square kilometer with network quality of 60 percent in good condition (ERA, 1996).

The inception of RSDP I anticipated the continued implementation of subsequent programs to achieve the level and condition of road networks necessary to elevate the country's economic status in general. Subsequent programs of RSDP II, III, and IV were implemented while RSDP V is under implementation.

2.3 Achievements of Road Sector Development Programs

MoT/ERA (2015) recognizing the achievements of RSDPs from 1997 to 2015 states that a total of 118,553 km of road physical works consisting of rehabilitation, upgrading and construction of various classes of road; and maintenance of federal and regional roads have been carried out through investment of ETB 218.7 billion. According to MoT/ERA (2015) implementation of RSDPs over 18 years from 1997 to 2015 increased the road network of the country from what was 26,550 km in 1997 to 110,414 km in 2015. As a result of the increased size of road network average distance to nearest all weather roads decreased from what was 21 km in 1997 to 5.5 km in 2015. Road density per 1,000 square kilometer increased from 24.1 km to 100.4 km, the size of paved road network of the country increased from 3,708 km to 14,055 km and the proportion of road network in good condition increased from 22% in to 70% in.

Assessment carried out by ERA (2011) applauded the impact of the RSDPs in building the capacity of domestic construction industry. ERA characteristically recognize the increased participation of domestic contractors and consultants in the development programs and the increased number and amount of contracts domestic contractors are able to execute citing a single contractor's capacity to contract works valued up to ETB 825 million. The capacity of domestic contractors has no doubt shown gradual improvement, which may be illustrated by a domestic contractor's competence to contract a single project of ETB 2.36 billion contract amount while the same contractor is executing 8 projects whose total contract amounts is ETB 12.62 billion (www.era.gov.et, accessed on the 25th March, 2018). However, the improvement of a single contractor may not be an indicator of the state of improvement of domestic contractors in general. Comparison of the contract amounts of road projects executed by domestic contractors versus foreign contractor's from 1997 to 2010 (RSDP I to RSDP III) is shown in the chart 2.1 below ERA (2011).

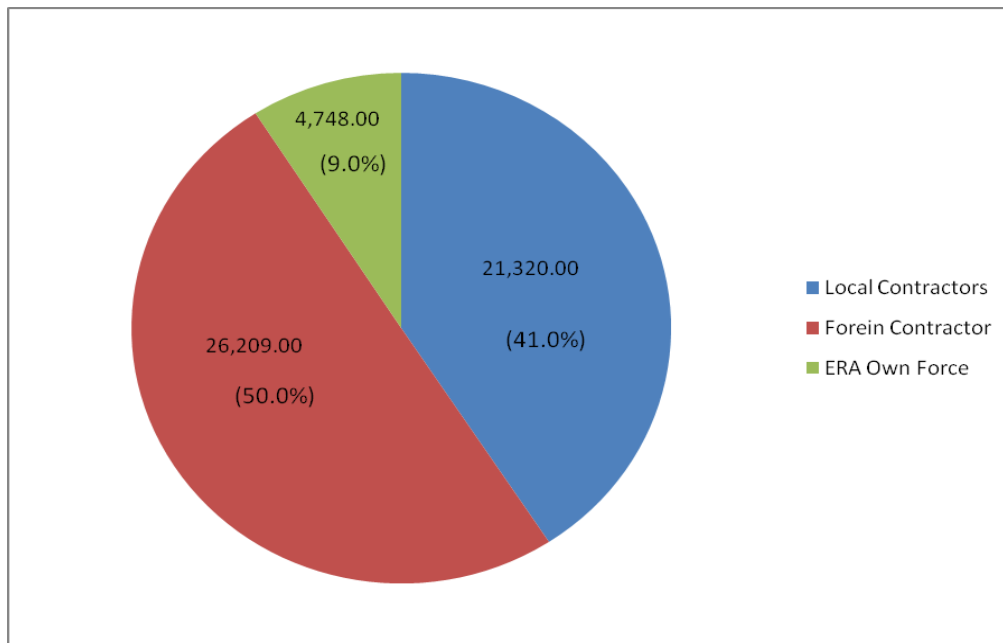


Chart 2.1: Amounts of Projects Awarded to Domestic Contractors, Foreign Contractors and ERA Own Force from 1997 to 2010 – excluding Addis Adama Expressway Project (Source ERA (2011))

From chart 2.1 above, it is notable that the total contract amounts of works executed by domestic contractors including ERA’s Own Force is nearly equal to that of foreign contractors over the execution period of RSDP I to RSDP III (1997 to 2010) which may be one measure of the achievements of the RSDPs goals. Local consulting firms, however, outperformed offering services worth more than that of foreign firms during the RSDPs implementation between 1997 to 2010 (ERA, 2011), which is another measure of achievement as indicated in the chart below

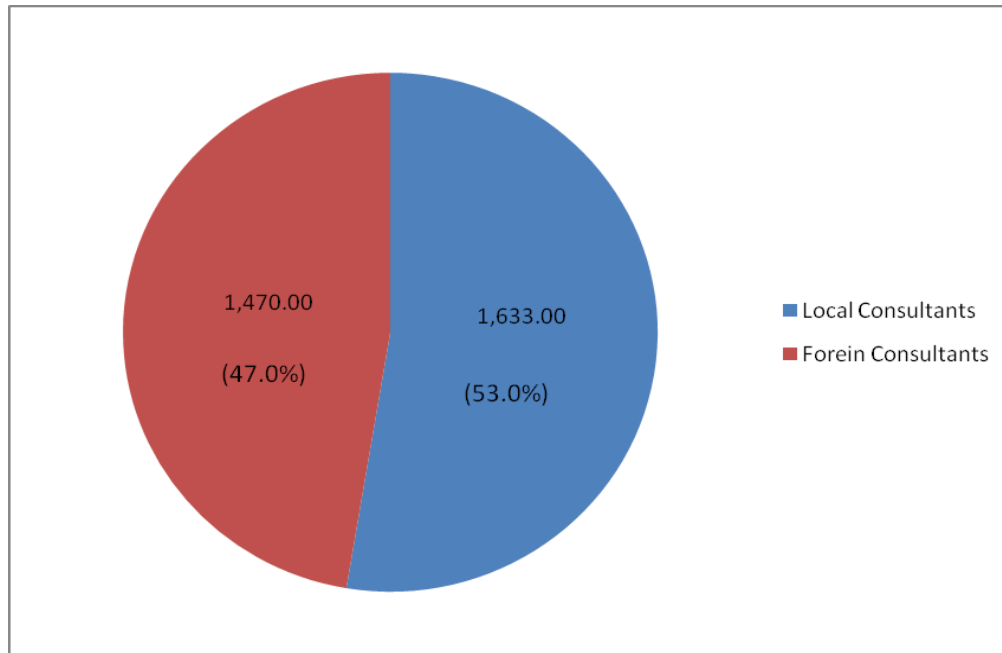


Chart 2.2: Amounts of Consultancy Contracts Awarded to Domestic Consulting Firms and Foreign Consulting Firms from 1997 to 2010 (Source ERA (2011))

Though the total value of consultancy services offered by domestic firms is more than that of the foreign ones for the period of implementation of RSDP I to RSDP III, it is important to consider the fact that domestic consulting firms offered services for 64% of the number of project whereas foreign firms offered services for 36% of the number of projects. Nonetheless, the outperformance of domestic consulting firms is by executing nearly double number of projects whose service values are nearly equal to that of foreign consulting firms which executed high value or expensive services.

Despite the achievements, MoT/ERA (2015) noted the major impediments encountered during implementation of RSDPs including institutional capacity limitations in procurement, contract administration knowledge gaps, drawbacks in engineering services and capacity limitation related to road asset management and the rising cost of implementation of the programs which put budgetary burden on the government.

2.4 Participation of Foreign Contractors in Road Sector Development Programs

During the inception of the first program ERA (1996), it is noted that the overall objectives of the road sector development program are derived from the urgent need for socio-economic development of the country. Accordingly, one of the strategic objectives of the RSDP was enhancing the road construction and maintenance capacity in the country through the promotion and use of domestic private contractors.

After implementation of RSDP I to RSDP III ERA (2011), it is reported that out of a total of 691 projects (both construction & consultancy) awarded, 443 projects were awarded to local companies. 64% of consultancy services projects were executed by local consulting firms out of a total of 435. 63% number of road construction works were executed by local construction companies out of a total project of 256. In terms of the value of works executed, local construction and consulting companies earned projects ETB 21.3 billion in total, while foreign contractors and consulting firms executed projects totaling ETB 39.03 billion.

According to the ERA's (2011) report a total of ETB 60.355 billion was disbursed to implement RSDPs up to the end of 2010. This investment resulted in improvement of the total road network which was 23,812.0 km in 1996 to 48,793.0 km in 2010 which is more than double.

Another assessment of the performance of RSDPs done by ERA (2015) indicated that over the 18 years of RSDP implementation from 1997 to 2015, construction contracts having a total price of ETB 154.7 billion were awarded to domestic and foreign contractors, of which ETB 65.0 billion was awarded to domestic contractors and the greater share amounting ETB 89.7 billion was awarded to foreign contractors. From comparison of ERA's (2015) and ERA's (2011) reports it is worthy of note that foreign contractors continue to dominate the construction of federal road projects taking 58% share of the total amount of works contract awarded. Based on reports ERA (2005), ERA (2011), ERA (2015) and MoT/ERA (2015) summary of the RSDP disbursements are as shown in the table 2.1 below.

Table 2.1 RSDP Disbursements (Source ERA (2006), ERA (2011), ERA (2015) and MoT/ERA (2015))

RSDP	Total (million ETB)	Internal Sources (%)	External Sources (%)	Foreign Companies		Domestic Companies	
				Amount	%	Amount	%
I (1997-2002)	7,285.00	61.00	39.00	4,800.82	65.90	2,484.19	34.10
II (2002-2007)	18,112.90	67.00	33.00	11,085.09	61.20	7,027.81	38.80
III (2007-2010)	34,957.80	75.00	25.00	23,526.60	67.30	11,431.20	32.70
IV (2010-2015)	157,082.80	77.10	22.90	87,180.90	55.50	69,901.85	44.50
V Plan (2015-2020)	334,500.00	73.80	22.90	192,672.0	57.60*	141,828.0	42.20*
Total	551,938.50	74.40	23.60	319,265.5	57.84	232,673.0	42.16

*based on current contracts proportion.

From the total amounts disbursed the domestic companies' share of the works executed is less than the foreign companies. Hence the influences of the foreign firms on the development of infrastructure in the country cannot be undermined. The planned execution of projects under RSDP V are indentified and listed and these projects are fairly distributed across regions based on population, area and other criteria to ensure equitable distribution of federal roads according to MoT/ERA (2015).

2.5 Road Construction Projects

A project is temporary endeavor undertaken to create a unique product or service (PMI, 2008). According to PMI (2008) projects are temporary means they have definite beginning and definite end; and they are unique means the product or service is different in some distinguishing way

from all similar products or services. The temporary endeavors of a project involves five stages of activity which comprise defining the location, nature, quality and magnitude of the works; obtaining permissions necessary to construct; designing and estimating the probable cost; construction and finally testing the works as constructed and putting them into operation according to PMI (2008).

Because projects are unique undertakings involving a degree of uncertainty and to manage the uncertainties, projects are usually phased (PMI, 2008). Solomon (2015) notes that ERA project phases can be divided into project planning and programming, project development, project implementation and project commissioning and contract closure phases. PMI (2008) underscores that the end of a project is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists.

Diagrammatical illustration of the project delivery and product operation process cycles of ERA's projects is depicted in figure 2.1 below.

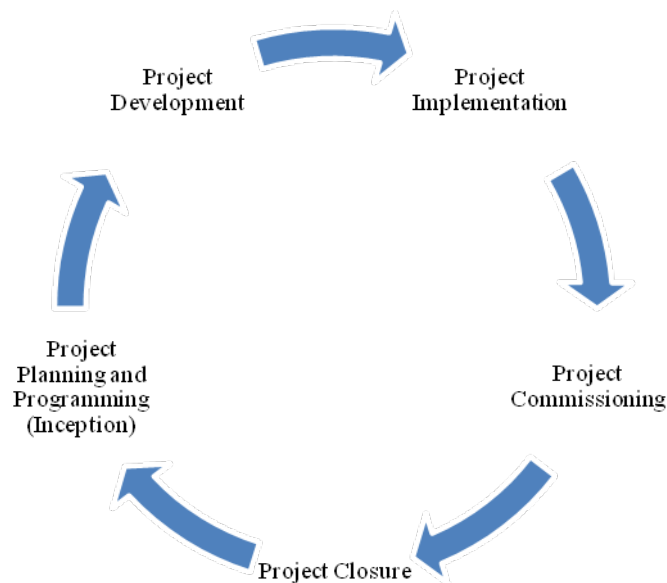


Figure 2.1 Project Phases of ERA (illustration based on Solomon's (2015))

Solomon (2015) notes that the overall product life cycle processes of projects in ERA are congregated into road infrastructure delivery and management processes that aggregates both the project delivery and product operation processes. Accordingly, project delivery process is broken down into network and programme development, project development and project implementation processes.

Once inception of a project is programmed then it passes on to project development which mainly consists of feasibility study, engineering design, financing arrangements and procurement major output at the end being design documents often compiled into the works and supervision contract . It is therefore, during project developments that ERA decides project delivery methods, finalizes and agrees on the contents of the contract documents and satisfies itself of the reasonable accuracy, completeness of the designs and contract documents. Project development process is affected by organizational structure within ERA, and externally by the design consultants who may be constrained by capacity and different environmental forces (Solomon, 2015).

The project implementation process which comprises the execution of the projects is effected by the coalition of ERA, contractors and the supervision consultants employing works and supervision contracts documents, nonetheless struggling with limitations such as capacity of the coalition and environmental forces like inflation (Solomon, 2015).

Despite their limitations, Getachew (2014) gives paramount importance to the extent of wellness of project risk management through sound business and construction practices and through careful preparation and review of the project contract documents for construction project successes. Hence, the subject of CPA must be carefully comprehended during each process to ensure that they neither overburden the employer nor over penalize the contractor.

Since contract provisions for CPA are prepared and decided up on during project development and put in to practices during project implementation process; thoughtful consideration during both stages may assure reasonable risk sharing and avoid undue benefit or loss to parties to a

contract. Therefore, due diligence and care must be exercised from project development stage through to project closure.

2.6 Contracts for Road Construction Projects

A contract is an agreement whereby two or more persons as between themselves create, vary or extinguish obligations of a proprietary nature (Article 1675 Civil Code, 1960) and the provisions of a contract lawfully formed shall be binding on the parties as though they were law according to article 1731 (1).

According to Bunni (2003), the simplest definition of a contract is *'A promise enforceable by law'*. Or contract is *'An agreement between two or more parties in which each party binds himself to do or forbear to do some act and each acquires the right to what the other promises'*.

Moreover, the Civil Code requires the consent of the parties *who define the object of their understanding and agree to be bounded thereby* (Article 1679); and Article 1731 allows the contents of a contract to be determined by the parties subject to mandatory provisions of the law.

Further to the above provisions, contracts formed with administrative authorities are governed by Title XIX Administrative Contracts section of the Civil Code. According to article 3131 (1) and (2) contracts concluded by the state or other administrative authorities shall be governed by the provisions of the Civil Code, which regulates contracts in general or special contracts. The provision of Title XIX Administrative Contracts section of the Civil Code supplement or replace such provisions where the contract is in the nature of an administrative contract.

In case of an international construction contract, Bunni (2005) advises to be watchful of the law under which the parties' rights and obligations are determined because it could be the law of the country where the contract is made or where the project is constructed or that of the domicile of one of the parties to the contract. ERA, for all contracts it executes with foreign contractors procured through both on National Competitive Bidding (NCB) or International Competitive Bidding (ICB) methods, prescribe that the contracts are enforced under the laws of the Federal

Democratic Republic of Ethiopia (Sub clause 5.1 of CoPA or Sub Clause 1.4 of SCC) and regard the contracts administrative which are regulated under the provision of Title XIX of the Civil Code, other provisions of the Code, other laws and regulations in force in the country.

In the formation of contracts, article 3136 (2) of the Civil Code allows general clauses and conditions to fix the provisions applicable to all or some of the contracts by a specified administrative authority. With the ambient of this article into consideration and/or through practices developed, all contracts executed with various contractors and consulting firms consist of standard conditions and special conditions applicable to each contract in separate sections.

ERA has gone through the use of various forms of standard conditions of contracts but as early as 2005 the use of FIDIC General Conditions of Contract (GCC) became common and these days ERA uses it for almost all construction contracts executed with both domestic and foreign construction companies for project contracts procured either through NCB or ICB methods except Public Procurement Agency (PPA) GCC which is in use for small works contracts.

Review of the various Design Bid Build (DBB) and Design Build (DB) contracts executed between ERA and contractors contains various documents forming part of the contract agreements. However, all the documents forming part of contracts are not relevant to the subject of CPA. From review of contract documents of various road construction projects; minutes of contract award negotiations, certain clauses of the appendix to bid (appendix to tender), certain clauses of the GCC and Special Conditions of Contract (SCC) / Conditions of Particular Application (CoPA) are the most relevant parts which prescribe the manner CPAs are dealt with.

The documents forming part of the contracts for DBB and DB projects show some differences because of the nature of the contract and the risks each party to the contract deemed to have assumed. Hence, the presence of some differences in the documents and contents emanate from reasons including but not limited to the differences in risk apportioning among the parties to the contract.

2.7 Contracts and Allocation of Risk

The Oxford Advanced Learners Dictionary (2010) defines risk as the possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result.

Bunni (2003) defines risk as the combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence. Kitchen's (1996) definition of risk in the context of the construction industry is a financial exposure that is not factored into the cost of doing business. Therefore, risk is viewed from the perspective of probability, frequency and damage based on the definitions given by Bunni (2003) and Kitchen (1996).

Kitchens (1996) conclusive statement that construction industry is an inherently high-risk business and Twort & Rees's (2004) equally assertiveness of the presence of inherent risks in construction works, demand a mechanism to anticipate and allocate the risks in advance before they eventuate.

Hence, Bunni (2003) suggests construction contracts to play a key role in the allocation of risks to which a project is exposed; and to provide a clear statement as to how these risks are to be dealt with and managed. In addition, Bunni (2003) explains that a contract should define upon whom the various risks of an enterprise fall, and the contractor should only price for those risks which an experienced contractor could reasonably be expected to foresee at the time of tender.

According to George (2013) contract is the best mechanism to allocate risks in order to promote project implementation on time and on budget with specified quality to obtain the greatest value of money. Bunni's (2003) suggestion of classification and allocation of risks on the basis of the criteria of control of the risks and their consequences, if and when they eventuate, is shared by Twort & Rees (2004) who noted that standard conditions of contract apportion the normal risks of construction to the party best able to control the risk.

Therefore, conditions of contracts allocate risks between the contracting parties. While doing so, the management of certain events and the associated risks are allocated in accordance with some rules rather than haphazardly. Such rules, according to Bunni (2005) revolve around the ability of a party:

- (a) Control any arrangements which might be required to deal with the hazard or any triggering incident relating to it;*
- (b) Control the risk or to influence any of its resultant effects;*
- (c) Perform a task relating to the project, such as obtaining and maintaining insurance cover; and*
- (d) Benefit from the project*

In allocating risk, Mudroch & Hughes (2000) indicated that even if a contract is silent on a particular risk, that risk will still lie with one party or the other. Hence, contract may seek to transfer a risk by making one party financially liable should the eventuality take place. In this way, risks are translated into financial equivalents so that they may be transferred or otherwise dealt with.

As Bunni (2005) pointed out when risk is uncertain, a contingent element will have to be included in the original price, which, in the event, may possibly not be required. If so, the employer will have agreed to an unnecessarily high price but may regard that as preferable. Since contractors bind themselves to construct, maintain or repair a work in consideration of payment according to Article 3244 (1) of the Civil Code, the risk associated with the fluctuation in the prices of construction inputs is a matter of concern. According to Twort & Rees (2004) wherever risk is shifted from the contractor to the owner, there should be a counterbalancing advantage of price to balance the risk assumed by the owner.

According to Twort & Rees (2004), it is unwise to try to pass to the contractor a risk that is difficult to assess. In Ethiopian context, Dawood & Bates (1998) cited in Mohammed (2013) regard the success of building construction projects to a great deal to the extent of cost escalation identified and allocated. However, according to Bates (1996) cited in Mohammed (2013) it is

likely that the financial success of a construction project can be uncertain because of risks due to changes in escalation rates during construction.

A research conducted by Asteway (2008) found out the fluctuation of prices of various construction materials in the range of a decrease of 45.53% to an increase of 189.29% compared against the prices at tender stage. However, major materials that take up more than 2.5% of the cost showed a price increase between 15.31% and 91.47% compared against the prices at tender stage. Asteway (2008) concludes stating that:

It is difficult to predict accurately and determine how the price of materials would increase or decrease. Even during high times of price fluctuation, it is very difficult to predict whether the then current prices will rise or fall or stay fairly constant

Therefore, recognizing the extreme difficulty of predicting the price trends of construction inputs, it would be wise to allocate the risk the rise and fall of prices of construction inputs in a manner suggested by scholars and acceptable industry practices.

ERA's use of internationally accepted contract conditions is a right direction since such contract forms apportion risks in a manner widely acknowledged by the industry stake holders. The use of FIDIC standard conditions of contracts for both NCB and ICB contracts with appropriate amendments under the special provisions to suit the nature of the contracts is wise. The FIDIC GCC allocates the risks associated with the fluctuation of prices of construction inputs as summarized under table 2.2 below.

Table 2.2 Risk Allocation of FIDIC GCC (4th edition, 1992)

S.No	Risk	Sub Clause	Assumed by
1	Increase of cost	70.1	Employer
2	Increase of because of subsequent change in legislation	70.2	Employer

Equally, the FIDIC (1995) GCC for turnkey and design build contracts allocates the risk of price fluctuation as summarized under table 2.3 below.

Table 2.3 Risk Allocation of FIDIC GCC (1995)

S.No	Risk	Sub Clause	Assumed by
1	Increase of cost	13.1	Contractor
2	Increase of cost because of subsequent change in legislation	13.16	Employer

The risks allocations are not similar in DB and DBB project delivery methods based on the standard GCC in use by ERA including differences in risk allocations emanating from the nature of the contracts. Remarkable difference exists in relation to the increase or decrease of costs of construction inputs.

The GCC (FIDIC, 4th edition, 1992) for DBB projects cater for the rise or fall of costs under Sub Clause 70.1 stating that costs:

“.... shall be added to or deducted from the Contract Price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the Works as may be determined in accordance with Part II of these Conditions.”

It is worthy of note that Sub Clause 70.1 quoted above, however, did not stipulate how the rise or fall of costs are entertained under a contract but opts to give the freedom to be specified in the SCC. However, the GCC (FIDIC, 1995) for DB projects put the risk of the rise or fall of costs on the contractor under Sub Clause 13.1 unless specified in the SCC. In relation to the rise of costs as a result of change in legislation the employer assumes the risk under both GCCs. Nonetheless, the SCC of DB projects reviewed for this research have provisions to cater for the rise or fall of costs in a manner similar to DBB contracts with some peculiar changes which might have emanated from the nature of project delivery method.

2.8 Risk in International Contracts

Zhe (1995) considers the state of contracting overseas construction projects usually a high risk business mostly because a lack of adequate overseas environmental information and overseas construction experience. Bunni (2005) in this regard pointed out legal risks as one of the risk facets in an international construction contract because the manner the parties' rights and obligations are determined is according to the law where the works is located or contract is made or where the project is constructed puts significant impact in the interpretation of contracts.

Because construction projects have several characteristics such as specific objective, time limit, financial constraints and economic requirements, special organizational and legal conditions, complexity there are many risk facets and complicated relations, which will influence it (Zhe, 1995).

In addition Kitchens (1996) states conclusively that the construction industry is an inherently high-risk business. Having stated so, Kitchens (1996) divide risks into the following two basic types: business risk and insurable (pure) risk. Business risks involve the inherent chances that an undertaking will result in either a profit or a loss, insurable risk, however, differs from business risk in that insurable risk involves only a chance for loss with no chance for profit.

Kitchens (1996) further divide the business risks in to the following general categories:

- **Economic risk** – financial uncertainty, escalation, change in tax rates
- **Political risk** – environmental law, equal opportunity laws, government regulations, zoning laws, permit process
- **Contract risk** – risk shifting clauses, delays, change orders, design errors, misunderstandings,
- **Construction risk** – labor productivity, materials availability, defective works, safety, late deliveries, subcontractors,
- **Management risk** – estimating, mistakes in bid proposals, competitions, lack of appropriate skills and competence

Bunni (2005) following identification and classification of risk under various headings suggest a thorough understanding of the concept of risk and knowhow to properly manage the risk matrix generated when a construction project is initiated. Therefore, risk management is a process to be addressed as a project is initiated.

Concerning the process of risk management, Mudroch & Hughes (2001) identified three stages: (1) identification of risk, (2) analysis of risk and (3) response to risk. In this process, they suggest that clients should avoid imposing undue or unbalanced risks on to contractors. The emphasis should be on the process of identifying the nature of the particular risks for a construction project and deciding where these risks should lie within the project team.

It is particularly important to consider the risks in overseas projects from the national/regional macroeconomic and political standpoints, simply because these risks are unfamiliar compared with those of the domestic environment, and they are significant particularly for large projects. For example project funding and cost escalations for large overseas projects are commonly linked with macroeconomic factors of the host country, such as fluctuation in inflation, interest and currency exchange rates (Zhe, 1995).

Similarly, Kapila & Hendrickson (2001) noted that exchange rate risk especially, changes in exchange rates alter the profitability of trade and investment deals. According to Kapila & Hendrickson (2001) foreign exchange exposure refers to the risk that future changes in a country's exchange rate will hurt a firm. Foreign exchange exposure can be divided into three categories: Transaction exposure, translation exposure, and economic exposure.

Transaction exposure is typically defined as the extent to which the income from individual transactions is affected by fluctuations in foreign exchange values.

Translation exposure is the impact of currency exchange rate changes on the reported consolidated results and balance sheet of a company. Translation exposure is basically concerned with the present measurement of past events.

Economic exposure is the extent to which a firm's future international earning power is affected by changes in exchange rates. Economic exposure is concerned with the long-run effect of changes in exchange rates on future prices, contracts, and costs.

Therefore, foreign contractors working in Ethiopia are exposed to various risks as any international contractors working away from their place of establishment or legal place of residence do. Hence, details know how of the macroeconomic, legal, contractual, technical, political and other categories of risks mentioned by Kitchens (1996) have significant effect on the successful completion of projects contracted to foreign contractors.

Of these risks, economic risk which includes the rise or fall of costs and exchange rate fluctuations are of significant importance because of their direct relationship to the financial viability of a project.

2.9 Risks in Ethiopian Road Construction Projects

Getachew (2014) notes that the road construction sector in Ethiopia is mainly administered by ERA which is the dominant player and the biggest single road construction employer in the country signifying lack of alternative market to search. ERA's dominance indicates the absence of an alternative government or private employer with significant market potential. ERA's (2008) assessment that contract documents are inconsistent, lack the necessary detailed specification and drawing with under estimation of quantities and impractical specification pose contract and construction risks mentioned by Kitchens (1996).

According to SMEC (2008) inconsistencies, lack of necessary detailed specification and drawing, under estimation of quantities and impractical specification in contract documents are mainly results of poor service by design consultants and lack of pro-active approach to the issues during the construction period by supervision consultants. Therefore, incompetency of consulting firms may not assure complete, well detailed, accurate and practical designs.

Hence, business risks of contractual nature are not uncommon in ERA projects. In addition, a research conducted by Turkey (2011) identified that unexpected inflation/price escalation is the

number one potential risk factor leading to cost overrun in ERA road construction projects. The major risk factors, according to Turkey (2011) entail an average cost overrun of 26.95% based on desk study of 30 upgrading and rehabilitation road projects. On top of the other risks, cost overruns pose another significant risk factor in Ethiopia's federal road projects which is validated by Turkey (2011) whose 100.0% questionnaire respondents recognized cost overruns a problem in Ethiopian construction industry particularly in federal road construction project.

While many risk factors are abound in Ethiopia's construction industry, a questionnaire based research conducted by Getachew (2014) found out that 75% of contractors conduct a formal risk analysis followed by 70%, 61.5% and 40% of risk analysis practice by consultants, insurance companies and clients respectively. Despite conducting formal risk analysis, the rise of costs of construction inputs is disconcerting to contractors noted Getachew (2014).

In similar study area, a research conducted by Asteway (2008) found out that price fluctuation occurs in an unpredictable manner at times with an increase of more than 34.0%. Furthermore, Asteway (2008) estimates that contractors' lose portion of their expected profit at least by 2.43% of contract amounts as a result of increase in the prices of construction inputs.

Delay to project completion periods exacerbate contractors' vulnerability to further price increases (Asteway, 2008). Similarly, Mohammed (2013), noted to have found out cement, fuel, foreign labors, local skilled and unskilled labors, reinforcement bar, bitumen, and equipment are the major construction inputs exposed to price escalation in federal road construction projects.

Asteway (2008) stated that market price fluctuation of construction inputs is another hindrance to the growth of the construction industry, especially those unpredictably and sharply flashing which usher contractors into failure to complete projects within time, quality and cost margin. Therefore, foreign contractors' undertaking contracts in Ethiopia are prone to the risks of unpredictable price trends plus other risks whose consequences may be severe without contingency measures are put in place in advance.

2.10 Bidding for Road Construction Contracts in Ethiopia

Contractor's tender is a priced offer as defined by FIDIC (1992) GCC Sub Clause 1.1 (b) (b) which is part of a bid submission of a competing bidder. Therefore, bidding and becoming successful for award of a road construction contract in Ethiopia comprises a lengthy process and requires being responsive to the various technical requirements and must be the lowest evaluated price according to the article 43 (8) of Proclamation no. 649/2009.

Proclamation No. 649/2009 states six types of procurements: open bidding, request for proposals, two stage tendering, restricted tendering, request for quotation and direct procurement according to article 33 (1). Of the six types of procurement methods, open bidding is applicable for almost all public bodies' construction contracts like ERA road construction contracts. Further to the various legal and procedural matters, a potential bidder to win a federal road construction project must consider the various risk facets prevalent in the country. Especially true is when a foreign contractor with little knowledge of the country is tendering for a project for the first time.

Projects financed from the proceeds of donors or financiers like the World Bank (WB), African Development Bank (AfDB), Bank of Arab for Development in African (BADEA) are governed by specific procurement guidelines prescribed by these institutions. In the procurement of works, article 69 (1) of Proclamation no. 649/2009 gives precedence to the procurement guidelines of these institutions.

Therefore, bidding for road construction projects in the country in general, may be made through National Competitive Bidding (NCB) or International Competitive Bidding (ICB). However, the distinction between the two choices is governed by various factors including financiers' guidelines, type of project, availability of domestic capacity etc. The details of these methods of procurement are described in subsequent two sub sections.

2.10.1 National Competitive Bidding (NCB)

NCB procurement method is usually used for projects with less value, thus not attractive to large international firms and all bidders are likely to be nationals of the project country or are companies established locally and generally run by local staff. This procurement procedure does not exclude international firms from participating but, local registration provisions may apply whereby involvement of international firms can be restricted (proclamation no. 649/2009).

As per Proclamation No. 649/2009 before using a NCB procurement method, public bodies are required to ascertain that the required objects of the procurement can only be procured from local suppliers and the value of the procurement is below the threshold established for ICB bidding or the required object of procurement is available only locally notwithstanding that the cost of the procurement exceeds the threshold (article 16.1.1). According to article 59(1) of Proclamation No. 649/2009 open ICB is used whenever in open NCB an effective competition cannot be obtained unless foreign firms are invited to bid or for procurements above a threshold level for national bidding.

Similarly for projects financed from the proceeds of the WB, NCB is deemed to be competitive bidding procedure normally used for public procurement in the country of the borrower, and it may be favored for procuring goods or works which, by their nature or scope, are unlikely to attract foreign competitors (WB, 2015). WB (2015) describes NCB as the most appropriate method of procurement where foreign bidders are not expected to be interested because (a) the contract values are small, (b) works are scattered geographically or spread over time, (c) works are labor intensive, or (d) the goods or works are available locally at prices below the international market.

From the various articles of Proclamation No. 649/2009 and from the WB's guidelines for procurement of works, it is apparent that NCB procurement method may not qualify for many road construction tenders especially financed from the proceeds of international financiers and donors. Hence, there are good reasons to opt for ICB procurement method for road construction tenders in the country.

An acceptable NCB system generally incorporates the basic principles of ICB including inter alia, timely notification through advertising in local newspapers, adequate competition, clarity of procedures, fair treatment for all bidders and award to the lowest evaluated bidder in accordance with the criteria set out in the bidding documents (WB, 2015). One important aspect of NCB procurement is that the currency of bid and currency of payment are in the local currency.

Proclamation No.649/2009 offers a preference margin for goods produced in Ethiopia, for works carried out by Ethiopian nationals and for consultancy services rendered by Ethiopian nationals. However, this provision is usually nullified in NCB since domestic companies or foreign companies registered as a domestic company are allowed to participate all of which may qualify for such preferences thereby nullifying the need.

Since contracts procured on NCB procurement method warrants payment in the national currency alone according to both Proclamation no. 649/2009 and the WB guideline (2015), contracts awarded through such procurement methods when offers provision for CPAs, they do it in the national currency alone.

2.10.2 International Competitive Bidding (ICB)

From the onset of RSDP I financial aid and assistance in the form of loans and grants covered certain portion of the disbursements. Moreover, the RSDP I (ERA, 1996) anticipated foreign governments and international financial institutions to offer financial support for implementation of those road projects which are economically viable and environmentally friendly. Therefore, procurement of services and goods from the international market was through ICB was duly recognized.

WB guidelines for the procurement of goods (2015) admits that ICB if properly administered, and with the allowance for preferences for domestically manufactured goods and where appropriate, for domestic contractors under prescribed conditions is the most appropriate method of procurement. In most cases, therefore, the WB requires its borrowers to obtain goods, works and services through ICB. Therefore, projects financed from the proceeds of international

financial institutions and foreign governments' loans and grants are guided by the procurement guidelines set out by the respective international institutions and governments. Accordingly, such projects are procured through ICB.

Proclamation No. 649/2009 also duly recognizes ICB procurement methods. Therefore, the various limitations of the domestic construction firms coupled with the procurement guidelines issued by international organizations, foreign governments and bilateral or multilateral agreements would incline for ICB tendering for significant number of road construction projects in the country.

In order to minimize the foreign exchange risk for bidders in ICB, the WB (2015) allows every bidder to express its bid price in the currency or currencies of any member country (up to a maximum of three currencies in most cases) or in EURO. This provision effectively causes the borrower to carry the exchange risk rather than bidders and eliminates disadvantages some bidders would otherwise have because of differences in strengths of bidders' currencies. As a result, contracts awarded through ICB procurement, allow payment in a currency other than the national currency with contract provisions for separate CPA for the national currency and the foreign currency stated in the contract, when such contracts entertain CPAs.

Since proclamation No.649/2009 offers a preference margin for goods produced in Ethiopia, for works carried out by Ethiopian nationals and for consultancy services rendered by Ethiopian nationals, ERA tender documents reviewed by the writer noted that domestic bidders are eligible for a 7½ % financial margin of preference in the comparison of their bids with those of bidders who do not qualify for the preference.

According to the WB guideline (2015) and ERA's practices, contracts are awarded to a bidder who meets the appropriate standards of capability and resources and whose bid has been determined (i) to be substantially responsive to the bidding documents and (ii) to offer the lowest evaluated cost.

Hence, foreign constructions companies shall have the additional burden of competing with 7½ % margin of preference domestic companies enjoy to win tenders. Therefore, their financial offers shall have to be competitive, cost effective and probably with little contingency for cost fluctuations over the course of execution of contracts.

2.11 Pricing for Road Construction Contracts

In both ICB and NCB procurements, tender price is based on the cost of carrying out the works plus various additions and allowances. In computing the tender or bid price a contractor constructs individual unit rates for all bill items listed in the bills of quantity on the basis of costs of various inputs at the time of tendering using various techniques including average historical records or market surveys (SMEC, 2008).

Furthermore, a contractor determines the cost of executing the works defined in the contract documents establishing the direct cost rates for each item in the bill of quantities which includes the direct cost for the labor, plant, materials and subcontractors, exclusive of additions for site overheads, head office overheads and profit (Kitchens, 1996).

Determining a direct cost involves selecting the appropriate resources of labor, plant and materials for the item of work, selecting the output or usage rates for each resource and combining this with the cost information collected. These combinations of the unit cost of resources together with the usage of resources produce direct cost for the work described in the bill item or group of bill items (SMEC, 2008).

However, Africon (2008) notes that one of the major difficulties encountered in the implementation of cost estimation in developing countries is lack of proper project preparation. Therefore, any mistake made by a contractor in estimating the costs can have a major effect on profitability. The contractor must use both reliable data and subjective judgment in formulating his tender (SMEC, 2008).

To carry out cost estimates, Lambeck & Eschemuller (2009) cite numerous sources available including database from previously completed projects, subcontractor quotations, suppliers' quotations, cost consultant advises, estimating services, publications and technical magazines. However, in Ethiopian publications and other sources like magazines are not widely available and are not commonly in use by most contractors for reasons including unreliable data. Therefore, contractors resort to simple market surveys to offer prices for tenders (Asteway, 2008).

Hence, any best pricing in Ethiopian is subjected to various risks including shortage of construction materials, global currency fluctuation, and change in foreign exchange rate and price fluctuation of construction materials according to Yadessa (2015). Equally the findings of Turkey (2011), Asteway (2008) and Mohammed (2013) are cautionary of the likelihood of risks due to unpredictable price trends of construction inputs.

In addition to the most economic direct activity cost estimation, Girmay (2003) suggests additional cost to be incurred by contractors that could include additional over head costs, costs of extension of various bonds such as performance bond and bank guarantee, operational and maintenance cost of facilities.

In consideration of the difficulty of forecasting future price trends, it is a common practices to base tender prices on current prices setting, however, allowing a certain percentage for contingency. In this regard, Asteway (2008) found out that no matter what kind of methods contractors use when pricing, the ultimate goal of all is to find ways to minimize the effects of price fluctuation which is difficult to enumerate.

To price for a road project, cost is estimated which is the monetary value of resources needed including direct labour, materials, equipment, services, facilities, technology, inflation and contingency provisions to complete the project activities (PMI, 2008). The basis of for pricing is therefore the bid document which usually prescribe that a contractor's priced offer is an undertaking as to its correctness and sufficiency including the correctness of the rates and prices contained in the bill of quantities, all of which cover all of a contractor's obligations under a

contract including those in respect of the supply of goods, materials, plant or services or of contingencies and all matters and things necessary for the proper execution and completion of the works and the remedying of any defects therein.

To carry out cost estimation, SMEC (2008) outlines the process; starting first by deciding the resources necessary to execute a certain quantity of work. Once the full complement of resources is determined, the costs for these resources and the time necessary to complete the work are calculated. Second, the total cost for the quantity is used to derive the unit rate taking into account plant and equipment owning costs, depreciation costs and operational and maintenance costs, labor cost, material cost and other costs.

The cost estimates and subsequent pricing for construction works are produced at a specific point in time and the prices used therein are relevant only for that time and for short time thereafter because prices for items supplied and work undertaken are continually subject to market forces (Turkey, 2011). Pricing when CPA provisions are in place, are contractor's offer based on prices of commodities and other inputs at the time when the pricing is done. Of the available methods of estimation, detailed estimation is suited when unit price estimates can be compiled and when the nature of the work is well defined Turkey (2011).

According to SMEC (2008) and PMI (2008) a cost estimate and subsequent pricing is a quantitative assessment of the likely costs for resources required to complete the activity, when done in detail entails considering the following separate cost components:

- Plant/machinery cost,
- Labor costs,
- Material costs,
- Other costs,
- Contractor's overheads, risk and profit margin

Some description of these costs and how they are determined is briefly described in the following sections.

2.11.1 Plant/Machinery Cost

According to SMEC (2008) and Gransberg & Popescu (2006) plant/machinery costs are usually calculated on hourly basis including owning cost, operational cost and maintenance cost. Owning cost includes depreciation, interest/insurance, and escalation cost. Similarly operational costs include costs of repair, fuel, tires, filters, oils and special wear items and maintenance cost includes cost of spare parts, wearable items etc.

The most common methods available to determine machinery cost are the Caterpillar method, Association of General Contractors of America (AGC) method, the Equipment Guide Book (EGB) method, the data quest method, the Corps of Engineers method and the Peurifoy method. However, each method arrives at a different hourly rental rate for the same piece of equipment because the method used by each to arrive at a number is largely a business policy decision rather than a technical decision (Gransberg & Popescu, 2006).

Gransberg & Popescu (2006) suggest referencing to the established methods to setting an internal standardized method for calculating equipment rental rates and to perform an independent estimate of rates that are proposed for a given project; nonetheless it must be strived to use the best numbers available at the time and to ensure that all the costs of both owning and operating the equipment are included in the final rate.

To compute machinery/equipment or plant costs per unit of quantity, the hourly productivities are usually referenced from product manuals subject to applying detrimental factors like location, nature of works, operator skills. The cumulative cost of machinery/equipment and plant per unit quantity of work is calculated by cumulative costs per hour divided by productivity-adjusted unit/s of quantity of work the machineries/equipments and plants are anticipated to execute per hour (Gransberg & Popescu, 2006).

2.11.2 Labor Cost

Of the several tools available, PMI (2008) cites published and updated production rates and unit costs of labor trades as starting points to estimate labor costs. In order to produce a labor estimate for an activity, Kitchens (1996) suggests to consider components of the labor rate per hour which is produced by combining the base wage rate, benefits, vacation pay, pension, training, allowances, dues, etc, insurance and tax. The hourly labour trade cost divided by the estimated average productivity of the trade gives the cost of labour per unit of an activity.

2.11.3 Material Cost

Material cost includes market price of a material, allowances for transportation, unloading and storage costs. It may also include allowances for future prices increases (SMEC, 2008).

2.11.4 Other Costs

The costs of environmental and social considerations including land acquisitions costs and the costs associated with resettlement and compensations should also be determined. The costs can be included in the overall total cost for each project (SMEC, 2008).

2.11.5 Overhead, Profit and Risk

According to SMEC (2008) the percentage to be added to construction costs to cover a contractor's overheads, profit and risk depend on a number of factors. Percentages can vary considerably; anywhere between 20 and 70 per cent. The main factors influencing this variation are as follows.

- Degree of competition for the work
- Incidence of taxes
- Knowledge of the country
- Contractor with local establishment

- Contractor setting up in the country for the first time

2.12 Contract Prices

According to FIDIC GCC (4th edition 1987, 1992 reprint) Sub Clause 1.1(e) (i)

Contract Price means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.

A contract price, therefore, is deemed to have had the satisfaction of a contractor as to its correctness and sufficiency including that of the rates and prices stated in the bill of quantities, all of which, cover all of a contractor's obligations under a contract including those in respect of the supply of goods, materials, plant or services or of contingencies and all matters and things necessary for the proper execution and completion of the works and remedying of any defects therein pursuant to the stipulation of Sub Clause 12.1 of the FIDIC (1992) GCC. According to FIDIC GCC (1995) Sub Clause 1.1.5.1:

Contract Price means the sum stated in the Letter of Acceptance as payable to the Contractor for the design, execution and completion of the Works and the remedying of any defects in accordance with the provisions of the Contract.

The definitions given in both forms of GCC are the same except the difference emanating from the design accountability assumed by a contractor under DB contracts which use the FIDIC (1995) GCC. Therefore, contract prices, unless otherwise contracts allow are not subject to adjustment during the period of execution. Therefore, contractors tenders which are computed at the time of bidding on the basis of market information then continues to be applicable for the whole duration of a contract with possible extension of time.

Contract prices which are computed and determined as mentioned under section 2.10 above are considerate of assumptions, risks, uncertainties which may have to change later. Market price

fluctuations which are difficult to enumerate directly affect contractors, since contractors are subject to procure and deliver all the necessary labor, material and equipment, depending on the type of contract required for the completion of the works (Asteway, 2008).

In a competitive market of open bidding, contractors' tenders are assumed to be the most competitive price for the execution of works and remedying defects. However, when certain risks like future price trend are uncertain to predict, some bidders may opt to price higher profit margins as Asteway (2008) concludes.

Despite recognition of the direct relationship between CPAs and price fluctuations it is worth noting that each input resource has its share of contribution in the rise or fall of the construction cost of a project and subsequent amount of CPA. In a road project, input resources cost has different weightings depending on the type of work, hence determining the fine balance among the inputs cannot be undermined (ERA, 2009)

2.13 Contract Price Adjustments

Both FIDIC (1992) and FIDIC (1995) GCCs give no definition for Contract Price Adjustment (CPA). Nonetheless, Sub Clause 70.1 of the GCC (1992) allows addition to or deduction from the contract price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the works.

In the absence of a definition for CPA by the most worldwide recognized conditions of contract, Getaneh (2011) gives his own definition for price adjustment which reads:

Price Adjustment refers to the partial adjustment of costs attributed to the rise and falls of material, equipment and labor prices.

Contract Price Adjustment (CPA), for the purpose of this research is defined as the addition to or deduction from the contract price such sums in respect of rise or fall in the cost of labour, equipment, or materials affecting the cost of the execution of the works.

Based on the definition of CPA given above, it is applicable to both rise and fall in the costs of construction inputs. The costs to a contractor therefore, are the prices of goods and services in the market. In this context therefore, cost may sometimes be referred as price. Hence, change in cost/change in price is an upward or downward movement of the expenditure of a contractor over time. Change in cost is also the fluctuation of expenditures of a contractor over time; that is the fluctuation of the prices of goods and services in the market over time.

Gransberg & Popescu (2006) argue that there are a number of ways, including a variety of computer programs, to project the cost escalation suggesting that, any projection of escalation has to be based on past history, coupled with a forecast of economic conditions over the expected life of the project. Contrary though, Pierce, Huynh & Guimaraes (2012) found it prudent to consider adopting mechanisms like CPA because construction and maintenance of transportation infrastructure consumes significant quantities of materials the costs of which fluctuates during the period of a construction contract, sometimes volatilitly.

Similarly, Mohammed (2013) suggests that past history of prices can be used to assess general escalation trends overtime. Somewhat a different perspective is given by Stallworthy & Khahrabanda (1985) who suggest that rate of inflation can swing wildly with economic conditions and some sort of educated guess is needed as to the escalation rate over the expected life of a project.

However, Kitchens (1996) warns that extending past inflation curve into the future is probably the simplest approach to projecting escalation, but the practice can be hazardous, if there happens to be a sudden shift in the rate during the course of the project. The opinions of Twort & Rees (2004), suggest that the estimated cost of a project is based on assumptions that may later have to be altered and how much the assumptions are and how much these assumptions vary over the period of the project are not easy to assess and quantity.

A research conducted by Asteway (2008) noted consistent sometimes haphazard increases of the prices of almost all goods and services overtime. Hence, Asteway (2008) recommends the inclusion of clauses within contracts which determine how a contractor is reimbursed the

additional costs after tendering. In the absence of provisions in contracts for reimbursement of price increases over time, Asteway (2008) cautions that contractors may allow a margin to their prices to cover the increase in the costs of construction inputs which may either not be enough or may offer lucrative returns.

ADB (2018) noted clients' temptation to assign the risk of input price fluctuation to contractors, but cautions that this usually comes at a higher overall cost for two reasons.

- *First, contractors will build in price contingencies for input price increases over the life of a contract. Over time, this will result in higher average prices being paid for the same works.*
- *Second, a competitive bidding process will reward the bidder that takes the highest risk, significantly increasing the risk of nonperformance and default should input prices rise significantly.*

Yadessa (2015) argued that price escalation in Ethiopia over the past years had impacted the overall RSDP performance of the country. Yadessa (2015) adds stating that price increases especially over recent years has been at an alarming rate neither linearly compatible with the increasing market indicators nor tangibly justified by concerned stakeholders or researchers.

Without admission to Asteway's (2008) argument that price escalation is generally tied to inflation, it is agreeable that contracts periods exceeding a year should allow provisions for CPA in the event of rise or fall of costs of construction inputs as recommended by international financial institutions and donors like the WB.

Therefore, increase or decrease of prices entails adjusting the contract prices as suggested by most internationally recognized conditions of contract including FIDIC. This adjustment of the contract price shall not alter or adjust the unit rates contained in the contracts, but adjustment of the amounts payable to contractors on pre agreed terms. The adjustment applies both ways as price increases or decreases thereby resulting positive or negative CPAs.

The merits of price adjustment allow the price of materials to fluctuate without imposing additional risk to the agency or the contractor (Finsen, 2005 cited in Mohammed, 2013). ADB (2018) in this regard, lauds the merits of price adjustment provisions as a means to give protection to contractors against price escalation and may also pass on savings to the employer due to the downward movements in prices. According to Price Indexing in Transportation Construction Contracts (2009), the use of contract provisions for price adjustments has the following benefits:

- Lower bid prices
- Increased number of bids and fewer bid retractions
- Better market stability
- Increased reliability in the supply chain
- Consistent contractor profit margins

Therefore, CPA helps in addressing the risks caused by price fluctuations. The uncertainty about future costs brings large risks to contractors. As a result, under regular payment provisions, contractors may include risk premiums to their bids to ensure profitability through unforeseen circumstances causing overall higher bid prices. In addition, in case of long contract periods, changing prices result in much higher risks as the changes increase with time resulting in unrealistic bid prices. By transferring the risks from the contractor to the client, the need for these contingency costs is eliminated resulting in better competitive bid prices. In addition, by appropriately sharing the risk, employers shield construction firms from losses on contracts. Hence, CPA helps reduce the number of firms that exit the market and provide better market stability.

Moreover, whenever prices fall employer benefits from such prices falls thereby offering reasonable risk appropriation mechanism. However, CPA in the absence of the strict contractual controlling mechanisms takes away contractors motivation to negotiate lower prices or puts out contractors endeavor to keep stock of materials when prices fall.

The recommended CPA mechanism is one that is set out in the bidding documents and is well understood by contractors and contract administrators, one which is consistent with the industry good practices, takes account of changes (increase or reduction) in the major local and foreign cost inputs to a project, is simple to administer, does not impose artificial limits on the amount of escalation that can be paid on a contract and only makes price adjustment applicable to projects of more than one year's duration (SMEC, 2018).

There are factors that affect whether or not price adjustment should be considered for a given material according to the National Cooperative Highway Research Program (NCHRP 2011). These factors are:

- Index availability;
- Index validity;
- Material measurement method;
- Material price change impact;
- Ability of the contractor to control the price of the material; and
- Program administration costs.

Some of the NCHRP (2011) suggested factors like index availability makes the practice of CPA in ERA contracts subject to the use of indices from sources other than Ethiopia. The use of such proxy indices poses limitations to the practices effectiveness in terms of reflecting the market trends of the country against the trends of foreign indices.

2.14 Triggers for Contract Price Adjustments

CPA is triggered when certain conditions are met which are dependent up on the terms of a contract which defines them. In the context of the contract documents of ERA reviewed, CPA comes to light whenever current prices or indices are less than or greater than the base prices or indices subject to specific other conditions stated. Therefore, fluctuation of indices or prices of certain construction inputs must happen to trigger the application of CPA.

According to Asteway (2008) price fluctuation can generally be defined as the rise or fall of price of goods, materials and services on the markets with the possibility of occurring either at international or local markets. The reasons for fluctuation are several, the major ones being government's regulation on oil price, shortage or excess supply of commodities and increase or decrease in demand of a certain item (Stukhart, 1982).

According to Fetene (2008) the most common causes of cost overrun includes increase in the cost of construction materials and change in foreign exchange rate for imported materials. Similarly, Couper (2003) states that the causes of fluctuation of prices or indices of construction inputs includes inflation which comes to light when the prices of goods increase without corresponding increase in productivity.

Therefore, escalation is a more all inclusive term used to reflect price increases due to not only inflation but also due to supply-demand factors and engineering advances. Projected escalation factors are based on past inflation rates and estimates where these rates might be in the future (Couper, 2003).

According to Asteway (2008) the term inflation applies to the disproportionate and relatively sharp and sudden increase in the quantity of money, or credit, or both, relative to goods available for purchase. Inflation produces a general rise in price levels but, more importantly, causes a decrease in the monetary unit with time, and these consequences are proportional to the rate of inflation. Yadessa's (2015) findings include considerable alarming price escalation in Ethiopia over the past years incompatible with market indicators. Contrary to Yadessa's (2015) assertion there has been considerable price stagnation and price decrease, at times, at least the following items and period as indicated in the table below.

Table 2.4 Prices of Fuel and Cement in Addis Ababa (Sources National Oil Company and Muger Cement Factory)

Fuel – NOC		Cement – Muger Cement Factory	
Period	Price (ETB)	Period	Price
09-12-2014 to 30-01-2015	17.49	09-01-2015 to 30-11-2015	293.01
31-01-2015 to 05-02-2016	16.10	01-12-2015 to 14-02-2016	277.00
06-02-2016 to 09-01-2017	14.16	15-02-2016 to 16-09-2016	270.00
10-01-2017 to 07-02-2017	15.18	16-09-2016 to 10-05-2017	275.00
08-02-2017 to 09-03-2017	15.75	11-05-2017 to 31-03-2018	280.00
10-03-2017 to 12-11-2018	16.35	02-04-2018 to 31-01-2019	300.00
13-11-2018 to 31-01-2019	17.49		

Therefore, cost of construction inputs at times may show insignificant increase, or swing between plus and minus or remain stagnant for certain period of time. Therefore, it may be difficult to forecast the future price trends when the rise or falls of cost are functions of multitude of factors. Contrary to Asteway's (2008) remark that escalation is generally tied to inflation, the fall in the prices of fuel or stagnant price of cement as summarized in table 2.4 above are recorded at times when the country level overall inflation rate (annual change based on 12 months Moving Average) rose by 9.2 percent in July 2016 as compared to the one observed in a similar period a year ago as reported by the Central Statistic Agency (CSA, 2016).

Fall of price of fuel is mainly attributed to the global decline of prices of oil products. However, the stagnation of price of cement may mainly relate to decline in the demand of cement coupled with intrusion of other cement factories to the market. Moreover, inflation in Ethiopia which is measured by CPI is the average change in the price paid by consumers for a fixed market basket of goods and services and it is based on household expenditure weights of the goods and services in the basket and their current market prices. Hence, CPIs or inflation has no direct relationship with the price trends of construction materials since CPIs measure the average change in prices consumers pay for fixed basket of goods and services of which of more than 50% is food and non alcoholic beverages (CSA, 2019).

According to Turkey (2011), the following are the factors that change the cost of the construction projects through time: poor project management, design changes, unexpected ground conditions, inflation, shortages of materials, change in exchange rates, inappropriate contractors, funding problems and force majeure. Based on a research conducted by Habtamu (2013) a large fraction of Ethiopia's inflation is explained by the supply side and monetary factors. Virtually, money supply growth, owing to the prevailing public credit expansion has a large and significant effect on inflation for the reason that the money growth continually eroded the value of the nation's currency.

Therefore, the application of CPA shall come in to practice on contracts which provides a mechanism to doing so when the prices or indices of certain inputs increases or decreases from those base figures. The causes for the increase or decrease of prices and subsequent application of the CPA include:

- Money growth, imported inflation from abroad and exchange rate depreciation according to Habtamu (2013)
- Escalation according to Asteway (2008),
- Change in legislation according to Mohammed (2013)
- Market condition including demand and supply relationships according to Sanderson (2006)
- Government's regulation on oil price, shortage or excess supply of commodities and increase or decrease in demand of a certain items according to Stukhart (1982).

From the foregoing it is notable that many factors some domestic and others international dictate prices of construction inputs against which no contractor has control over to mitigate the impacts.

2.15 Legal Perspective on Contract Price Adjustments

Contracts in Ethiopia are governed by the Civil Code of the country enacted by proclamation no. 165 in 1960 and other laws, proclamations and regulations enacted. But the most relevant titles of the Civil Code related to construction contracts are Title XII-Contracts in General, Title XIII-

Extra-Contractual Liability and Unlawful Enrichment. Title XIX – Administrative Contracts is also relevant for contract committed with the state and other administrative bodies.

Article 1731(1) states that provisions of a contract legally formed are binding on the parties as though they were law. In addition article 1731(2) allows parties to determine the contents of their contract subject to the mandatory provisions of the law. Therefore, contracts legally formed shall be binding up on the parties who committed the contract.

In addition, article 1733 prescribes that where the provisions of a contract are clear, the court may not depart from them and determine by way of interpretations the intentions of the parties. Furthermore, the stipulation of article 1758 obliges a debtor bound to deliver a thing to bear the risks of loss of or damage to such thing until delivery is made in accordance with the contract.

In relation to the subject of CPA article 1764 (1) do not allow a legal ground to ask reimbursement in the event of rise of prices but rather makes a contract to remain in force notwithstanding that the conditions of its performance have changed and the obligations assumed by a party have become more onerous than foresaw. In addition, unless the conditions of performance of a contract are regulated by the parties in the contract, article 1764 (2) prescribes that the effects of changes in the conditions of performance may be regulated by the parties, and not by the court, either in the original contract or in a new agreement.

The application of Title XIX-Administrative Contract is obligatory as stated under article 3131 (1) for contracts concluded by the state or other administrative authorities. In addition, the stipulation of article 3138 (1) of the Civil Code recognizes the use of model specification, general clauses and conditions or common directives, concerning the interpretation, contents and execution of a contract when contracts expressly makes reference thereto. Hence, the use and reference to or of General Condition of Contract like FIDIC and other specifications as forming part of contracts are legally binding.

The stipulation of article 3172 (1) obliges contracting parties to perform their obligations in the manner provided in the contract. Moreover, pursuant to article 3183 (1) where circumstances

which could not be foreseen on the making of the contract upset the balance of a contract, the party contracting with the administrative authorities is obliged to perform his obligations where such performance remains materially possible.

Article 3183 (2) seems entertaining to claim for some share of the burden, however, a person contracting with administrative authorities may, require the assistance of the administrative authority in overcoming the supervening difficulties by sharing in the loss arising from changed circumstances.

In relation to the rise or fall of prices of construction inputs the stipulation of article 3187 makes it more stringent stating that no compensation may be claimed where circumstances have only reduced or taken away the benefits, without bringing about a loss for the party.

At times of fuel price increases which is regulated by the government, the provision of article 3190 (1) allow a claim for compensation to be pursued, nonetheless laws, regulations, orders and other measures of general application, must directly modify the provisions of the contract or prevent the enforcement of some provisions of the contract or prematurely put an end to the performance of the contract.

Despite a more lenient statement of article 3190 (2) to claim compensation when measures of general application like fuel prices increases are made, it disregards compensation if the regulation issued to increase prices specifies that no compensation shall be paid. The stipulation of article 3191 (1) puts off any right to compensation in the event of increase of prices of construction inputs caused by measures of general application taken by the public authorities if such general measures without affecting the substance of the contract, they only modify the conditions of its performance and render such performance more difficult or more onerous.

From the foregoing it is clear that the various stipulations of the Civil Code do not contain articles providing a means to make it mandatory to adjust contract prices in the event of rise or fall of costs. The law allows the free will of the parties to stipulate the manner in which the contract is performed. Therefore, the stipulations of contract clauses related to the rise or fall of

costs are legally binding and the courts would not depart from them by way of interpretations as stated under article 1733 of the Civil Code.

In general, there is no legally obliging article to enforce contract price adjustments. Therefore, it is the free will of the parties to a contract to determine the manner in which the rise or fall of costs is entertained under a contract.

Furthermore, contents of a contract is left to be determined by the parties subject to the mandatory provisions of the law as stated under article 1731(2) of the Civil Code. However, there is no mandatory provision in relation to the manner the rise or fall of costs shall be dealt with. Therefore, the contract provisions which regulate the manner the rise or fall of construction input costs are binding up on the parties and the courts where the provisions of a contract are clear, may not depart from them and determine by way of interpretations the intentions of the parties.

2.16 Contractual Perspective on Contract Price Adjustments

Since the country's laws do not prescribe mandatory provisions to adjust contract prices in the event of rise or fall of costs, the free will of the parties to a contract to determine the manner in which the rise or fall of costs is entertained under a contract prevails and remains binding up on them.

From study of contract documents obtained from ERA, the use of various FIDIC GCCs for all construction contracts entered in to under ICB or NCB procurements is well accepted except Public Procurement Agency (PPA) GCC which ERA uses for small works procured through NCB method. The FIDIC GCCs commonly in use are the 4th edition (1987, 1992 reprint) and 1995 edition for DBB and DB contracts respectively. Hence, contractual perspective related to CPA referred in this study is confined to the prescription of these two GCCs and the corresponding amendments thereto in contracts prepared by ERA.

As a common practice, the provisions of these GCCs are amended or deleted to suit specific project needs. According to Sub Clause 70.1 of the FIDIC (1992) GCC in the event of the rise or fall of costs the addition or deduction is added to or deducted from the contract price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the works setting aside the details of the manner and mechanism of adjustment to the Conditions of Particular Application (CoPA).

Moreover, Sub Clause 70.2 of the FIDIC (1992) GCC allows adjustment of a contract price, if, after the date 28 days prior to the latest date for submission of tenders there occur changes to any national or state statute, ordinance, decree or other law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such state statute, ordinance, decree, law, regulation or bye-law causes additional or reduced cost to the contractor.

According to Sub Clause 13.16 of the FIDIC (1995) the contract price is adjusted to take account of any increase or decrease in cost resulting from changes in legislation of the country, made after the base date, which is the latest date for submission of bids. Such legislation means any law, order, regulation or by-law having the force of law, including currency restrictions which affect a contractor in the performance of his obligations.

However, Sub Clause 70.1 of the FIDIC (1992) GCC is usually amended to make it more specific and descriptive of the manner contract price adjustment is made in respect of the rise or fall in the cost of labor, contractor's equipment, plant, materials, and other inputs to the works usually by prescribing a formula to determine the amounts of CPA.

Sub Clause 70.3 of CoPA specifies a formula usable to determine the amounts of CPA due. The formula is the following general type:

$$pn = A + b \frac{Fn}{Fo} + c \frac{Bn}{Bo} + d \frac{Sn}{So} + e \frac{Cn}{Co} + f \frac{En}{Eo}$$

Where:

“pn” is a price adjustment factor to be applied to the amount of the work carried out in a subject month’

“A” is a constant, specified, representing the nonadjustable portion;

“b”, “c”, “d”, “e” and “f” are weightings or coefficients representing the estimated proportion of each cost element eligible for price adjustment,

“Fn”, “Bn”, “Sn”, “Cn”, and “En” are the current cost indices or prices of fuel, bitumen, reinforcement steel, cement and equipment respectively for month “n,” applicable to each cost element; and

“Fo”, “Bo”, “So”, “Co” and “Eo” are the base cost indices or prices corresponding to fuel, bitumen, reinforcement steel, cement and equipment at the base date specified in a contract.

The stipulation of Sub Clause 70.3 of CoPA allows correction factor of Z_o/Z_n when a price adjustment factor is applied to payments made in a currency other than the currency of the source of the index or price for a particular index or price. Z_o is the number of units of currency of the country of the index or price, equivalent to one unit of the currency payment on the date of the base index or prices, and Z_n is the corresponding number of such currency units on the date of the current index or price.

On ERA DBB projects, the use of the formula mentioned above is supplemented with tables containing estimated ranges of coefficients or weightings of construction inputs and the non adjustable portions per category of group of pay items. Example of weightings ranges and non adjustable portions per category of major work groups in projects administered by ERA for DBB projects is as shown in the table 2.5 below.

Table 2.5 Example of Range of Weightings and Non Adjustable Portions per Bill Group (%)

Index description	Site Clearance	Drainage	Earthworks	Sub Base and Road Base	Bituminous Surfacing	Structures	Ancillary Works
Non-adjustable	30	30	30	30	30	30	30
Local Labor	-	-	-	-	-		-
Equipment	45 - 55	20 - 30	45 - 55	50 - 60	45 - 55	20-30	15 - 20
Bitumen	-	-	-	-	5 - 10		-
Fuel	15 - 25	2 - 5	10 - 25	15 - 20	10 - 15	2-5	2 - 5
Steel	-	10 - 20	-	-	-	10-20	30 - 40
Cement	-	25 - 30	-	-	-	25-30	10 - 20

Under ICB procured contracts where payment is made in the national currency and other foreign currency a price adjustment factor is applied to amounts in each specific currency separately. Therefore, a similar weighting table like that of table 2.7 shown above makes part of the contracts to take account of the currencies of payment.

Similarly, Sub Clause 13.6 of FIDIC (1995) GCC is amended in the corresponding SCC Sub Clause 13.6 of DB projects stipulate the use of price adjustment factor derived from a formula which is generally like:

$$P_n = A + \frac{bL_n}{L_o} + \frac{cM_n}{M_o} + \frac{dE_n}{E_o} + \text{etc}$$

Where:

“P_n” is a price adjustment factor, “A” is a constant representing the nonadjustable portion, “b”, “c” and “d” are weightings or coefficients representing the estimated proportion of each cost element,

“L₀”, “M₀”, “E₀” are the base cost indices or reference prices of the cost elements at the base date, “L_n”, “M_n”, and “E_n” are the current cost indices or reference prices corresponding to base cost indices or reference

Like that of DBB projects, the SCC of DB projects, allows under Sub Clause 13.6 a correction factor of Z_0/Z_n when a price adjustment factor is applied to payments made in a currency other than the currency of the source of index or prices for a particular indexed input. Z_0 is the number of units of currency of the country of the index or price, equivalent to one unit of the currency payment on the date of the base index or price, and Z_n is the corresponding number of such currency units on the date of the current index or price.

Similarly, in ERA DB projects, the use of formula mentioned above is supplemented by a table containing estimated range of coefficients or weightings of construction inputs and the non adjustable portions. An example of the weightings ranges and non adjustable portion is as shown in the table 2.6 below.

Table 2.6 Example of Percentage Range of Weightings and Non Adjustable Portion

Description of index	% range of weighting
Fixed/Nonadjustable	30
Foreign Labor	0 - 5
Fuel	10 - 15
Bitumen	2 - 4
Steel Reinforcement Bar	5 - 10
Cement	5 - 15
Equipment	30 - 40
Total	100%

Moreover, contracts reviewed by the writer noted provision of an additional sub clause 70.7 of CoPA which allows adjustment of the weightings when a consultant or engineer the estimated

weightings unreasonable, unbalanced or inapplicable as a result of varied or additional work executed or instructed or for any other reason.

There are marked similarities between the provisions of the contracts of DB and DBB projects of ERA related to CPA of contracts procured both under NCB and ICB procurement method. These similarities include:

1. Disqualification of an adjustment for local labor,
2. Disqualification of the General Items from contract price adjustment,
3. Adjustment factor when the source of indices or prices are different from the currency of payment, and
4. Distinct contract price adjustment is made for the national currency and other currency of payment when a contract allows payment in currency other than the national currency,

Despite the similarities and commonalities of determining CPAs under both DBB and DB projects, however, the following marked differences are visible.

1. Weightings or coefficients and non adjustable portion are distinct per bill group for DBB projects, whereas aggregate weightings or coefficients and non adjustable portion are applicable for the lump sum contract amount for DB projects,
2. Distinct adjustment factor and subsequent CPA are determined per bill group for DBB projects, whereas they are determined on aggregate basis on DB projects,
3. Determination of CPA for a specific bill group of work is precedent up on the execution of some of the works in the bill group under DBB projects, however, DB projects call for the determination of CPA for using the general formula without distinction whether a specific work is executed or not.

Furthermore, recent contracts of ERA establish a cap of 20.0% of the revised contract prices as a maximum amount of CPA payable resulting from the rise of cost of labor, contractor's equipment, plant, and material. By such prescription, contractors are advised to properly plan and execute the works so as to complete the works before such limit are surpassed. Besides, it is

assumed that contractors considers the cap and make allowance inconsideration of risk emanating from the contracts.

2.17 General Frameworks for Contract Price Adjustments

Based on a review of price adjustment clauses at a number of different states in the USA for different construction materials, Pierce, Huynh & Guimaraes (2012) noted three common elements which are qualifications, price adjustment triggers, and caps which generally define the framework for CPA.

2.17.1 Qualification

The most common requirements invoke minimum material quantities, minimum contract sums, and/or minimum contract duration. CPA clauses can have one or more of these requirements for the same material. WB (2015) and the AfDB (2013) procurement guideline allow application of price adjustment for contracts that are expected to take longer than 18 months. Whereas Pakistan Engineering Council (2009) recognizes cost elements, having cost impact of 5.0% or higher are qualified for adjustment.

2.17.2 Price Adjustment Triggers

Trigger values represent thresholds of price change required to invoke price adjustment clauses. Trigger values can be expressed as either a percent change from a base price or a monetary change from a base price (Pierce, Huynh & Guimaraes, 2012). NCHRP (2011) states commonality of trigger values in the USA and suggest that typically it ranges between zero percent and 20.0% change in base price in either direction. However, NCHRP (2011) indicates that there is a broad distribution in trigger values among states within the USA; however, a large group of states use 5.0% to 7.5% as trigger value.

The most common trigger value is 5.0%, although it may be as high as 25.0%. However, trigger values between 3.0% and 10.0% are suggested to avoid induction of CPA resulting from minor fluctuations in costs of construction inputs (Pierce, Huynh & Guimaraes, 2012).

2.17.3 Price Adjustment Caps

A cap can be specified to limit the price adjustment to a maximum acceptable amount. It provides a means to share the risk when prices change, especially when the price change is dramatic. Caps can be expressed as a percent change from a base price, a monetary change from a base price, or as a monetary sum. If the current price exceeds the corresponding cap, then a partial difference between the current price and base price is paid.

Price adjustment caps can also be specified in contracts to protect against unlimited coverage from extreme shifts in material cost. While caps can be an effective risk sharing component of CPAs, caps range from 50.0% to 100.0% of the base price or index.

Of the three elements that define the CPA frameworks, ERA contracts reviewed contained provisions for CPA caps of 20.0% of the contract prices, and certain contracts contained a provision for elapse of one year to trigger the application of CPA.

2.18 Methods for Contract Price Adjustments

There is more than one method of determining the effect of the rise or fall in the costs of construction inputs on payments due to a contractor. According SMEC (2008), the two most common methods of CPA are the Proven Cost Method and the Formula Method.

Similarly DPER (2016) lists Proven Cost and Formula Fluctuation Method as the options to choose from to determine adjustments to the contract sums. In USA, an extension of the formula method is commonly in use but in an inclusive price adjustment contracts, the entire difference between the current price and base price is paid, whereas in an exclusive price adjustment contract, a partial difference between the current price and base price is paid (Pierce, Huynh & Guimaraes, 2012).

From the literature review, it has been noted that other than the formulae method, simplified formula methods are being used in other African countries. Furthermore, countries like Uganda, Kenya, Zambia and South Africa has national bodies publishing price indices useful for CPA.

In general, the most common method of determining the CPA is the formula method though projects financed from the proceeds of the EU prefers and uses Proven Cost Methods.

2.18.1 Proven Cost Method

The Proven Cost Method as the name implies requires a contractor, at tender stage, to detail those elements of his costs which he requires to be subject to CPA. These details include the base costs and suppliers of the various elements upon which the tender was based. A contractor is then reimbursed the difference between the base cost and the actual invoiced cost of those same items when they are purchased. Although this is the method generally used on EU funded projects, it is not the preferred method as it has the potential for abuse according to SMEC (2008).

Using this method requires ensuring that all purchases are from the suppliers identified at the time of tender and the actual costs are correct. Any change in suppliers is likely to result in an invalid comparison of prices and may accordingly result in overcompensation (SMEC, 2008).

Based on questionnaire study conducted by Mohammed (2013), only 7.0%, 15.0% and 14.0% of clients, consultants and contractors respectively agree that the use of proven cost method of contract price adjustment is better suggesting that the formula method is more preferred.

2.18.2 Formula Method

In the Formula Method the works to be undertaken are mathematically described in a formula. The formula contains a number of factors representing the various elements of the project at the time of tender and a number of similar factors for the various elements of work at the time that the works are undertaken. By using these factors in the formula a percentage increase in the

tendered value of work done is obtained and the amount resulting from this represents the CPA due.

From review of contract documents of ERA the preferred method of CPA is the Formula Method and has a general formula mentioned under section 2.16 for DBB and DB projects:

SMEC (2008) suggests the use of simplified formula when various reliable indices are unavailable. A simplified form of the formula utilizing only the consumer price index, which is published, has the following form:

$$P_n = 0.1 + 0.9 \text{CPI}_n / \text{CPI}_o$$

Where:

“ P_n ” is a price adjustment factor, “ CPI_n ” current consumer price index, and “ CPI_o ” base consumer price index.

Formula method, according to a research conducted by Mohammed (2013) is preferred more than the proven cost method with clients, consultants and contractors (93%, 85% and 86%) responding in favor of formula method of price adjustment respectively.

Despite preference to the formula method, Yadessa (2015) argues that price adjustment formula does not properly cater price inflation of construction materials and miscellaneous factors. It may be true that the formula method may not yield the intended result unless cautiously drafted from the beginning. When using the formula method, use of the required indices is highly recommended according to Aurecon (2013). Similarly, the use of formula method is done by introducing statistically determined indices for each of the expenditures and adjusting those in proportion to the changes in the indices (SMEC, 2008).

The formulae method alone is in use for CPA of ERA contracts, since according to SMEC (2008), the Proven Cost Method has the potential for abuse by:

- Under quoting base prices,
- Over invoicing current prices, and
- Changing suppliers.

The use of formula method is highly tide to the availability and use of indices which are published by reputable organizations. In this regard, DPER (2016) strongly recommends the requirement of using indices for materials, fuel and equipments published by statistics office for use of formula method. But, it does not rule out the use of consumer price index in the absence of other relevant indices.

Equally ADB (2018) indicates the use of indices in formula method of CPA. In the absence of indices, SMEC (2018), DPER (2016) and ADB (2018) do not rule out the use of simplified form of the formula based on CPIs which are generally available in every country. The use of simplified formula based on comparison of current and base CPIs, however, may not be true to the purpose of allocation of risk in Ethiopia for the reason that CPI measures the average change in the price paid by consumers for a fixed basket of goods and services and it is usually based on household expenditure weights of the goods and services in the basket and their current market prices according to CSA of Ethiopia (2019).

According to CSA (2019) CPIs are derived from two major groups that are food and nonfood index. The non-food index has eleven major divisions each, which has insignificant relationship to the prices of construction input prices.

In addition, as shown in table 2.4 above, the fall of prices of fuel and cement recorded in 2016 recorded at time when the country level overall inflation rate (annual change based on 12 months Moving Average) rose by 9.2 % in July 2016 as compared to the one observed in a similar period a year ago as reported by the CSA (CSA, 2016) may be an indicator that the CPI may not measure the price trend of constructions inputs in Ethiopia. Hence, the use of CPI for the purpose of CPA determination may not be relevant.

2.18.2.1 Fixed or Non Adjustable Portions

The formula method of CPA contained a fixed or non adjustable portion. Accordingly, the so designated portion of the contract amount remains unadjusted in the course of execution of contracts. Hence, it is appropriate to study what constitutes the fixed portion and how it is determined.

SMEC (2018) recommends a range of 10.0% to 25.0% for all major work items. However, no explanatory notes are provided to assist decision making within this wide range. ADB (2018) shades some light on what should be constituents of a fixed portion. Accordingly, the fixed portion of a price adjustment formula is calculated based on estimates of overhead costs, profit level, and price contingencies. It may also include (i) other cost components over which the contractor has reasonable control; (ii) a stable price trend, such as costs for rental equipment and miscellaneous materials; and (iii) those cost components that are strictly regulated. Having said so, it recommends 0.15, cautioning but the actual figure will depend on the calculation made and may vary between 0.1 and 0.2.

According to the ADB (2018):

$$\text{Non adjustable Portion} = \text{Contingency} + \text{Overheads} + \text{Profit} + \text{Controllable Cost Elements}$$

Where:

Contingency is usually determined based on a contractor's assessment of the extent of risk associated with performing a contract, which may be influenced by a contractor's general experience and knowledge of a country and market.

Overheads are determined, controlled, and managed solely a contractor. Different contractors use a different basis for determining their overheads and ranges between 10.0 % and 20.0 % of an estimated cost.

Profit: Multilateral development banks (MDBs) require that the term “profit” shall be defined as “one twentieth (5%) of the cost.

Controllable Cost Elements: An experienced contractor can control or mitigate future prices escalation for many cost elements comprising works. The estimated portion of such cost elements may be included in the nonadjustable portion of the contract price.

Aurecon (2013) recommends 10.0% non adjustable portion unless otherwise specifically stated but without further explanations what make up the non adjustable portion. Similarly, DPER (2016) recommends 10.0% overhead costs that are not subject to price adjustment. Nonetheless, no further explanations regarding profit margin and other controllable costs or contingencies are offered.

According to SMEC (2008) a contractor's overheads and profit depend on a number of factors, percentages varying considerably anywhere between 20.0% and 70.0%. The main factors influencing this variation are:

- Degree of competition for the work
- Incidence of taxes
- Knowledge of the country
- Contractor with local establishment
- Contractor setting up in the country for the first time

Similarly, SMEC (2008) outlines the presence of certain small costs of a contractor for which a client does not assume the risk of price variations arguing that there is a certain percentage of the expenditure over which a contractor must exercise control. Examples of this according to SMEC (2008) might be the type of vehicles which a contractor chooses to purchase for his staff, the insurer with whom he chooses to place the works insurance, the bankers who issue the guarantees etc. Nonetheless, further guides are not provided.

Therefore, in determining the nonadjustable portion, consideration in general are given to those items against which a contractor assumes the risks, profit margin anticipated, fixed overhead costs which are disbursed on shorter period after contract commencement (and thought not to have been affected), overhead costs against which a contractor has substantial control over and other miscellaneous expenses.

Based on review of contract documents, however, the non adjustable portion of ERA contracts are not consistent for various projects, and no records could be found how they are determined, how they are equal for various currencies of payments and why it is not negotiable during contract negotiations or before contract signing.

2.18.2.2 Weightings or Coefficients

The formula method has coefficients or weightings usually represented by “b”, “c”, “d” etc representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) in the works specified in the contract. The sum of “b”, “c” and “d” are be unity less A which is the fixed or non adjusted portion.

As per ADB's (2018) opinion the adjustable component in general covers major cost components of a contract such as labor, equipment, and materials, over which a contractor has no control over. Each cost component has a coefficient or weight that is calculated based on its proportional value to the total contract amount as per the engineer's estimate. Despite its suggestion that bidders provide a fixed portion as well as coefficients and indices for an adjustable portion in their bids, ADB (2018) adds no additional recommendation.

According to DPER (2016), however, bidders may be given an opportunity to comment on the employer's nominal percentages and weightings since the nominal percentages and weightings are not intended to be an exact representation of the actual use of materials etc. on the project; but they are used solely for the purpose of calculating the price variation.

SMEC (2018) recommends the use of standard coefficients tabulated below but cautioning to check their appropriateness.

Table 2.7 Recommended Standard Coefficients Range (Source: SMEC, 2018)

Index description	General	Site Clearance	Drainage	Earthworks	Sub Base and Road Base	Bituminous Surfacing	Structures	Ancillary Works
Non-adjustable	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25
Labor	10 - 20	10 - 25	15 - 25	10 - 20	10 - 20	10 - 20	5 - 20	10 - 25
Equipment	10 - 40	20 - 60	5 - 20	20 - 70	20 - 70	20 - 60	10 - 20	10 - 20
Bitumen						30 - 50		
Fuel	10 - 50	20 - 50	10 - 25	10 - 20	10 - 20	10 - 20	5 - 20	10 - 25
Steel			10 - 35				20 - 40	20 - 40
Cement			10 - 25				10 - 30	10 - 35

SMEC's (2018) recommended standard coefficient ranges are not appropriately justified, contained wide ranges, and seems unlikely to suit to wide variety of project characteristics including but not limited to surfacing types. It may be because of the difficulty of determining the most reasonable ranges at design stages, ERA DBB contracts reviewed contained provisions allowing adjustment of the weightings if, in the opinion of the consultant, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or instructed or for any other reason (Sub Clause 70.7 of COPA).

The importance of balance of the weightings is furthered by the provision of Sub Clause 70.7 of CoPA which requires reevaluation and correction of weightings based on available records and reasonable judgments of the consultant with a view of ensuring neither under nor over payments of CPA.

According to Pakistan Engineering Council (PEC) Standard Procedure and Formula for Price Adjustment (2009), each of the cost elements having cost impact of 5.0% or higher are selected for adjustment by preparing a detailed cost estimate for the complete project. Subsequently, appropriate rate analysis of the engineer's estimate is made to determine costs of each element which are divided by the total amount of engineer's estimate to determine various weightings.

PEC's recommendation is better specific, indicating that the engineer is the one to determine the weightings of the various cost elements at design stage. Such estimates, according to DPER (2016), should not be rigid and may be commented by bidders. Without providing details, unpublished internal study conducted by ERA (2009) estimates the weightings of construction inputs to road projects are as shown in the table 2.8 below.

Table 2.8 Weightings of Construction Inputs (Source, Unpublished ERA (2009) Study)

Item of Work	Weight Fuel	Weight Equipment	Fixed Weight Labor	Weight Cement	Weight Steel	Weight Bitumen
Earthwork	0.3	0.6	0.1	–	–	–
Sub base and Base	0.3	0.6	0.1	–	–	–
DBST	0.1	0.16	0.1	–	–	0.64
AC	0.1	0.3	0.05	–	–	0.55
Concrete	0.007	0.063	0.43	0.40	–	–
Pipe	0.007	0.063	0.43	0.40	0.10	–
Masonry Work	0.007	0.063	0.43	0.50	–	–

Similarly Aurecon (2013) recommends guiding weightings for various types of road works as shown in the table 2.9 below but stressed that these weightings serve merely as guides and cannot be taken for granted without exercising determination of the right weightings specific to the nature of a contract.

Table 2.9 Coefficients for Various Types of Road Works (Source, Aurecon (2013))

No..	Work Category	Labor	Plant	Materials	Fuel
1	Bulk Earthworks	0.10	0.65	0.05	0.20
2	Earthworks (with culverts and drainage)	0.15	0.50	0.20	0.15
3	New Road Construction				
3.1	National Provincial Roads				
(a)	Including Bitumen	0.15	0.35	0.35	0.15
(b)	Excluding Bitumen	0.20	0.40	0.25	0.15
3.2	Urban Roads				
(a)	Including Bitumen	0.25	0.15	0.55	0.05
(b)	Excluding Bitumen	0.30	0.30	0.35	0.05
4	Township Roads and Services				
(a)	Including Bitumen	0.20	0.25	0.45	0.10
(b)	Excluding Bitumen	0.21	0.27	0.42	0.10
5	Rehabilitation/Resurfacing Works				
(a)	Including Bitumen	0.15	0.25	0.50	0.10
(b)	Excluding Bitumen	0.20	0.35	0.35	0.10
6	Routine Maintenance Works				
(a)	Including Bitumen	0.45	0.30	0.15	0.10
(b)	Excluding Bitumen	0.48	0.37	0.05	0.10
7	Water and Sewer Reticulation	0.15	0.20	0.55	0.10
8	Concrete Works (Reservoirs and other General Civil Engineering Works)	0.25	0.15	0.55	0.05
9	Concrete Works (Major Structures)	0.15	0.20	0.55	0.10

2.18.2.3 Indices or Costs/Prices for Contract Price Adjustments

As described under sub section 2.18.2 above, the formula method of CPA is hugely reliant on the use of indices which are thought to be reasonable measure of fluctuation of prices on wider geographical area. In the absence of reliable, dependable and accurate indices, the use of the

formula method alone may not be true to the fair risk allocation CPAs anticipated to yield. In this relation, SMEC (2018) recommends to check indices quoted by contractors to verify their authenticity, to ensure their existence for a reasonable period (two years or more), to ensure they are not volatile or subject to manipulation, they are appropriate for the material being considered, they are published regularly and in a manner that can be accessed by contract supervisory personnel.

According SMEC (2008) formula method of CPA is developed by identifying items of greatest expenditure and combining these with statistically derived indices, which indicate changes in the prices of those items. Furthermore, SMEC (2018) recommends, where possible, to specify in the bidding documents the source of indices to be used for price adjustment rather than leaving them up to contractors to chose.

Similarly, the use of indices is not overlooked in the Aurecon's (2013) explanation about Contract Price Adjustment Factor (F_{cpa}). In similar context, DPER (2016) underlines that the use of formula method of CPA is based on price indices for materials, fuel and CPI published by statistical offices. ADB (2018) also recognizes the use of indices that are useful for such purposes.

The various indices required for purpose of CPA using formula method are usually produced by governmental departments of statistics office to represent the price movements of those materials or groups of materials within certain areas of influence. Indices are, therefore, directly linked to the economy, rate of inflation, political stability and exchange rates of a particular country or area of influence. Because indices are area specific they cannot be used as being representative of other areas (OECD, 1996).

Therefore, true measure of CPA is highly reliant on (OECD, 1996):

1. The choice of the most relevant indices not prices published by reputable organization,
2. The use of area specific indices not prices,
3. The reliability of indices,

4. Long term availability of indices,
5. Convertibility of indices,
6. Verifiability of indices

However, in contract documents of both DBB and DB projects reviewed, the use of prices together with indices in formula method is not uncommon interchangeably using them implying that one represents the other. Recognizing the unavailability of price indices other than the CPI in Ethiopia, ERA rationally or otherwise opts to use indices together with prices for the purpose of CPA which requires verification of their relevance, their reputability, their reliability, long term availability, verifiability and most of all the relevance of foreign indices to the economic and market trends of the country.

2.18.2.4 Comparison between Indices and Costs/Prices

Indices, which the formula method is reliant on, is defined according to SSI Turkey (2002) cited in Kahraman (2005) as a tool which measures the rate at which the prices of goods and services are changing over time. The consumer price index, producer price index, export price index, import price index can be examples for these indices. Similarly, www.bls.gov describes that the Producer Price Index (PPI) measures average changes in the net prices received by domestic producers for their output using information obtained through systematic sampling of industries.

According to OECD (1996) construction covers a wide variety of activities, including construction of dwellings, non-residential buildings, and civil engineering works hence the items comprising an index and their relative weights are the result of different norms and standards that apply in each country.

The basic variables required to for the calculation of price indices are basket of goods and services, base year weights, base year prices and current prices (Kahraman, 2005). In determining PPIs changes in excise taxes, revenues collected by producers on behalf of the federal, state, and local government are not reflected in the index. Similarly, PPI measures the price differences by comparing the producer prices exclusive of VAT and other similar taxes of

products manufactured for the home country in a certain reference period and subject to domestic sale Kahraman (2005).

According to OECD (1996) a variety of tools are used to measure price changes taking place in an industry or a country including:

- a) Consumer price indices (CPIs),
- b) Producer price indices (PPIs),
- c) Price indices relating to specific goods and or services and
- d) GDP deflators

Concerning prices, OECD (1996) states that there are various types of price which include tender prices that are determined at the time of submission of tender which are theoretical, prices at the time of award which may be the market prices at the time of tender and invoice prices which are the actual amount paid. There are several price determining factors for a specific commodity including but not limited to color, place of sale, type of buyer, delivery method, quantity of sale, sales contract modality, mode of payment according to www.bls.gov.

Therefore, prices are a function of specific seller which depend on many factors and usually are inclusive of taxes collected on behalf of local or national government. Based on the preceding discussion, the comparison of distinct characteristics of costs/prices and indices is presented in the table 2.10 below.

Table 2.10 Comparison of Characteristics of Prices and Indices

Price	Indices
Offered by specific seller or retailer	Produced by government agencies or reputable organization
Short period of application	Applicable for at least a month
Affected by mode of purchase	Unaffected by mode of purchase
Limited application	Broad application

Easily unavailable	Easy to obtain
Mostly unofficial available.	Officially available
A function of specific item	A function of basket of items
Unsustainable	Sustainable for long period
Reference base unavailable	Based on reference base period
Exposed to forgery, manipulation	Unlikely for forgery but government manipulation is likely
Usually available	May not be available in some countries

Cognizant of the requirement of using indices for the purpose of determining CPA using formula method as advocated by many, and cognizant of the differences in the characteristics of price and indices as a measure of price trends over time and for various different characteristics each represent as summarized in the table 2.10 above, the use of prices of specific seller or retailer or wholesaler as a base or contemporary reference to determine CPA is unreasonable and may have consequences in the form of over or under payment.

The use of CPI for the propose of CPI in Ethiopia may not be appropriate as CPI measures the average change in the price paid by consumers for a fixed market basket of goods and services of which more than 50.0% are food and non alcoholic beverages based on household expenditure weights (CSA, 2019) which may not have significant relationship with the price trends of construction inputs. To support the argument that CPI may not represent the price trends of major construction inputs, comparison of percentage change in the price of diesel and cement in Addis Ababa are compared against the percentage change of country level CPI is shown in the chart below.

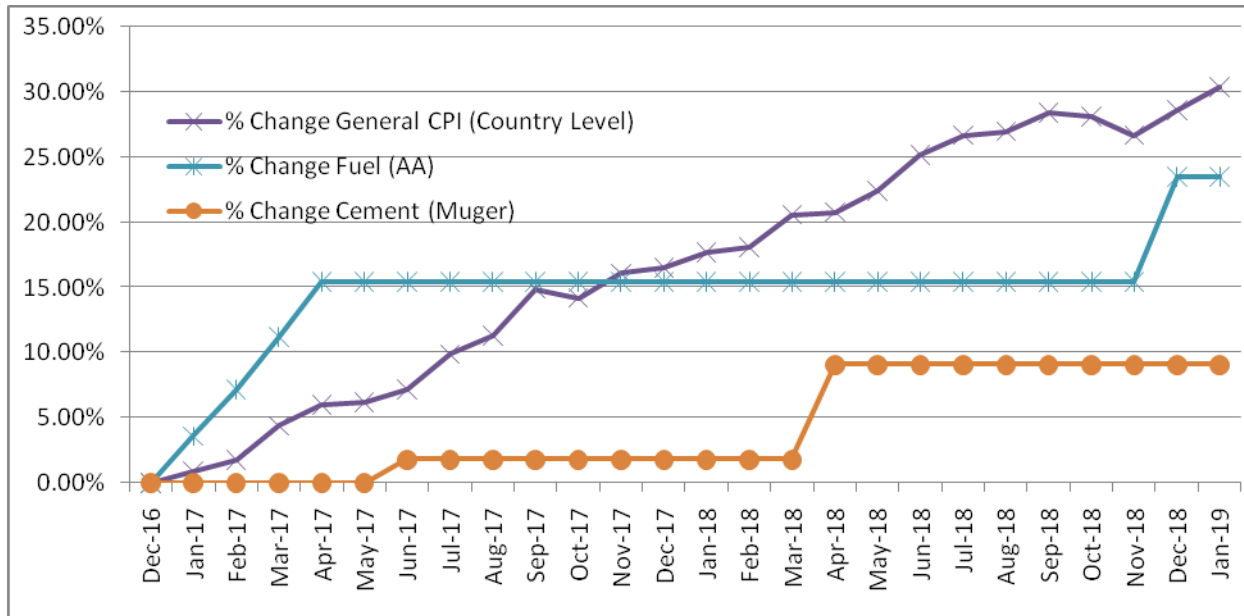


Chart 2.3 Comparison of % change in Prices of Diesel, Cement and Country Level CPI (Sources NOC Ethiopia, Muger Cement S.C and CSA (20119)

From chart 2.3 above, it is apparent that the price trends of major construction inputs like cement and fuel may not tally with the country level CPI of the country. Therefore, from the chart above it can reasonably be concluded that:

1. CPI trend in Ethiopia may not have direct relationship with price trends of certain construction inputs, and
2. CPI may not be relevant reference to determine CPA using formula method,

CPI's measure of inflation and the assumption that overall costs of construction increases as inflation pursues to ascertaining CPA proportionally may not hold true. Moreover, the trends of some indices from other countries may not have resemblance with the price trends or inflation in other country because of many macroeconomic and other factors.

For justification, another comparison of percentage change of country level CPI of Ethiopia is made against percentage change of PPI index of construction machinery and equipment (USA)

which is the most commonly in use reference index in ERA contracts for CPA is presented in the chart 2.4 below.

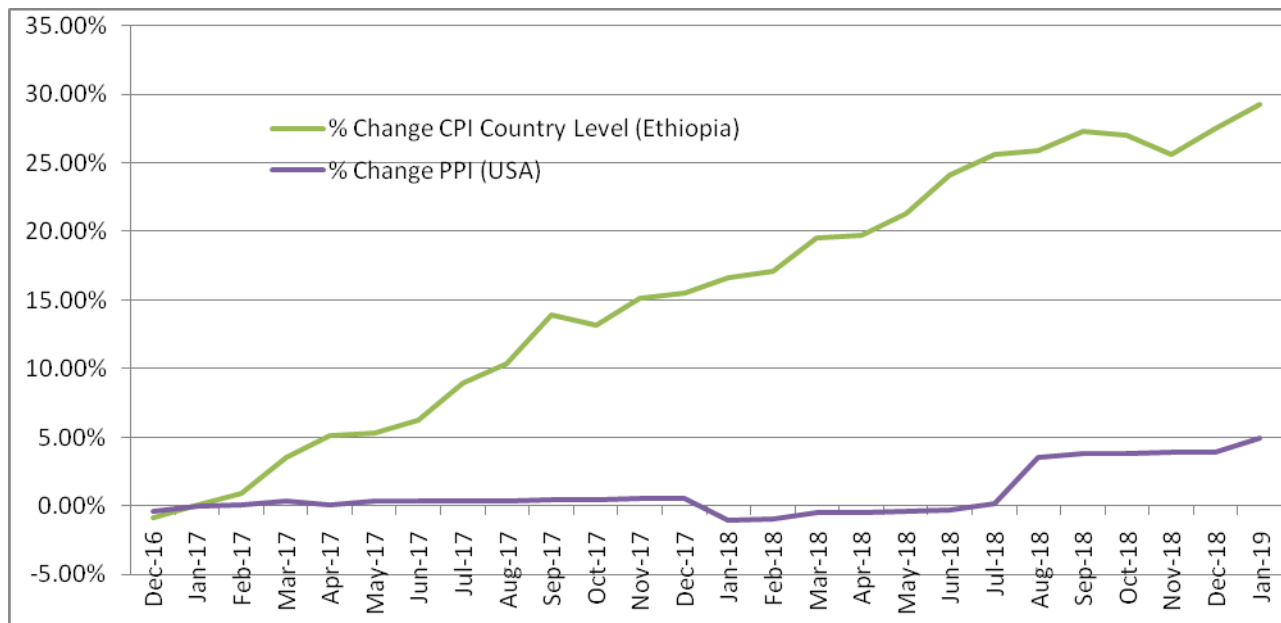


Chart 2.4 Comparison of % Change Trend CPI (Ethiopia) and PPI Construction Machinery & Equipment (USA) (Sources of raw data: CSA (Ethiopia) and <https://data.bls.gov>)

Again from chart 2.4 above, it is apparent that the trend of country level CPI of Ethiopia and that of PPI for Construction Equipment and Machinery of (USA) shows distinct trends of their own. Therefore, from the chart above it can again be reasonably concluded that:

3. CPI which is the measure of inflation in Ethiopia shows a trend of its own which is distinct from that of the trend of PPI for Construction Machinery & Equipment of USA. Hence, the use of PPI of USA as a reference index for construction equipments in CPA may not yield reasonably accurate amounts of price changes over contract periods.
4. CPI of Ethiopia shows a continuous cumulative growth whereas PPI of USA fluctuates insignificantly as compared to the CPI of Ethiopia.
5. Since PPIs provide measures of average movements of prices received by the producers of commodities according to OECD (1996), the use of such index in Ethiopia where producers have the potential to dictate market prices is rather inappropriate.

Therefore, as much as the use of prices of retailer or wholesalers as a reference is not recommended for the purpose of determining CPA, the use of indices from countries other than the country where the work is executed may make the idea of fair risk allocation questionable with a possibility of yielding undervaluation or overvaluation of CPA amounts.

2.18.2.5 Sources of Indices and Costs/Prices

ERA contracts usually specify that the sources of indices listed in the contract are subject to consultants' approval, the indices are required to be appropriate for their purpose and must relate to a contractor's proposed source of supply of inputs on the basis of which his contract prices have been computed (Sub Clause 70.4 of CoPA for DBB projects and Sub Clause 13.1 (b) for DB project).

Nonetheless, ERA practices known so far indicates lack of verification of appropriateness of indices for their purpose and lacks establishing the sources of indices are similar to actual sources of supply of inputs. Again, from the practices known so far, however, the sources of cost or prices are usually suppliers or retailers' quotations or invoices which could equally serve as an evidence of an actual purchase. Particular worry is price quotations which may be manipulated, untrue or even may be forgery.

ADB (2018) underscores the need to implement price adjustment provisions with an extensive verification process and skills in contract management. The caution comes in consideration of the possible mismanagement of price adjustment, if happens, may lead to delays in contract payments and potential abuse and integrity issues. Possible mismanagement may include use of under rated base indices, overrated current indices, use of forged documents, extensive verification, and etc. Hence, SMEC (2018) strongly suggest the use of indices sourced from reputable statistical organizations.

In addition, ADB (2018) strongly underscores evaluation sources of indices proposed by a bidder including determination of the relevance of sources of indices. Recognizing the absence indices which could be sourced from reputable statistical organization in Ethiopia, SMEC (2018)

suggests the use of price quotations from wholesaler known in the country to serve as proxy indices for the purpose of CPA. Regarding foreign indices, SMEC (2018) suggests the gross use of sources which they regard reputable but without due regard to the verification of the sources indices for the purpose they are intended to serve.

2.18.2.6 Reliability of Indices and Costs/Prices

Since indices have wider application to the construction industry, the reliability of them is unequivocally necessary. ADB (2018) requires the use of objective prices indices for the purpose of CPA because there is a risk of manipulation.

SMEC (2018) in order to assure an equitable means of sharing construction project pricing risks, suggests to specify in the bidding documents the source of indices to be used for price adjustment rather than leaving them up to contractors, check the indices quoted by contractors are genuine, ensure that the indices have existed for a reasonable period, are not volatile or subject to manipulation and are appropriate for the material being considered, are published regularly in a manner that can be accessed by contract supervisory personnel.

2.19 International Financiers' and Donors' Guidelines on Contract Price Adjustments

According to the Standard Bidding Document for Procurement of Small Work (2012) useful for admeasurements contracts financed by the WB valued generally less than US\$10 million procured through ICB, which may also be adapted to NCB, the formula recommended for use to determine CPAs is of the following general type

$$P_c = A_c + B_c \text{ Imc/Ioc}$$

Where:

P_c is the adjustment factor for the portion of the contract price payable in a specific currency "c."

A_c and B_c are coefficients specified, representing the nonadjustable and adjustable portions, respectively, and

I_{mc} is the index prevailing at the end of the month being invoiced and I_{oc} is the index prevailing 28 days before bid opening

The Standard Bidding Document for Procurement of Works (2015) useful for contracts amounts exceeding US\$ 10 million procured through ICB allows for adjustment of contract prices in connection with the rises or falls in the cost of labour, goods and other inputs to the works, by addition to or deduction from the contract amount such sum determined by a formula prescribed. The formula is typical formula stated under sub section 2.16.2 above. In addition, the adjustment to be applied is determined from formulae for each of the currencies in which the contract price is payable.

Other development partners with persistent participation in Ethiopia's infrastructure development projects like BADEA and AfDB use the FIDIC MDB harmonised edition 2010 GCC which provide for price adjustment using the formula method in general.

Contracts of projects financed in whole or in part from the resources of BADEA, OPEC Fund for International Development (OPECID) or Kuwait Fund for Arab Economic Development (KFAED) specify some restrictions on contract price adjustment provisions based on the Guidelines for Procurement of Goods and Contracting for Execution of Works (2001) which prescribes the use of formula method CPA but subject to the following provisions:

- The total price adjustment amount cannot be more than 20% of the basic contract price; and
- This price adjustment cannot be made before the expiry of one year from the date fixed for receiving tenders.

AfDB through its publication of Rules for Procurement of Goods and Works (2007) requires bidding documents to state either, that (a) bid prices will be fixed, or (b) that price adjustments will be made to reflect any increase or decrease in major cost components of a contract, such as

labor, equipment, materials, and fuel. Having prescribed so, however, allows CPA provisions in simple contracts involving delivery of goods, or completion of works within eighteen months. However, for contracts exceeding 18 months CPAs are allowed favoring the use of formula method of determination and without prescribing caps (AfDB, 2007).

International donors and financiers with active participatory role in development of the Ethiopia's infrastructures, have significantly resembling stance related to CPA in projects financed party or whole from their proceeds. These include consideration for CPA provisions in contracts, suggestion for the use of formula method of determining CPA, allowance of CPA in each currency of payment and the recommendation to use indices for the purpose of CPA except some restrictions prescribed by BADEA, OPECFID and KFAED.

2.20 Other Countries Experiences in Contract Price Adjustments

The practices of CPA in various countries are dictated by peculiarities of the respective countries. Such peculiarities include the presence or absence of prices indices, market stability etc. brief study of the findings of other countries experiences is presented in the following sub section.

2.20.1 South Africa

Most engineering construction based contracts contain provisions for adjustment to changes in cost utilizing a price adjustment formula to take in to account the increase or decrease in the costs of labor, equipment, plant, materials and fuel over the period of the contract. It is the general practice that the client of the works specifies the exact formula that is used for the contract; however standard formulae for determining the escalation have been developed, in South Africa, by the South African Institution of Civil Engineering (SAICE), South African Federation of Engineering Contractors (SAFEC) and Steel and Engineering Industries Federation of South Africa (SEIFSA) (Aurecon, 2013)).

The formula accepted and approved for inclusion in the General Conditions of Contract for Construction Works (2nd edition 2010) by the South African Institution of Civil Engineering

(SAICE) is based on the formulae for escalation which has been adopted in the industry as it has been accepted by SAICE, Construction Industry Development Board (CIDB) and the South African Federation of Engineering Contractors (SAFEC). The expression utilized by SAICE to calculate the Contract Price Adjustment Factor (F_{cpa}) is:

$$F_{cpa} = (1-x) [a (\frac{L_t}{L_o}) + b (\frac{P_t}{P_o}) + c (\frac{M_t}{M_{m0}}) + d (\frac{F_t}{F_o}) - 1]$$

Where:

“x” is the portion of the contract value that is not subject to adjustment and unless stated otherwise under a contract, the fixed portion is be 0.1 or 10.0%.

“a”, “b”, “c” and “d” are the coefficients contained in the contract which are deemed, irrespective of the actual constituents of the work, to be representative of the proportionate labor, contractor’s equipment, materials and fuel respectively.

“L”, “P”, “M”, “F” are the Labor, Plant, Material and Fuel Index published by the statistics office of South Africa in monthly statistical news release.

For “L”, “P”, “M”, and “F” the suffix “o” denotes the base indices applicable to the base time “t” the current indices applicable that will be utilized in the determination of the CPA factor.

Similarly Aurecon (2013) recommends guiding coefficients for various types of road works as summarized in the table 2.9 above but suggests that the coefficients serve merely as guides and urges determining the right weightings specific to the characteristics of a specific contract. The price adjustment amount is determined by multiplying the relevant amount by the contract price adjustment factor. In summary, F_{cpa} provides a multiplication factor to adjust what the contractor is paid for to reasonably account for the effects of inflation that occur within the civil engineering construction industry that can be calculated based on published indices.

The practices in South Africa has some resemblance to that of Ethiopia, however, the main difference is the availability of national indices applicable to the various cost elements in South Africa. The indices are available for the various regions of the country and contracts usually prescribe the use of indices of the area where the works is undertaken. Another significant difference is the establishment of generally recognized method of CPA in South Africa while such establishment is nonexistent in the Ethiopia.

2.20.2 Zambia

Few road construction contract documents to which the writer had a chance to have a look contained a provision for adjustment of the contract price. The formula method is in use in the country for road construction contracts. However, the formula method is the simplified formula method based on following genera formula:

$$P_c = A_c + B_c \text{ Im}_c/\text{Io}_c$$

Where:

A_c represents the non adjustable portion and weights 20.0%, hence the adjustable portion is 80.0%. Im_c and Io_c represents the current and base indices of the Consumer Price Indices published by the Central Statistical Office of Zambia.

The method in use is similar to that of the WB recommends for small works. It is based on the use of simplified formula reliant of consumer price indices which in Ethiopian context are not reflective of the measure of price fluctuations of construction inputs.

2.20.3 Pakistan

The Pakistan Engineering Council's (PEC) Standard Procedure and Formula for Price Adjustment (2009) discourages employers to ask tenderers to quote firm prices with no provision of adjustments, especially for long-term contracts.

PEC Standard Procedure and Formula for Price Adjustment (2009) has distinct provision which allows CPA in case of default on the part of a contractor causing delay in original scheduled completion. However, the rate of CPA will be frozen at the original scheduled date of completion; however CPA will be applicable till actual completion. While computing CPA beyond the scheduled completion period, in the event the rate is reduced, then that reduced rate will be applied.

Important features of the prescriptions of the Standard Procedure and Formula for Price Adjustment (2009) include:

- The requirement to carryout detailed estimate for a complete project,
- Only cost elements having cost impact of 5.0% or higher are selected for adjustment,
- Each cost element determined are divided by the total amount of estimate to determine various weightings.
- The prices of elements subject to price adjustment are to the extent possible as given in the Statistical Bulletins published by Federal Bureau of Statistics (FBS), Statistical Division Government of Pakistan.
- Formula Method is used to determine CPA.
- The specified elements subject to CPA includes unskilled labor, cement, steel and bitumen for highway and bridge construction.
- The co-efficient for each specified element are calculated and given in the bidding/tender documents and the sum of these coefficients shall form the adjustable portion of the contract, which shall not exceed 0.65.

Accordingly, the non adjustable portion is not less than 35.0%. The recommended procedures of PEC other than giving specific procedural matters are significantly similar to ERA's practices except it subscribes to a minimum 35.0% non adjustable portion.

2.21 Contract Price Adjustment Provisions during Design and Tender Stages

In relation to CPA risk allocations, PEC suggests to carry out detailed estimate to determine the relative weightings of various cost elements by considering only those costs having an impact of 5.0% or above of the total cost. However, such guideline do not existing in ERA practices so far.

Turkey (2011) indicated that cost estimates during design stages are entrusted to design consultants and ERA does some checking but superficially because of lack of ably competent staff. In this regard, George (2013) notes basic problem related to price adjustment in ERA projects emanating from poor understanding of the contracting parties (employer, contractor and consultant) about price adjustment especially of design firms who often fail to workout appropriate weighting for input materials based on detailed estimate.

Contracts which are the best instruments of risk allocations to promote project execution on time and on budget with specified quality are recklessly prepared in some of ERA projects (George, 2013). According to George's (2013) findings design firms usually do copying the weightings from other projects with little regard to the nature of the project, location, type of pavement structure and other parameters necessary for the determination of the weightings. Similarly, the absence of indices produced by reputable organization in the country, gave way for the use of price quotations from individual wholesalers or manufacturers from domestic market and other indices from abroad which is another problem (George, 2013).

Getaneh (2011) similarly remarks that prices quoted by wholesaler or retailers is prone to manipulation in the form of under quoting the base price and urges the National Bank of Ethiopia (NBE) and CSA to establish price indices which has not been materialized so far. OECD (1996) cautions that indices are area specific and they cannot be used as being representative of other areas. However, without verification of their appropriateness or representation, foreign indices are directly used in ERA contracts which may be the reason for the erratic CPA amounts noted among various projects as presented in section 2.22 table 2.11.

ADB (2018), SMEC (2018) and Aurecon (2013) strongly suggest verifying the appropriateness

of indices during tender stage and before contracts are concluded. ERA contracts Sub Clause 70.4 and Sub Clause 13.1 (b) usually specify that the sources of indices are subject to the consultants' approval and the indices are required to be appropriate for their purpose and must relate to a contractor's proposed source of supply of inputs on the basis of which his contract price has been computed, Nonetheless, ERA practices know so far shows the absence of approval of the sources of indices after due verification of their appropriateness and relationship to a contractor's proposed or actual source of inputs.

George (2013) similarly pointed out that there is no mechanism for checking authenticity of base prices/indices and the reliability of sources giving rise to the possibility of under rated base prices and over rated current prices. From the researcher's experience and interviews with professional involved in the contract document preparations, it could be noted that determination of the non adjustable portion, the coefficients, the sources of indices are given little attention. In most cases, the design stage exercises are done without detailed estimate of the values of each component of the works to determine the appropriate weights. In addition, no guidelines or frameworks are available to streamline the design or tender stage practices.

2.22 Effects of Contract Price Adjustment Amounts

Various studies have suggested that price adjustments in the federal road projects are consuming substantial sum of the national budget. A recent unpublished study of price adjustment amounts paid on some federal road projects conducted by SMEC (2018) is presented in the table 2.11 below.

Table 2.11 Summary of Price Adjustment Amounts of Some Federal Road Projects

Project Name	Start Date	Contract Duration (days)	Original Contract Price (ETB)	EOT (days)	Price Adjustment	
					ETB	% of the Contract Price
Construction Works for Welkite-Hosaina Road Project Contract-2: Arekit-Hosaina	07-Oct-11	912.0	618,986,415	294.0	172,220,8352	27.82
Construction works of Gedo-Nekempte Road Rehabilitation Project, Contract 1: Gedo-Bako	13-Oct-09	913.0	489,545,006	nil	234,795,550	47.96
Construction Works of Mehal Meda – Alem Ketema Road Project, Lot 1: Mehalmeda - 72	15-Sep-11	1,096.0	817,523,895	534.0	110,240,333	13.48
Construction Works of Kombolcha-Bati Mile Link Road Upgrading project Contract 2: Burka –Mille	02-Sep-13	1,095.0	1,285,721,070	125.0	1,372,063	0.11
Construction Works of Arbaminch- Kemba -	08-Sep-11	1,095.0	393,210,290	809.0	156,675,039	39.85

Sawla Road Project Lot III: Otolo-Sawla						
Construction Works of Seru-Shenen Wonz - Shekhussien Contract 1: Seru- km 20	09-Sep-11	1,140.0	159,464,587	188.0	22,051,640	13.83
Wadera-Harekello-Negele Borena Road Construction Contract	08-Jun-09	910.0	324,573,178	Nil	68,595,271	21.13
Construction Works of Tongo-Begi-Mugi Road Project Contract 2: Gidami-Mugi	07-Jun-08	1,095.0	372,419,932	2,050.0	142,195,248	38.18
Construction Works of Jimma-Mizan Road Upgrading Project Contract 1: Jimma - Bonga	21-Apr-08	1,035.0	686,101,955	1,104.0	330,827,157	48.22
Construction Works of Mekenajo - Dembidolo Road Upgrading Project Contract 1: Mekenajo-Ayra	07-Oct-11	910.0	633,534,840	429.0	86,679,161	13.68
Construction Works of Mekenajo- Dembidolo Road Upgrading Project, Contract 2: Ayra-Chanka	07-Oct-11	910.0	669,093,905	636.0	157,213,544	23.50
Construction Works of Mekenajo - Dembidolo Road Upgrading Project Contract 3: Chanka – Dembidolo	07-Oct-11	910.0	648,530,585	676.0	64,518,651	9.95

From table 2.11 above, it is important to note that the CPA amounts vary considerably and go up as high as 48.22% and as low 0.11% of the contract prices. 3 contracts of the Mekenajo – Dembidolo road upgrading projects which were commenced on the same date, with contract amounts nearly equal to each other, having the same contract duration but slightly varying extension of times granted; however, resulted in considerably varying amounts of CAPs. Contract 2 and contract 3 which were executed over a period of 1,546.0 and 1,586.0 calendar days contract period (including extension of times granted) result in ETB 157,213,544 and ETB 64,518,651 CPAs respectively representing 23.5% and 9.95% of the respective contract amounts of ETB 669,093,905.0 and ETB 648,530,585.0 which could be a manifestation of the haphazard manner of administering the practices of CPA from design state through project implementation stage.

2.23 Summary of Literature Review

From the literature review exercised it is important to note that the government of Ethiopia is continuing its strong commitment of investing infrastructure development in the country. This investment, consumes substantial amount of the national budget, out of which, more than 50.0% is paid to contracts committed with foreign construction firms; thereby demanding payments in foreign currency.

In respect of the law, there is no mandatory provision to adjust contract prices inconsideration of rise or fall of costs. Hence, the provisions of contracts are useful tools to allocate risk in the consideration of the rise or fall of costs with careful consideration to the wordings of the relevant clauses of a contract, the method of adjustment, and determination of the non adjustable portion, determination of the coefficients, choice of sources of indices and prices.

The use of worldwide recognized GCC like that of FIDIC is one step to recognizing the use of reputable method of risk allocation. The risk allocation, however, is noted to be having some flaws emanating from ERA's interest to avoid budget overruns. In this regard, ERA's limitation of the maximum amount of CPA payable which is 20.0% the revised contract prices give little regard to the erratic costs of construction inputs in the country, the use of foreign indices on

which contractors have no control over, the unpredictable trend of the national currency against most convertible currencies and the range of variation of CPAs actually experienced on various projects as listed in table 2.11 above. Moreover, limitation gives the impression that price escalates, however, from the records available; prices have the possibility of going down and have actually gone down and yield negative CPAs.

Another aspect of ERA's experience in the contract price adjustment is that it only uses formula method. However, the indices for formula method are not produced in the country. Hence, proxy indices which are prices of suppliers are used for the purpose of determining the amounts payable or deductible from contractors. The absence of national indices puts question on the reliability, effectiveness of the indices from other countries or proxy indices. Moreover, the use of indices from sources thought to be reliable and purposeful may not produce reasonable degree of resemblance to the market trends in the country putting some doubts on their further use.

In the subject of CPA, especially related to guidelines to determine the cost elements, non adjustable portions and coefficients are highly dependent on national factors. Hence, use of other countries method, experience, indices may offer a possibility of attracting the economic factors of another country in to the contract provision of ERA where it has little applicability and resemblance.

As much as the inclusion of CPA provisions in contracts are important for fair risk allocation, determination of the non adjustable portion and weightings during design stage are equally important. Imbalance in the non adjustable portion and the weightings may result overpayment or underpayment to contractors, therefore, as part of appropriation of risks, detailed and reasonably accurate estimate at tender document preparation stage is of paramount importance.

To ensure reasonable degree of consistency at intuitional level, the establishment of a guiding framework similar to the practices in South Africa or Pakistan would have resulted better administration including consistent use of non adjustable portion and accuracy of weightings. The reviews exercised so far reveals that such frameworks do not exist causing wide variation among various projects.

Change in prices which may be measured by various indices or prices of sellers are bounded by various factors including geopolitical, economical, legal, demand and supply relationships to mention some which are at least country specific if not area specific. Similarly, CPAs are affected by choices of indices or prices of sellers which, in the absence of verifiability, credibility and long term availability could lead to the misapplication of the provisions of contracts which are mean to allocate risks fairly.

In summary, the practices of ERA against major parameters deemed important for CPA are comparatively presented in the table below.

Table 2.12 Comparison of Major Parameters against ERA's Practices related to CPA

Parameters	Recommended practices	ERA practices
CPA Framework	Favorable to streamline risk allocation through determination of the various elements of CPA.	Lacks Authority wide framework.
Consistency	Consistent approach through the implementation of guiding framework.	Significant inconsistency among projects.
Accuracy of Weightings	Important factor to ensure neither under payment nor overpayment of CPA	Significantly out of range estimates potential cause for speculative choices.
Indices	Use of area specific, reliable, accessible and verifiable indices curtails risks of manipulation or forgery.	Use of indices and prices interchangeably are not uncommon. Reliability, effectiveness and verifiability of the indices and prices are questionable.

Chapter Three

Research Methodology and Design

3.1 Introduction

Research is defined as human activity based on intellectual application in the investigation of matter. In other words, research is the systematic process of collecting and analyzing information to increase our understanding of the phenomenon under study (AAU, 2009). In this chapter, therefore, the research methodology and design followed to achieve the set of objective stated under section 1.4 of chapter 1 and to answer the key questions stated under section 1.3 of chapter 1 are discussed.

3.2 Description of the Study

This research project aims to study the practices of CPA resulting from the rise or fall of costs of construction inputs of road construction projects administered by ERA focusing exclusively on contracts awarded to foreign contractors. The research encompasses studying of risk allocation related to rise or fall of costs of construction inputs, studying of the appropriateness of the indices or costs/prices usually in use for the purpose of determining CPA and the reasonable accuracy of the weightings.

The research covers case study of the practices of contract price adjustments of projects awarded for foreign contractors. For the purpose of this research, extensive review of past research papers, publications and other relevant materials are reviewed. The literature review is done extensively to identify and elaborate the contractual/best practices aspects related to the practices of CPAs during projects cycle. The findings from the literature review is compared against the practices of the selected projects to assess the practices gaps, deviations or compliance in terms of appropriateness of indices or costs in use, reasonable accuracy of the weightings and responsiveness of the practices of the selected projects to changes of project parameters.

3.3 Research Type

The research is a case study which is conducted first through review of literatures, study of prior research works on similar subjects and comparing the findings of the literature against the practices of ERA's projects in general. The objectives of this research includes assessment of the practices of risk allocations and associated CPAs and evaluation of the purposefulness and appropriateness of the reference costs/prices and indices which is exploring the current practices to identifying the major characteristics of ERA with the aim of improving the current practices calling for descriptive explorations of the practices of ERA.

Therefore, this research studies the practices of CPA of contracts executed with foreign contractors using descriptive, exploratory and quantitative and qualitative analysis. This research is descriptive because it describes compares, classify, analyze and interpret CPA from various perspectives. Furthermore, this research is also an exploratory research establishing the cause and effect relationships arising out of increase or decrease of costs of construction inputs.

3.4 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with in procedure. In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, investigation and analysis of data (Kothari 2004).

In consideration of the research objectives and key questions outlined, the most suitable research technique that combines describing and exploring the practices of ERA related to CPA of foreign contractors' road projects to identify key gaps, key problems and shortcomings is case study. This research studies the practices of CPA of foreign contractors using both descriptive and exploratory type of research employing quantitative and qualitative analysis. The case studies emphasize detailed analysis of limited number of projects using descriptive and exploratory examinations providing very engaging, rich explorations of ongoing projects. Selection for the case study is done through purposive sampling method. This method is selected because of the

limited number of population size and the presumption that this method of sampling would enable in depth focusing which is one reason case studies are favored.

3.4.1 Data Sources and Research Instrument

Two research instruments are used for the collection of relevant materials for this research. To identify and elaborate the descriptive frameworks in the area of CPA, literature reviews are the main instruments used first. Second, desk study is carried out using secondary data from contract documents, payment certificates, reports and other relevant files from ERA. Table 3.1 presents major documents used for the case studies.

Table 3.1 Research Instrument Documents

Documents Requested (DBB Projects)	Documents Requested (DB Projects)
1. Minutes of Contract award negotiation related to Contract Price Adjustment	1. Minutes of Contract award negotiation related to Contract Price Adjustment
2. Table of weightings for Contract Price Adjustment	2. Table of weightings for Contract Price Adjustment
3. Appendix to Tender Payment Proportion	3. Appendix to Tender payment proportion
4. Sub Clause 70 of the Conditions of Particular Application	4. Sub Clause 13.1 of the Special Conditions of Contract
5. Latest IPC Summary page showing the amount of Contract Price Adjustment certified	5. Latest IPC Summary page showing the amount of Contract Price Adjustment certified
6. Updated report of list of equipments/plants available on site	6. Updated report of list of equipments/plants available on site
7. Unit Rates breakdown	7. Schedule of Payments

3.4.2 Case Studies Size

Case studies are usually conducted by selecting a few best fit cases for the phenomenon under study. They emphasize detailed contextual analysis of a limited number of events or conditions

and their relationships (Solomon, 2015). According to Yin (2003), studying small number of cases can offer no grounds for establishing reliability or generalizability. Yin (2003) also argues that ‘the case study’ , like experiment, does not represent a “sample”, in doing a case study the goal is to expand and generalize theories (analytical generalization) and not to enumerate frequencies (statistical generalization). To facilitate the generalization and ensure the quality of the research, however, it is necessary to select the appropriate number and type of cases. Hence, Yin (2003) notes that while a larger case number may be needed for theoretical replication, when fit, even two cases may be enough for literal replication.

For case study of this research, a total of 5 projects are purposively selected 1 from each contract administration region of ERA (central, south, north, east and west regions) all of which are procured through DBB project delivery method. The projects selected for the case study are listed under table 3.2 below.

Table 3.2 Projects Selected for Case Study

Project no.	Project	Commencement Date	Contract Amount (ETB)	Progress (%)
1	Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	01-Apr-13	892,181,567.0	90.5
2	Menebegna-Shambu-Bako Road Upgrading Project Contract 2: Shambu – Bako	07-Jul-16	993,280,400.0	51.8
3	Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	12-Jun-15	2,042,059,919.0	74.1
4	Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	02-May-17	1,300,353,822.84	53.2

5	Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	01-Apr-13	1,078,751,896.0	71.3
---	--	-----------	-----------------	------

3.5 Scope and Limitation of the Study

This research like any other similar research is bounded by scope. Its scope covers selected projects out of many projects currently under construction in the country which are awarded to foreign contractors under the administration of ERA. In addition, assessment of the accuracy of weightings of equipment, cement, fuel, reinforcement bars and bitumen is within the scope of the study.

The limitations of this research include exclusion of contracts awarded to domestic contractors. In addition, the research does not cover the assessment of accuracy, appropriateness, and reasonability of the vast parameters related to CPA.

3.6 Validation of the Case Studies

Validation of the case study findings through disclosure of the research work primarily to ERA regional directorates and other professionals in the industry is part of the research techniques.

Chapter Four

Case Studies

4.1 General Description of the Projects

The projects selected for the case studies are commenced at various times between 2013 and 2015 and are located at various parts of the country thereby falling under different administrative contract administrative regions of ERA. Moreover, the projects are financed from the proceeds of the GOE, OFID BADEA and AfDB. These projects are at various stage of progress, have peculiar nature and are procured under DBB project delivery method. The details of the projects are summarized under table 4.1 below.

Table 4.1 Additional Details of the Case Study Projects

Project no.	Project	Financer	Region	Payment proportion (ETB:USD)
1	Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	GoE	West	80.0 : 20.0
2	Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu – Bako	BADEA, OFID and GoE	Central	25.0 : 75.0
3	Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	GoE	North	80.0 : 20.0
4	Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	GoE	East	100.0 : 00.0
5	Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	AfDB and GoE	South	30.0 : 70.0

For ease of naming and reference in subsequent pages the projects mentioned above may be named Project 1, Project 2 etc as per the order they are listed.

4.2 Risk Allocation Related to Contract Price Adjustments

Writers and researchers like George (2013) and Bunni (2003) have indicated that contracts are best tools to allocate risks. However, the details of the risk allocations are usually suggested in the form of broad guidelines as mentioned under section 2.7 of this research work. The use of internationally recognized conditions of contracts would ease understanding and makes the risk allocation easily graspable for foreign contractors.

ERA uses FIDIC GCC as the general conditions of contract for all of the above projects. FIDIC (1992) GCC is used for all projects except project 5. Project 5 uses the Multilateral Development Bank (MDB FIDIC) 2006 harmonized edition GCC because of financier prescriptions. Because of the use of FIDIC GCC for all the projects, they generally share substantial degree of similarity in the wordings of risk allocation and the risk allocations themselves. This is especially true for projects 1 to 4 which use FIDIC (1992) GCC, share common character arising out of DBB project delivery method they are procured and ad-measurement contracts they are.

To study the risk allocations, excerpts of the most appropriate sub clauses of the FIDIC GCCs' related to prices and price adjustments are summarized under table 4.2 below.

Table 4.2 FIDIC Sub Clause Summary Related to Price and Price Adjustments

Sub Clause	FIDIC	Stipulation
12.1	1992	<i>The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the</i>

		<i>Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.</i>
70.1	1992	<i>There shall be added to or deducted from the Contract Price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the Works as may be determined in accordance with Part II of these Conditions.</i>
70.2	1992	<i>If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the Works are being or are to be executed changes to any National or State Statute, Ordinance, Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the Contractor, other than under Sub-Clause 70.1, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price-and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.</i>
4.11	2006	<p><i>The Contractor shall be deemed to:</i></p> <p>(a) <i>have satisfied himself as to the correctness and sufficiency of the Accepted Contract Amount, and</i></p> <p>(b) <i>have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].</i></p> <p><i>Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the</i></p>

		<i>proper execution and completion of the Works and the remedying of any defects.</i>
13.7	2006	<i>The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.</i>
13.8	2006	<i>If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed 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.</i>

The stipulation of sub clause 12.1 (FIDIC, 1992) and sub clause 4.11 (FIDIC, 2006); in the absence of any other stipulation otherwise, prescribes that a contractor has satisfied himself as to the correctness and sufficiency of his tender and of the rates and prices stated in the contract or the lump sum contract amount, all of which cover all of his obligations under the contract.

Similarly, in the absence of the stipulation of sub Clause 70.1 and 70.2 of the FIDIC (1992) GCC, the contract price would have been the amount payable to a contractor for the execution of the works and remedying any defects without any consideration for CPA. The stipulation of the GCC under Sub Clause 70.1 less assertively recognize that the rise or fall in the cost of labour and/or materials or any other matter affecting the cost of the execution of the works may be determined in accordance with Part II of the conditions of contract. Hence, without prescribing the details opts the subject of CPA to be specified in the CoPA.

However, the FIDIC (2006) GCC used for project 5 provides a more detailed and specific CPA prescription usually found on the CoPA which supplements FIDIC (1992) GCC. Differently, however, the FIDIC (1995) GCC do not recognize adjustment of the contract prices unless provided in the SCC.

Because details of the CPA are left for the prescription of the CoPA or the SCC, contents of FIDIC (1992) and FIDIC (1995) relevant to the subject of CPA are deleted and replaced with more detailed and particular prescriptions under the contracts studied. Excerpts of these prescriptions summarized in the table below are applicable for all the projects subject to the GCC they rely on.

Table 4.3 SCC/CoPA Sub Clauses Stipulations Related to CPA

Sub Clause	GCC FIDIC	Stipulation
70.1	1992	<i>The amounts payable to the Contractor in various currencies pursuant to Sub-Clause 60.1 shall be adjusted in respect of the rise or fall in the cost of labour, Contractor's Equipment, Plant, materials, and other inputs to the Works, by applying to such amounts the formulae prescribed in this Clause.</i>
70.3	1992	<p><i>The adjustment to the Interim Payment Certificates in respect of changes in cost and legislation shall be determined from separate formulae for each of the currencies of payment and each of the types of construction work to be performed and plant to be supplied. The formulae will be of the following general type:</i></p> $pn = A + b \frac{Fn}{Fo} + c \frac{Bn}{Bo} + d \frac{Sn}{So} + e \frac{Cn}{Co} + f \frac{En}{Eo}$ <p><i>The formula for price adjustment of the contract will not include the labour factor. The Contractor is therefore advised to take this into account when preparing his bid.</i></p>

70.4	1992	<p><i>The sources of indices shall be those listed in the Appendix to Bid, as approved by the Engineer. Indices shall be appropriate for their purpose and shall relate to the Contractor's proposed source of supply of inputs on the basis of which his Contract Price and expected foreign currency requirements shall have been computed. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightings and Source of Indices in the Appendix to Bid, which shall be subject to approval by the Engineer.</i></p>
70.6	1992	<p><i>The weightings for each of the factors of cost given in the Appendix to Bid shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or instructed under Clause 51 or for any other reason. The balance of the weightings shall be evaluated based on the available records and reasonable judgments of the Engineer and correction of the weightings shall be made to ensure that the Contractor is neither under paid nor overpaid.</i></p>
13.7	2006	<p><i>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.</i></p> <p><i>The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table) for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.</i></p> <p><i>In cases where the "currency of index" (stated in the table) is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the</i></p>

		<p><i>central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable.</i></p> <p><i>Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.</i></p>
13.1	1995	<p>(a) <i>Payment for the works executed by the contractor shall be effected based on the total lump sum amount, which is the governing contract amount.</i></p> <p>(b) <i>If the amounts certified in each payment certificate, before deducting for advance payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due</i></p> $P_n = A + \frac{bL_n}{L_o} + \frac{cM_n}{M_o} + \frac{dE_n}{E_o} + \text{etc}$ <p><i>If a price adjustment factor is applied to payment made in a currency other than the currency of the source of the index for a particular indexed input, a correction factor Z_o/Z_n will be applied to the respective component factor of P_n for the formula of the relevant currency. Z_o is the number of units of currency of the country of the index, equivalent to one unit of the currency of payment on the date of the base index, and Z_n is the corresponding number of such currency units on the date of the currency index.</i></p>

In general all of the contracts selected for this case study prescribe similarity of risk allocation terms related to CPA. The similarities include,

1. Recognition of the use of formulae method of CPA,
2. Disqualification of an adjustment for local labor,

3. The stipulation of non adjustable or fixed portion,
4. Recognition of the cost indices or prices prevailing on the day 28 days prior to the latest date for submission of bids as a reference base date (except for project 2),
5. Disqualification from CPA of part of the works which is the provision and maintenance of facilities for the Engineers'/Employer's Representative use,
6. Disqualification from CPA of works executed on day work basis,
7. Allocation of risks in the event of rise or fall of costs due to change legislation, laws, byelaws, regulations etc to the Employer,
8. The use of distinct CPA for various major work groups
9. Application of adjustment factor when the source of indices or prices are different from the currency of payment, and
10. Distinct CPA for the national currency and other currency of payment when a contract allows payment in currency other than the national currency,

Despite the similarities, some peculiar differences are notable. Such differences, except minor differences in wordings, emanate mainly from financier requirements. In this regard, contracts of Project 2 which is partly financed from the proceeds of BADEA and OFID and Project 4 differ because:

- The total CPA amount cannot be more than 20% of the basic contract price,
- CPA cannot be made before the expiry of one year from the date fixed for receiving tenders, and
- The base cost indices or prices for price adjustment are those prevailing on the date one year after the closing date for submission of bids.

By the above subscription contractor of Project 2 is expected to forecast the prices of construction inputs a year after the closing date of bids to come up with a realistic pricing and win contracts since contractor is not entitled CPA before the elapse of a year after closing date of submission of bids. In addition, the ceiling amount of CAP is 20.0% of the original contract price which may be an unwise way of passing to the contractor a risk that is difficult to assess.

Such prescriptions are tantamount to assuming that contractors are able to forecast price trends in the country which most researchers argued that it is a wild game. Nonetheless, as far as the writers could verify, the above listed prescriptions are financiers' key procurement requirements against which ERA has very limited say.

The use of separate weightings for major works groups and application of the formula method recalls the determination of CPA based on the specific works executed in any given month. This way, CPA is computed dividing the current indices or prices corresponding to those major groups of works executed only by the corresponding base indices or prices. For example use of current prices of bitumen, steel or cement comes to necessity to determine CPA in any given month if and only if major work groups having weightings for these items are executed during the same period.

In general however, the contract clauses of the projects allocate risks in a manner widely recognized starting from the use of worldwide recognized conditions of contracts. But the contracts allow the employer no remedy against:

- The contractors' choice of purchasing of construction inputs from sources other than the sources of indices,
- Comparing the a month ahead current prices against the base prices without regard to the actual time the construction inputs are purchased for payment of CPA for a specific month,
- Material on site payments made for those commodities purchased or materials produced earlier than the month CPA is due,
- The contractors desire of purchasing at any time of their choices,
- The contractors choice of purchasing those items indicated to have justified the proportion of foreign currency payments purchasing them from the domestic market,
- Contractors liberty to lease machineries from the domestic market while CPA are earmarked using foreign sourced indices,
- Adjustment of the proportions of local currency and foreign currency payments in the event of subcontracting of part of the works to domestic contractors,

Therefore, consideration to remedy the employer against the drawbacks mentioned above must be made to ensure that employer benefits from the advantage contractors main gain from material on site payments, bulk purchases, subcontracting part of the works to domestic contractors to mention some.

4.3 Consistency of the Contract Price Adjustment Frameworks

As stated under section 2.17, the three common elements that define frameworks of CPA are qualifications, price adjustment triggers, and caps. In the practices of the use of consistent framework, contracts studied have similarities and differences as explained hereunder.

4.3.1 Qualification

To qualify for CPA the contracts pose no specific qualification requirements. Some preset qualification requirement such as minimum material quantities, minimum contract sums, and/or minimum contract duration are not applicable to the projects studied except the elapse of one year after the latest date for submission of bid set as qualification requirement to invoke the application of CPA under Project 2. The other contracts contain no such prescription thereby allowing the putting in to force the application of CPA forthright.

4.3.2 Price Adjustment Triggers

Application of the CPA, when no triggers values are present, commences immediately. Trigger values are meant to represent thresholds of price change required to invoke CPA and avoid induction of CPA by minor fluctuations in construction input costs. Despite the pros and cons of trigger values, the contracts studied set no such thresholds hence CPA's are triggered up on any change in the prices or indices chosen for this purpose. It would have been reasonable, rather than setting caps, to establish minimum trigger value within a range of 1.0% to 3.0%, to commence application of CPA inconsideration of the fact that predetermined trigger values not caps can be estimated and considered during tendering.

4.3.3 Price Adjustment Caps

A cap can be specified to limit the maximum CPA amount and it is thought to provide a means to share the risk when prices change dramatically. Of the ERA contracts reviewed only Project 2 and 4 specify a maximum CPA cap of 20.0% of the contract price. The CPA caps are the results of financiers' requirements and are not the result of institution wide practice within ERA.

From the foregoing discussion, it can be remarked that the CPA frameworks are not consistently and widely applied throughout and vary among projects depending on the sources of finances and financier's requirements. Comparison of the CPA frameworks of the above case study projects are summarized in the table 4.4 below.

Table 4.4 Price Adjustment Frameworks of ERA Projects

Project	Qualification	Trigger	Caps
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	None	None	None
Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu – Bako	Yes	None	Yes
Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	None	None	None
Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	Yes	None	Yes
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	None	None	None

Except to the extent Project 2 and Project 4 set some of the CPA frameworks, contracts of the other projects prescribe no qualification, triggers or caps. It would have been appropriate, to rationalize the practices of CPA through a formalized framework applicable institution wide so that the process of CPA starting design stage through implementation stage might have been

streamlined. Such frameworks may include stipulation of commodities qualifying for CPA, determination of the non adjustable portion, justification for exclusion of local labor from CPA and the way weightings are estimated. In the absence of such framework, CPAs are left to wide variations, inconsistencies and ultimately may end up serving little of the purpose it is intended.

4.4 The Non Adjustable or Fixed Portion

The formula method of CPA contained a fixed or non adjustable portion. Accordingly, the so designated portion of the contract amount remains unadjusted in the course of execution of the contracts. SMEC (2018) recommends a range of 10.0% to 25.0% for all major work items whereas ADB (2018) recommends 15.0%, cautiously stating that the actual figure may vary between 15.0% and 20.0%.

The recommended ranges of the non adjustable portion vary considerably. For example, Aurecon's (2013) recommendation fall as minimum as 10.0%, while PEC's (2009) goes up as high as 35.0%. These recommendations are gross without details; nonetheless, ADB (2018) highlights what elements are considered non adjustable including Contingency, overheads, profit and Controllable Cost Elements. The non adjustable portions of the case study projects, however, show peculiar variations both in terms of amount and uniform or non uniform application summarized in the table 4.5 below.

Table 4.5 Non Adjustable/Fixed Portions of Case Study Projects (%)

Project Name	Site Clearance	Drainage	Earthworks	Sub Base & Road Base	Bituminous Surfacing	Structures	Ancillary Works
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	20.0	20.0	20.0	20.0	10.0	20.0	20.0
Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu – Bako	35.0 (L)	10.0 (L)	25.0 (L)	25.0 (L)	40.0 (L)	4.0 (L)	30.0 (L)

	22.0 (F)	43.0 (F)	25.0 (F)	25.0 (F)	26.0 (F)	45.0 (F)	56.0 (F)
	25.2	34.7	25.0	25.0	29.5	34.7	49.5
Gashena – Lalibela- Sekota Road Project, Contract 2: Bilbila – Sekota	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	20.0	20.0	20.0	20.0	10.0	20.0	20.0

Note: L = Local Portion, F= Foreign Portion

From the table above, it is notable that the non adjustable portion is as low as 10.0% and as high as 56.0%. In addition, project 3 and 4 use a blanket application of a uniform non adjustable portion for all major work groups and currencies of payments, while the non adjustable portions of Project 1 and 5 are exactly the same which may, as George (2013) pointed out, be the consequence of copy pasting unchallenging to ignore. The non adjustable portion of Project 2 shows significant variation from the other projects in terms of varied application along major group of works, degree of variation between the local currency and foreign currency portions and ranges between 25.0% and 49.5% in aggregate terms.

Taking in to thought the ADB's (2018) guideline that the non adjustable portion includes contingency, overheads, profit and controllable cost elements further study of the documents of the above projects give overheads and profit margins the contractors' might have used to come up with the contract amounts as presented in the following table with remarks.

Table 4.6 Fixed/Non Adjustable Portions

Project Name	Overhead, profit margin (%)	Remark
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	35.0	35.0% of the direct cost based on the contractor's unit rates breakdown.
Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu – Bako	23.64 Plus 3.0 local taxes and duties.	23.64% of the direct cost based on the contractor's contract price breakdown. Plus a contingent of 3.0% of the direct cost for local taxes and duties based on the contractor's contract price breakdown.
Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	A minimum of 28.65 and a maximum of 67.9	Overhead and profit margin of 40.5% and 67.9% are used on provisional sum items of the bill of quantities. Whereas 28.65% is used for day work items of the bill of quantities.
Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	30.0	30.0% of the direct cost based on the contractor's unit rates breakdown.
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	25.0	Overhead and profit margin of 25.0% is used on provisional sum items and day work items of the bill of quantities.

In recognition of the fact that the above projects entail payments in currency other than the national currency, the use of uniform non adjustable portion equate to the assumption that the contractors overheads costs, contingency amounts, and profit margins are equally proportional to the direct cost. In this regard, the practice of Project 2 in terms of application of different non adjustable portions for the local and foreign currency payments is rational. However, it comes as a result of the contractor detailed justification of the currency proportions during bid negotiation stage.

Moreover, the non adjustable portions so predetermined by ERA or the design consultants do not tally with the notion that these are costs such as overheads, contingency amount, risks, controllable expenses and profit margins the contractors themselves have determined or stated directly or indirectly. The absence of documentations how the non adjustable portions are determined makes it hard to establish where flaws might had been made.

It is also important to note that the contracts of all the projects disregard adjustment of costs of local labor, thereby implying outright inclusion of the local labor cost portion to the fixed or non adjustable portion. Hence, the non adjustable portions of local currency payment should have been greater than foreign currency portion.

Based on the notion that the non adjustable portions are deemed to have included costs such as overheads, contingency amounts, risks, profits margins and other costs contractors have control over; and local labor portion of the costs which ERA out rightly excludes from CPA; the recommended ranges of non adjustable portion based on the researchers experiences would be as estimated and shown in the table below.

Table 4.7 Recommended Ranges of Non Adjustable Portions

Description	Minimum (%)	Maximum (%)	Average (%)
Overheads and profit margins	20.0	30.0	25.0
Contingency amount	1.0	2.0	1.5
Controllable expenses	2.0	3.0	2.5
Local labor	5.0	7.0	6.0
Total	28.0	42.0	35.0

Moreover, because the contracts of the projects reviewed (except Project 4) allow payments in both the national currency and foreign currency, the use of the same non adjustable portion for the local currency portion and foreign currency portion CPA is hard to establish rationally without implying that the overheads, contingency amounts, profit margins and local labor costs are uniform percentage of the total direct costs. It would have been reasonable had the non

adjustable portion for the local currency and foreign currency portion be determined separately, which would have resulted a higher non adjustable portion for local currency portion of payment at least for the reason that the local labor is out rightly disregarded from being an element of CPA.

4.5 Sources of Indices and Costs/Prices

According to the contract provisions of the projects, indices are required to be appropriate for their purpose and relate to the contractors' proposed source of supply of inputs on the basis of which their contract prices are deemed to have been computed. According to this stipulation, the source or country of indices used are the sources from where the contractors mobilize resources thereby implying that the market trends of the sources of indices determine the CPA amounts due to contractors.

In addition, the stipulations imply that contractors' breakdown of the proportions of the local currency and foreign currency payments are determined on the basis of the sources of supply of construction inputs. From the contracts of the projects studied, sources of indices and prices for the purpose of CPA for local and foreign currency portion payments are as summarized in the tables 4.8.1 and 4.8.2 below.

Table 4.8.1 Sources of Indices and Prices Applicable for Local Currency Payment CPA

Project	Local Currency Payment					
	Foreign labor	Equipment	Bitumen	Fuel	Steel	Cement
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	NA	China (I)	USA (I)	Ethiopia (P)	China (I)	Ethiopia (P)
Menebegna-Shambu-Bako Road	NA	Hong	NA	Ethiopia	NA	Ethiopia

Upgrading Project Contract 2: Shambu – Bako		Kong (I)		(P)		(P)
Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	NA	China (I)	Ethiopia (P)	Ethiopia (P)	Ethiopia (P)	Ethiopia (P)
Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	NA	USA (I)	Ethiopia (P)	Ethiopia (P)	Ethiopia (P)	Ethiopia (P)
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	Egypt (I)	USA (I)	Ethiopia (P)	Ethiopia (P)	Egypt (I)	Ethiopia (P)

Note: P = Price and I= Indices

Table 4.8.2 Sources of Indices and Prices Applicable for Foreign Currency Payment CPA

Project	Foreign Currency Payment					
	Foreign labor	Equipment	Bitumen	Fuel	Steel	Cement
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	NA	China (I)	USA (I)	Ethiopia (P)	China (I)	Ethiopia (P)
Menebegna-Shambu-Bako Road Upgrading Project Contract 2: Shambu – Bako	Hong Kong (I)	Hong Kong (I)	Ethiopia (P)	NA	Hong Kong (I)	NA
Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	China (I)	China (I)	NA	NA	NA	NA
Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor	NA	NA	NA	NA	NA	NA
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	Egypt (I)	USA (I)	Ethiopia (P)	Ethiopia (P)	Egypt (I)	Ethiopia (P)

Note: P = Price and I= Indices

The contracts of the projects state that the sources of indices are those listed in the contracts, as approved by the engineer. Moreover, indices are expected to be appropriate for their purpose and relate to contractor's proposed source of supply of inputs on the basis of which their contract prices have been computed. However, it could be confirmed that the sources of indices once committed in the contracts have never been questioned or put to the verification of engineers as to their appropriateness with another striking anomaly that the sources of indices usually do not relate to the actual sources of supply of inputs.

4.6 Reliability and Appropriateness of Indices or Costs/Prices

The contracts studied disclose the use both indices and prices without distinction. Moreover, the choices of the use of indices or prices seems to have been left to contractors' choices and no credible document could be found if ERA ever has argued or questioned about the appropriateness or usefulness of the indices or prices.

Despite the stipulations of under Sub Clause 70.4 CoPA and Sub Clause 13.1 the SCC of the projects that the sources of indices are required to be approved by an engineer, the prices and indices so chosen by contractors are not questioned, verified or approved but rather they are taken as they are. The sources of indices are confirmed to have been chosen by contractors and ERA puts no reasonable restriction and verification to test their purposefulness, reliability or appropriateness. Neither do the engineers exercise any verification to ensure their purposefulness, reliability or appropriateness for the purpose they are intended to serve.

In addition, despite the stipulation that indices are required to be appropriate for their purpose and relate to the contractors' proposed source of supply of inputs on the basis of which contract prices and expected foreign currency requirements are computed, no exercise of verification of their appropriateness are noted. Rather the contractors are not restricted to procure commodities, lease machineries from the domestic market or subcontract part of the works to domestic contractors without compromising their entitlements whatsoever related to CPA.

In practices, therefore, the indices once so chosen continue to be referred for the purpose of CPAs without due process of verification of their appropriateness and without verifying the source of supply of construction inputs tally with that of the sources of indices. To measure the practices of CPA Considering OECD's (1996) remark to measure CPA practices against the practices of the projects selected for the study shades light on the practices shortcomings as summarized in the table below.

Table 4.9 Measure of Indices or Prices for CPA

Parameters	Practices of ERA projects
choice of the most relevant indices not prices published by reputable organization	Use of indices and prices interchangeably is common. The publishers of the indices are reputable organizations though the prices quoted by private sellers are doubtful of their reputations.
the use of area specific indices not prices	The indices are not applicable to the areas where the projects are executed. The use of foreign indices with exchange rate correction factor would not assure effectiveness of the indices. More concern comes from the use of prices or prices quotations of supplier which are prone to forgery and other malaises.
the reliability of the indices,	The use of indices from countries of higher government intervention in the political economy result shades doubts.
long term availability of the indices,	Long term availability of the indices is questionable since the indices published by foreign governments. In addition, cessation of publication of the indices of China since July, 2015 is a clear indication that long term availability is questionable.

convertibility of the indices,	Convertibility of the indices is hard to examine. However, the use of indices from countries where strong government control of the exchange rates would shade doubt about the convertibility of the indices.
verifiability of the indices	There is no mechanism to verify some of the indices like the indices published by Bureau of Statistic of China because the publications are not available to the general public.

In addition to the general measure of the appropriateness, reliability and purposefulness of the indices or prices in use in ERA projects; further scrutiny indicates that there inconsistencies, unassuring use of indices the details of the evaluation of the practices is as summarily presented in the tables below.

Table 4.10 Evaluation of the Sources of Indices of the Local Currency Portion CPA

Project	Remarks on the Sources of Indices or Prices for Local Currency CPA
1	<ol style="list-style-type: none"> 1. The choice of use of indices or prices is solely left to the contractor. 2. The use of indices of China alone for equipment for the local currency portion of CPA is not accurate because the contractor uses some equipment like dozers, graders, excavators from sources other than China. The use of indices from USA and China for bitumen and steel respectively implies that these materials are sourced from the respective countries. However, there is no confirmation that the actual sources of inputs tally with the sources of indices referred for the purpose of CPA. 3. The use of indices published by Bureau of Statistic of China whose publication is not available for scrutiny is highly questionable. Moreover, cessation of publication of the indices puts another difficulty of convertibility. 4. Other than reputability, availability and verifiability of USA index for bitumen,

	<p>reasonability and purposefulness of it for the local currency portion of CPA could not be established.</p> <p>5. Though not favored, it is not unclear why domestic seller's prices are not used for the purpose of CPA, since payment in local currency would imply that the materials are procured locally. Moreover, use of foreign indices for local currency portion of CPA is a typical of this project alone (excluding foreign indices of equipment commonly in use on all projects).</p>
2	<p>1. The choice of use of indices or prices is solely left to the contractor.</p> <p>2. The use of indices from Hong Kong alone for equipment for the local currency portion of CPA is not accurate because the contractor uses equipments like dump trucks, loader, rollers, crusher, asphalt plant which are made in China plus equipment like dozers, graders; excavators are from sources other than Hong Kong. .</p> <p>3. The use of indices of Hong Kong which has some degree of trend resemblance with that of China may be a substitute for the widely accustomed use of indices published by Bureau of Statistic of China in ERA, however, the rationale behind the choice of Hong Kong indices is unclear.</p>
3	<p>1. The choice of use of indices or prices is solely left to the contractor.</p> <p>2. Prices of domestic suppliers' dominate the choice of reference prices for local currency portion of CPA, while the use of indices of China for equipment is as common as on the other projects without justifying the rationale behind the use of foreign indices of specific country.</p> <p>3. The use of indices published by Bureau of Statistic of China whose publication is not available for scrutiny is highly questionable. Moreover, cessation of publication of the indices puts another difficulty of convertibility.</p> <p>4. Use of indices of domestic seller's prices of steel, fuel, cement is peculiar of this project.</p>
4	<p>1. The choice of use of indices or prices is solely left to the contractor.</p> <p>2. The contract prices hence CPA is payable wholly in the local currency which makes the contract peculiar from the other contracts.</p>

	<p>3. The use of indices of USA for equipment for the local currency portion of CPA is not accurate because the Contractor is Chinese establishment and substantial of his resources dump trucks, loader, rollers, water trucks, chip spreaders are Chinese origin. It is also unclear why USA index for equipment is chosen over indices of other countries.</p>
5	<p>1. The choice of use of indices or prices is solely left to the contractor.</p> <p>2. The use of index of USA alone for equipment for the local currency portion of CPA do not accurately tally with the contract stipulation that the sources of indices are deemed to represent the source of resources because the contractor uses dump trucks, loaders, water trucks and rollers of Chinese origin.</p> <p>3. The use of index of Egypt for foreign labor may be reasonable as the contractor is based in Egypt. However, the sharp increase in the points of the index which is noted from documents received for this study may demand questioning the index itself and its relevance. Moreover, reputability of the indices could not be verified and long term availability cannot be assured.</p> <p>4. The use of Egyptian index of steel for local currency portion of CPA is not similarly unjustified. Moreover, there is no confirmation that the sources of steel is not other than Egypt.</p> <p>5. The use of labor indices of foreign base for the local currency portion of CPA is a typical variation of this project the relevance of which could not be established.</p>

Further to the above remarks specific to each project, the peculiarly similarity in the choice of indices or prices for the purpose of CPA is ERA passive role which could be noted from the varied sources of contractors' choices accepted, ERA's acceptance of either prices or indices of the contractor's choice and the continued use of contemporary indices to determine CPAs without regard to the sources of supply of inputs. It is similarly true domestic suppliers' contemporary prices quotations (not price invoices) are referred to determine CPAs; hence, as far as a contractor could obtain and submit current price quotations, the actual sources of purchase are not verified.

Measure of the appropriateness, reliability and purposefulness of the indices or prices in use in ERA projects selected for the study for the foreign currency portion of the CPA indicates that there are similar inconsistencies; unassuring use of indices or prices for the purpose they are deemed to serve as summarily presented in the table below.

Table 4.11 Evaluation of the Sources of Indices of the Foreign Currency Portion CPA

Project	Sources of Indices or Prices for Foreign Currency CPA
1	<ol style="list-style-type: none"> <li data-bbox="337 657 1432 741">1. The choice of use of indices or prices is solely left to the contractor and ERA passively accepted them. <li data-bbox="337 762 1432 1014">2. The use of index of China for equipment and steel; index of USA for bitumen for the foreign currency portion of CPA is equally not accurate because the contractor uses equipment like dozers, graders, excavators from sources other than China. Moreover, there is no confirmation that the sources of bitumen and steel are USA and China respectively. <li data-bbox="337 1035 1432 1287">3. The use of foreign index of steel and bitumen (usually PPI index of specific category) which are computed in consideration of the various types of each product, their weight, price etc is unlikely to correspond with the typically deformed reinforcement bars steel product and typical type of penetration grade bitumen commonly in use in the country. <li data-bbox="337 1308 1432 1455">4. The use of indices published by Bureau of Statistic of China whose publication is not available for scrutiny is highly questionable. Moreover, cessation of publication of the indices puts another difficulty of convertibility. <li data-bbox="337 1476 1432 1560">5. Consideration of price fuel which is fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable. <li data-bbox="337 1581 1432 1833">6. Consideration of price cement which is fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable. The use of domestically sourced fuel and cement meant that the contract price is tendered accordingly hence; they should only have been referred to determine the local currency portion of CPA.

2	<ol style="list-style-type: none"> 1. The use indices of Hong Kong together with currency conversion factor make direct application impractical since the Hong Kong pound is not officially convertible in Ethiopia. Hence, indirect method of converting from Hong Kong pound to Chinese Yuan then to US dollar is open for misapplication. 2. The use of indices of Hong Kong alone for equipment and steel for the foreign currency portion of CPA is equally not accurate because the contractor's substantial resources are made in China and some resources are of origins other than China or Hong Kong. 3. The use of domestic supplier's price of bitumen for foreign currency portion of CPA is open for abuse. In addition, events such as the recent price hike of bitumen in the domestic market may result in unbalanced CPA. 4. The use of foreign index of steel (usually PPI index of specific category) which is computed in consideration of the various type of steel product, their weight, prices etc is unlikely to correspond with the typically deformed reinforcement bars steel product commonly in use in the country. 5. Use of indices or prices as the contractor chooses opens us a room for speculation. The use of domestic prices of bitumen to determine the foreign currency portion of the CPA is unreasonable since the use of domestically sourced commodity should have entailed adjustment of the contract price accordingly.
3	<ol style="list-style-type: none"> 1. Other than the use of Chinese indices for equipment and foreign labor, domestically sourced commodities like fuel and cement are not applicable to determine the foreign currency portion of CPA which is right. 2. However, the use of index of China alone for equipment for the foreign currency portion of CPA disregards some equipment like dozers, graders, excavators whose sources are other than China.
4	<p>The contract price and hence CPA is wholly payable in the local currency which makes this contract different from the others. Payment of the contract price wholly in the local currency is preset in the bidding document.</p>
5	<ol style="list-style-type: none"> 1. The choice of use of indices or prices is solely determined by the contractor.

	<ol style="list-style-type: none"> 2. The use of indices of USA alone for equipment for the foreign currency portion of CPA is not accurate because the contractor uses dump trucks, loaders, water tucks and rollers of Chinese origin. 3. The use of indices of Egypt for foreign labor may be reasonable as the contractor is based in Egypt. However, the sharp increase in the points of the indices puts trend of the index in question. Moreover, reputability of the indices could not be verified and long term availability cannot be assured. Moreover, there is no confirmation that the sources of steel is not other than Egypt. 4. The use of domestic supplier's price of bitumen for foreign currency portion of CPA is open for abuse. In addition, events such as the recent price hike of bitumen in the domestic market may result in unreasonable CPA. 5. The use of foreign index of steel (usually PPI index of specific category) which is computed in consideration of the various type of steel products, their weight, prices etc is unlikely to correspond with the typically deformed reinforcement bars steel product commonly in use in the country. 6. The use of steel indices of Egypt together with currency conversion factor makes direct application impractical since the Egyptian pound is not officially convertible in Ethiopia. Hence, foreign sources are used for indirect conversion which may pose the risk of misapplication. 7. Consideration of price fuel which is fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable. 8. Consideration of price cement which is fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable. Reference of the use of domestically sourced fuel and cement meant that the contract price is tendered accordingly that they shall be procured from the domestic market hence; they should only have been referred to determine the local currency portion of CPA.
--	--

From tables 4.11 and 4.12 above, it is notable that ERA's practices of accepting indices or prices of the contractors' choice do not follow consistent, purposive, reliable and assuring manner of ensuring CPAs are fair representation of the rise of fall of costs in the country . Moreover, the

choice of either indices or prices is usually left to contractors and there are no reasonable practices in place to verify their reliability and appropriateness. The absence of any guiding frameworks weakens ERA's practices opens to the use of indices or prices in speculative manner.

To summarize, the indices or price used for the purpose of CPA of the local currency and foreign currency portions of the contract payments of the projects studied indicate:

1. Reference use of fuel and cement which are fully procured from domestic market in local currency to adjust foreign currency portion of contract amounts disregards the stipulation of sub clause 70.4 of CoPA and 13.1 of the SCC of the projects which states:

Indices shall be appropriate for their purpose and shall relate to the Contractor's proposed source of supply of inputs on the basis of which his Contract Price has been computed.

2. The continued use of indices without due verification and approval by the engineer despite the stipulation under sub clause 70.4 of CoPA and sub clause 13.1 of the SCC which prescribes the engineers' approval of indices. No documentary evidence suggests that they have gone through verification and approval process.
3. despite the stipulation that objects the free will of contractors to change base prices of ordinal quotations or reference indices, the practices indicates that contractors' continue using reference prices of original quotations and indices of references as far as they could regularly update current prices or indices from the original sources. Therefore, the reference indices or quotations merely serve as a reference bases and the current indices or prices as contemporary ones to determine CPAs without any verification that the actual sources and reference source are the same.
4. The stipulations of the contracts or the laws of the land do not practically deny them the opportunity of purchasing commodities from the domestic market at local currency even though the contracts bestow up on them payment and CPAs in foreign currency.

5. The contracts are not flexible and proactive to investigate and adjust the sources of indices inconsideration of the actual sources of inputs and inconsideration of subcontracting part of the works to domestic contractors.

4.7 Weightings or Coefficients Ranges

As per ADB's (2018) opinion the adjustable component in general covers major cost components of the works such as labor, equipment, and materials, over which the contractor has no control over during the execution of contracts. Therefore, each cost component has a coefficient or weight that is calculated based on its proportional value to the total contract amount as per the engineer's estimate.

The weightings or coefficients ranges provided in the contract documents of the projects reviewed are estimated by ERA (or have them estimated by a consulting firm) and provided for related major construction inputs in accordance with the potential range of construction methodologies and based on estimated cost in a common currency.

The weightings if accurately determined are one of the reasonable instruments of to assure the addition to or deduction from payments to contractors resulting from rise or fall of construction costs. The practices of ERA is in such a way that range of weightings are determined first and contractors are allowed to provide their estimated range within the range predetermined by ERA. Hence, the possibility of selecting speculative weight can not be out ruled. Having said so, the ranges of weightings provided by ERA during tendering are presented in the following tables.

Table 4.12.1 Weighting Ranges Provided in the Contract for the Purpose of CPA (Project 1, Source the Contract Document)

Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam		Description		Equipment		Bitumen		Fuel		Steel		Cement	
				%	Range	%	Range	%	Range	%	Range	%	Range
		60.0		-	10.0	-	-	-	-	30.0	10.0	2.0	-
		75.0		-	15.0	-	-	-	-	40.0	20.0	5.0	-
	Site Clearance	20.0		-	2.0	-	-	-	-	-	-	-	-
	Drainage	35.0		-	5.0	-	-	-	-	-	-	-	-
	Earthworks	60.0		-	10.0	-	-	-	-	-	-	-	-
		80.0		-	15.0	-	-	-	-	-	-	-	-
	Sub base	55.0		-	15.0	-	-	-	-	-	-	-	-
		80.0		-	20.0	-	-	-	-	-	-	-	-
	Base Course	55.0		-	15.0	-	-	-	-	-	-	-	-
		80.0		-	20.0	-	-	-	-	-	-	-	-
	Bituminous Surfacing	50.0		-	10.0	15.0	-	-	-	-	-	-	-
		65.0		-	20.0	30.0	-	-	-	-	-	-	-
	Structures	20.0		-	2.0	-	-	-	-	34.0	10.0	2.0	-
		35.0		-	5.0	-	-	-	-	40.0	20.0	5.0	-
	Ancillary Works	15.0		-	2.0	-	-	-	-	10.0	15.0	2.0	-
		35.0		-	5.0	-	-	-	-	20.0	25.0	5.0	-

Table 4.12.2 Weighting Ranges Provided in the Contract for the Purpose of CPA (Project 2, Source: the Contract Document)

Menebena-Shambu-Bako Road Upgrading Project Contract 2: Shambu - Bako		Description		Site Clearance		Drainage		Earthworks		Sub base		Base Course		Bituminous Surfacing		Structures		Ancillary Works	
				%	Range	%	Range	%	Range	%	Range	%	Range	%	Range	%	Range	%	Range
	Foreign Labor	0.0		-	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5.0		-	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Equipment	40.0		-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		60.0		-	35.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bitumen	-		-	-	-	-	-	-	-	-	-	-	15.0	25.0	-	-	-	-
		-		-	-	-	-	-	-	-	-	-	-	40.0	-	-	-	-	-
		0.0		-	0.0	-	-	-	-	-	-	-	-	20.0	-	-	-	-	-
		5.0		-	5.0	-	-	-	-	-	-	-	-	40.0	-	-	-	-	-
		0.0		-	0.0	-	-	-	-	-	-	-	-	15.0	-	-	-	-	-
		5.0		-	5.0	-	-	-	-	-	-	-	-	35.0	-	-	-	-	-
		0.0		-	0.0	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-
		5.0		-	5.0	-	-	-	-	-	-	-	-	15.0	-	-	-	-	-

Fuel	10.0	20.0	5.0	15.0	10.0	20.0	10.0	20.0	10.0	20.0	5.0	15.0	5.0	15.0	2.0	5.0
	-	-	15.0	25.0	-	-	-	-	-	-	-	-	15.0	25.0	5.0	10.0
Steel	-	-	15.0	25.0	-	-	-	-	-	-	-	-	15.0	25.0	5.0	10.0
	-	-	15.0	20.0	-	-	-	-	-	-	-	-	15.0	20.0	5.0	10.0
Cement	-	-	15.0	20.0	-	-	-	-	-	-	-	-	15.0	20.0	5.0	10.0
	-	-	15.0	20.0	-	-	-	-	-	-	-	-	15.0	20.0	5.0	10.0

Table 4.12.3 Weighting Ranges Provided in the Contract for the Purpose of CPA (Project 3, Source: the Contract Document)

Gashena – Lalibela- Sekota Road Project, Contract 2: Bilbila – Sekota	Description	Site Clearance		Drainage		Earthworks		Sub base		Base Course		Bituminous Surfacing		Structures		Ancillary Works	
		% Range		% Range		% Range		% Range		% Range		% Range		% Range		% Range	
	Foreign Labor	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	15.0
	Equipment	55.0	65.0	25.0	35.0	55.0	70.0	55.0	70.0	55.0	70.0	50.0	60.0	25.0	35.0	15.0	20.0
	Bitumen	-	-	-	-	-	-	-	-	-	-	10.0	25.0	-	-	-	-
	Fuel	15.0	25.0	2.0	5.0	15.0	25.0	15.0	25.0	15.0	25.0	10.0	15.0	2.0	5.0	2.0	5.0
	Steel	-	-	10.0	20.0	-	-	-	-	-	-	-	-	10.0	20.0	30.0	40.0
	Cement	-	-	30.0	40.0	-	-	-	-	-	-	-	-	30.0	40.0	10.0	20.0

Table 4.12.4 Weighting Ranges Provided in the Contract for the Purpose of CPA (Project 4, Source: the Contract Document)

Chereti – Goroboksa- Gorodamole Road Project, Lot 1: Chereti – Hageremekor		Description		Site Clearance		Drainage		Earthworks		Sub base		Base Course		Bituminous Surfacing		Structures		Ancillary Works	
				% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	
Cement		-	-	25.0	30.0	-	-	-	-	-	-	-	-	-	25.0	30.0	10.0	30.0	20.0
Steel		-	-	10.0	20.0	-	-	-	-	-	-	-	-	-	10.0	20.0	30.0	40.0	-
Fuel		15.0	25.0	2.0	5.0	15.0	25.0	10.0	20.0	10.0	20.0	10.0	15.0	2.0	5.0	2.0	5.0	2.0	5.0
Bitumen		-	-	-	-	-	-	-	-	-	-	25.0	35.0	-	-	-	-	-	-
Equipment		45.0	55.0	20.0	30.0	45.0	55.0	50.0	60.0	50.0	60.0	25.0	35.0	20.0	30.0	15.0	20.0	15.0	20.0

Table 4.12.5 Weighting Ranges Provided in the Contract for the Purpose of CPA (Project 5, Source: the Contract Document)

Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam		Description		Site Clearance		Drainage		Earthworks		Sub base		Base Course		Bituminous Surfacing		Structures		Ancillary Works	
				% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	% Range	
Bitumen		-	-	-	-	-	-	-	-	-	-	15.0	30.0	-	-	-	-	-	-
Equipment		60.0	75.0	20.0	30.0	60.0	75.0	60.0	75.0	55.0	75.0	50.0	60.0	20.0	30.0	15.0	25.0	15.0	25.0
Foreign Labor		-	-	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0	2.0	5.0	5.0	10.0	5.0	10.0

	Fuel	10.0	15.0	2.0	5.0	10.0	15.0	15.0	20.0	15.0	20.0	10.0	20.0	2.0	5.0	2.0	5.0
	Steel	-	-	10.0	20.0	-	-	-	-	-	-	-	-	10.0	20.0	15.0	25.0
	Cement	-	-	30.0	40.0	-	-	-	-	-	-	-	-	30.0	40.0	10.0	20.0

The weightings provided in the contract documents without due process of verification of their accuracy depicts some degree of inconsistency. The only consistent element is the exclusion of the local labor cost elements from consideration for CPA. While the local labor may not be insignificant portion of the costs compared against the foreign labor, exclusion of it from consideration for CPA is government policy driven than financiers' requirements.

One striking similarity among the weighting ranges provided by contracts documents is the wideness of the ranges. The range of weightings are as narrow as 5.0% and as wide as 25.0% shades doubt, to begin with, about the accuracy of the weightings. The weightings should not have such wide ranges had they been properly and accurately computed. The allowance of wide ranges to fall within would encourage speculation and choice of ranges which would probably result in more reimbursements than actually incurred.

Despite ERA (2013) vows to limit the accuracy of cost estimates within $\pm 10.0\%$, weighting ranges as wide as 25.0% and the striking similarity of the ranges of weightings themselves of these two projects might be the result of copy pasting from other projects as George's (2013) concludes. Weighting ranges as wide as 25.0% would imply that their accuracy is with this wide range, it is open for speculative choice and ultimately result in over or under payment of CPAs. Therefore, it is not unreasonable to say that contractors, during tender stage, may opt to ranges that will likely give them the most irrespective of the actual weightings. The weightings ranges, accordingly chosen by contractors are summarily presented in the table

Another notable element of difference among the weightings of the projects is Foreign Labor which under Project 1 and 4 it is not considered as part of the adjustable element, while under the

remaining projects is it considered as part of the adjustable element with a range of 0.0% to 5.0%. In summary, the weighing ranges provided in the contract documents of the projects reviewed reveals the following major predicament:

1. Local labor is disregarded from being part of the adjustment weights, because of government's policy driven decision which makes unreasonable sense.
2. Project 2, 3 and 5 regard foreign labor as part of the adjustment weight all providing varied ranges between 0.0 and 15.0% while Project 1 and 4 implicitly disregard foreign labor from adjustment portions,
3. Project 1 provides wide ranges of coefficients as wide as 25.0% while the narrowest range is 10.0%,
4. The ranges of Equipment/Fuel ratio for Site Clearance, Earthworks, Sub Base, Base Course and Bituminous Surfacing Works of the projects is as tabulated hereunder.

Table 4.13 Equipment/Fuel Ratio of Major Group of Works

Project	Description	Site Clearance		Earthworks		Sub base		Base Course		Bituminous Surfacing	
		%	Range	%	Range	%	Range	%	Range	%	Range
Project 1	Equipment (E)	60.0	75.0	60.0	75.0	60.0	75.0	55.0	75.0	50.0	60.0
	Fuel (F)	10.0	15.0	10.0	15.0	15.0	20.0	15.0	20.0	10.0	20.0
	E/F Ratio	6.0	5.0	6.0	5.0	4.0	3.7	3.7	3.7	5.0	3.0

Project 2	Equipment (E)	40.0	60.0	40.0	60.0	40.0	60.0	40.0	60.0	20.0	40.0
	Fuel (F)	10.0	20.0	10.0	20.0	10.0	20.0	10.0	20.0	5.0	15.0
	E/F Ratio	4.0	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	2.7
Project 3	Equipment (E)	55.0	65.0	55.0	70.0	55.0	70.0	55.0	70.0	50.0	60.0
	Fuel (F)	15.0	25.0	15.0	25.0	15.0	25.0	15.0	25.0	10.0	15.0
	E/F Ratio	3.7	2.6	3.7	2.8	3.7	2.8	3.7	2.8	5.0	4.0
Project 4	Equipment (E)	45.0	55.0	45.0	55.0	50.0	60.0	50.0	60.0	25.0	35.0
	Fuel (F)	15.0	25.0	15.0	25.0	10.0	20.0	10.0	20.0	10.0	15.0
	E/F Ratio	3.0	2.2	3.0	2.2	5.0	3.0	5.0	3.0	2.5	2.3
Project 5	Equipment (E)	60.0	75.0	60.0	75.0	60.0	75.0	55.0	75.0	50.0	60.0
	Fuel (F)	10.0	15.0	10.0	15.0	15.0	20.0	15.0	20.0	10.0	20.0
	E/F Ratio	6.0	5.0	6.0	5.0	4.0	3.7	3.7	3.7	5.0	3.0

The range of weightings provided is meant to indicate the proportion share of each cost element contributes towards the total cost. Accordingly, E/F ratio would indicate how much more or less equipment contributes towards the total cost compared against fuel. In consideration of the fact that equipment cost and fuel cost are directly related, a wide variety of the equipment versus fuel cost relationship that may be seen from table above is an indication of the possible haphazard way the weighing ranges are determined.

Based on detailed breakdown of the cost of equipments exercised for the purpose of this research, which includes depreciation cost, investment cost, maintenance and repair cost and

operating cost (excluding fuel) of major construction equipments in use in the country indicates that the equipment cost/fuel cost ration of individual equipments fall within a range of 2.54 and 3.85 the details of which is attached under Annex A of this thesis. However, the aggregate is 2.6 taking in to consideration one unit of each major construction equipment. However, the ranges provided indicate a ratio equipment and fuel hugely unbalanced with a room for speculative choices which may result in under recovery or over valuation of the increase in prices.

4.8 Contract Weightings or Coefficients

4.8.1 Weightings of Equipment and Fuel

The contract documents provide acceptable weighting ranges as guidance to bidders and for the purpose of checking their submissions as estimated by ERA (or have them estimated by the design consultants) for related major construction inputs based on estimated cost in a common currency. Contractors' tenders are checked to verify their choices fall with the acceptable range. The wide ranges provided, as stated above under section 4.7 has the potential of speculative choices. Moreover, these ranges are usually non negotiable compromising the advantage that might have been gained from adjustment of the weightings during tender stage. Nonetheless, the choices of the contractors which are part and parcel of the contract documents and the basis of determining CPA are tabulated hereunder.

Table 4.14.1 (a) Contract Weightings for Local Currency Portion of CPA (Project 1, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	Fixed Portion	20.0	20.0	20.0	20.0	20.0	10.0	20.0	20.0
	Equipment	65.0	20.0	65.0	60.0	60.0	50.0	20.0	30.0
	Bitumen	-	-	-	-	-	30.0	-	-
	Fuel	15.0	5.0	15.0	20.0	20.0	10.0	5.0	5.0
	Steel	-	20.0	-	-	-	-	15.0	25.0
	Cement	-	35.0	-	-	-	-	40.0	20.0

Table 4.14.1 (b) Contract Weightings for Foreign Currency Portion of CPA (Project 1, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Bonga – Ameya – Chida Road Upgrading Project, Contract 1: Bonga-Felegeselam	Fixed Portion	20.0	20.0	20.0	20.0	20.0	10.0	20.0	20.0
	Equipment	65.0	20.0	65.0	60.0	60.0	50.0	20.0	30.0
	Bitumen	-	-	-	-	-	30.0	-	-
	Fuel	15.0	5.0	15.0	20.0	20.0	10.0	5.0	5.0
	Steel	-	20.0	-	-	-	-	15.0	25.0
	Cement	-	35.0	-	-	-	-	40.0	20.0

Table 4.14.2 (a) Contract Weightings for Local Currency Portion of CPA (Project 2, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu - Bako	Fixed Portion	35.0	10.0	25.0	25.0	25.0	40.0	4.0	30.0
	Fuel	65.0	23.0	75.0	75.0	75.0	60.0	72.0	41.0
	Cement	-	67.0	-	-	-	-	24.0	29.0

Table 4.14.2 (b) Contract Weightings for Foreign Currency Portion of CPA (Project 2, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Menebegna-Shambu-Bako Road Upgrading Project, Contract 2: Shambu - Bako	Fixed Portion	22.0	43.0	25.0	25.0	25.0	26.0	45.0	56.0
	Foreign Labor	6.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
	Equipment	72.0	30.0	70.0	70.0	70.0	40.0	30.0	25.0
	Bitumen	-	-	-	-	-	29.0	-	-
	Fuel	-	-	-	10.0	10.0	-	-	10.0
	Steel	-	22.0	-	-	-	-	20.0	13.0
		-	-	-	-	-	-	-	-

Table 4.14.3 (a) Contract Weightings for Local Currency Portion of CPA (Project 3, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Gashena – Lalibelab-Sekota Road Project, Contract 2: Bilbila – Sekota	Fixed Portion	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
	Equipment	66.2	28.7	67.0	65.0	65.0	61.0	28.0	23.0
	Bitumen	-	-	-	-	-	12.0	-	-
	Fuel	18.8	3.0	18.0	20.0	20.0	12.0	3.0	2.5
	Steel	-	15.0	-	-	-	-	12.0	47.0
	Cement	-	38.2	-	-	-	-	42.0	12.0

Table 4.14.3 (b) Contract Weightings for Foreign Currency Portion of CPA (Project 3, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Gashena – Lalibelab- Sekota Road Project, Contract 2: Bilbila – Sekota	Fixed Portion	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
	Foreign Labor	25.0	25.0	5.0	5.0	5.0	32.0	15.0	85.0
	Equipment	60.0	60.0	80.0	80.0	80.0	53.0	70.0	-
	Cement	-	-	-	-	-	-	-	-

Table 4.14.4 (a) Contract Weightings for Local Currency Portion of CPA (Project 4, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Chereti – Goroboksa-Gorodamole Road Project, Lot 1: Chereti – Hageremekor	Fixed Portion	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Equipment	45.0	20.0	45.0	55.0	55.0	30.0	20.0	15.0
	Bitumen	-	-	-	-	-	25.0	-	-
	Fuel	25.0	5.0	25.0	15.0	15.0	15.0	5.0	5.0
	Steel	-	20.0	-	-	-	-	20.0	35.0
	Cement	-	25.0	-	-	-	-	25.0	15.0

Table 4.14.4 (b) Contract Weightings for Local Currency Portion of CPA (Project 1, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Chereti – Goroboksa-Gorodamole Road Project, Lot 1: Chereti – Hageremekor	Fixed Portion	100.0% of the contract price is payable on local currency. Hence, there are no weightings for price adjustment for foreign currency payment.							
	Equipment								
	Bitumen								
	Fuel								
	Steel								
	Cement								

Table 4.14.5 (a) Contract Weightings for Local Currency Portion of CPA (Project 5, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	Fixed Portion	20.0	20.0	20.0	20.0	20.0	10.0	20.0	20.0
	Foreign Labor	-	2.0	2.0	2.0	2.0	2.0	2.0	8.0
	Equipment	65.0	20.0	63.0	60.0	60.0	50.0	20.0	22.0
	Bitumen	-	-	-	-	-	25.0	-	-
	Fuel	15.0	5.0	15.0	18.0	18.0	13.0	5.0	5.0
	Steel	-	18.0	-	-	-	-	18.0	25.0
	Cement	-	35.0	-	-	-	-	35.0	20.0

Table 4.14.5 (b) Contract Weightings for Foreign Currency Portion of CPA (Project 5, Source: the Contract Document)

Project	Description	Site Clearance	Drainage	Earthworks	Sub base	Base Course	Bituminous Surfacing	Structures	Ancillary Works
		%	%	%	%	%	%	%	%
Construction Works of Hawassa – Ageremariam Section, Lot 3: Yirgachefe – Ageremariam	Fixed Portion	20.0	20.0	20.0	20.0	20.0	10.0	20.0	20.0
	Foreign Labor	-	2.0	2.0	2.0	2.0	2.0	2.0	8.0
	Equipment	65.0	20.0	63.0	60.0	60.0	50.0	20.0	22.0
	Bitumen	-	-	-	-	-	25.0	-	-
	Fuel	15.0	5.0	15.0	18.0	18.0	13.0	5.0	5.0
	Steel	-	18.0	-	-	-	-	18.0	25.0
	Cement	-	35.0	-	-	-	-	35.0	20.0

It is reasonable to say that the shortfalls of the weighting ranges provided would have a similar drawback on the contract weightings. In determining the reasonable weightings of equipment and fuel for site clearance, earthworks, sub base, road base and bituminous surfacing works comparing the cost of fuel and equipment per hour which are the only two cost elements may give a reasonable assurance of the relative weight of each without working out the detailed cost estimate. Accordingly, the E/F ratio of the contracts is summarily presented in the following table.

Therefore, test of the accuracy of the reasonable balance of the weightings of equipment and fuel can be measured by estimating the average cost contribution of each. Accordingly, considering the fact the total adjustable portion is the sum of weightings of equipment and fuel for site clearance, earthworks, sub base and base course this method of comparing the cost contribution of each is simple and can be used to verify the reasonable accuracy of the weightings. Thus, the E/F ratio of the case study projects is summarily presented in the table below.

Table 4.15 E/F Ratio of Case Study Projects

Project	Description	Site Clearance	Earthworks	Sub base	Base Course	Bituminous Surfacing
		Weight	Weight	Weight	Weight	Weight
Project 1	Equipment (E)	65.0	65.0	60.0	60.0	50.0
	Fuel (F)	15.0	15.0	20.0	20.0	10.0
	E/F Ratio	4.33	4.33	3.0	3.0	5.0
Project 2	Equipment (E)	54.00	52.5	52.5	52.5	30.0
	Fuel (F)	16.25	18.75	18.75	18.75	18.0
	E/F Ratio	3.3	2.8	2.8	2.8	1.7
Project 3	Equipment (E)	52.96	69.6	68.0	68.0	59.4

	Fuel (F)	15.0	14.4	16.0	16.0	9.6
	E/F Ratio	3.53	4.83	4.25	4.25	6.18
Project 4	Equipment (E)	45.0	45.0	55.0	55.0	30.0
	Fuel (F)	25.0	25.0	15.0	15.0	15.0
	E/F Ratio	1.8	1.8	3.66	3.66	2.0
Project 5	Equipment (E)	65.0	63.0	60.0	60.0	50.0
	Fuel (F)	15.0	15.0	18.0	18.0	13.0
	E/F Ratio	4.33	4.2	3.3	3.3	3.8

According to Aurecon (2013) and ERA (2009) the contribution of equipment and fuel towards the total cost of a project for earthworks has a ratio of 3.25 and 2.0 respectively. Taking the average of Aurecon (2013) ERA (2009) gives E/F ratio of 2.6 while the detailed breakdown attached under Annex A gives a result of 2.3 ratio for major earthmoving equipments relevant to site clearance, earthworks and sub base works. The average of 2.3 and Aurecon (2013) ERA (2009) average of 2.6 results in 2.5 whereas which is a testing figure against the E/F ratio of the case study projects. Similarly a figure of 2.6 to 2.8 can be reasonable to test the reasonable accuracy of base course and bituminous surfacing works.

Accordingly, test of the reasonable accuracy of the contract weightings of the case study projects indicates findings as explained in the table below for each project.

Table 4.16 Remarks on Accuracy of Weightings of Equipment and Fuel

Project	Remarks on E/F Ratio
1	<ol style="list-style-type: none"> Highly inclined towards equipment for site clearance and earthworks. A reasonable proximity is noted on sub base and base course works. A ratio of 5 for bituminous surfacing is highly inclined towards equipment. In general the estimated weighting is not accurate with an acceptable \pm of 10.0%.
2	<ol style="list-style-type: none"> Within the reasonable range of \pm10.0% except for site clearance works which

	is rather inclined towards equipment.
3	<ol style="list-style-type: none"> 1. Highly inclined towards equipment for all works. 2. A ratio of 6.18 for bituminous surfacing is highly inclined towards equipment. 3. In general the contract weightings are not accurate with an acceptable \pm of 10.0% and they are way out of the reasonable range.
4	<ol style="list-style-type: none"> 1. Inclined towards fuel for site clearance, earthworks and bituminous surfacing while inclination is notable towards equipment for sub base and base course works. 2. A ratio of 2 for bituminous surfacing is highly inclined towards fuel. The significant difference is notable from project 1, 2, 3 and 4 which has E/F ratio of 5.0, 1.7, 6.18 and 2.0 respectively. 3. In general the contract weightings are not accurate with an acceptable \pm of 10.0% but they are way out of the reasonable range.
5	<ol style="list-style-type: none"> 1. Highly inclined towards equipment for all major works. 2. In general the estimated weighting is not accurate with an acceptable \pm of 10.0%.

The weighting so chosen by contractors within the ranges provided by ERA, as can be noted from the table above, does fall within wide variations among the projects studied. The E/F ratios similarly signify the haphazard manner of the practices. Striking similarity of the weightings of Project 1 and Project 5 is another example of the possible outcome of copy pasting from other projects without detailed estimation the weightings.

4.8.2 Weightings of Bitumen, Cement and Reinforcing Bars

The importance of the balance of the weightings and accuracy of them is paramount and it is furthered by the provision of Sub Clause 70.7 of CoPA which requires reevaluation based on available records and reasonable judgments of the consultant with a view of ensuring that the contractor is neither under nor overpaid. This makes it paramount that the weightings are important element of the formula method of determining CPAs. Hence, like that of equipment

and fuel it is appropriate to test the reasonable accuracy and balance of the weightings of bitumen, reinforcing steel and cement of the contracts selected for the study.

Accordingly, detailed recalculation of the estimated weightings bitumen, cement and reinforcement bars is carried out and attached under Annex B. determination of the estimated weightings of bitumen is done as briefly described below:

1. Quantities of bituminous works is taken from the contracts' Bill of Quantities,
2. Estimate of quantities of various types of bitumen is carried out for each project based on technical specifications of the respective projects (Q),
3. "Rate" for each type of bitumen is estimated for each project considering the prices of these bitumen types at the time of tendering as quoted by a domestic supplier multiplied by overhead and profit margins taken from the respective contracts (R),
4. The sum of the total estimated amount of various types of bitumen is carried out by multiplying the estimated quantities of various types of bitumen (Q) by the respective Rates for each project (E), and
5. The sum of the total estimated amounts (E) are divided by the contract amounts of Bituminous Surfacing Works (C) for each project to determine the respective weightings (W)

Similarly determination of the estimated weightings of cement for Drainage and Structures are carried out as briefly described below:

1. Quantities of various classes of concrete works are taken from the contracts' Bill of Quantities (BOQ) for Drainage and Structures,
2. Estimate of quantities of various classes of concrete are carried out for Drainage and Structures works of each project based on quantities from the BOQs, technical specifications and drawings of the respective projects. The estimated quantities of each classes of concrete are multiplied by an estimate of the average quintal of cement each class of concrete consumes to arrive at the total quantity of cement for Drainage and Structures separately for each project (Q),

3. "Rate" for cement is estimated for each project considering the price of cement at the time of tendering as quoted by a manufacturer multiplied by overhead and profit margins taken from the respective contracts (R),
4. The total estimated amount of cement is determined by multiplying the estimated quantities of cement (Q) for Drainage and Structures separately multiplied by the respective Rate for each project (E), and
5. The total estimated amount of cement (E) for Drainage and Structures are divided by the contract amounts of Drainage and Structures respectively (C) for each project to determine the respective weightings (W) of cement for Drainage and Structures.

Determination of the estimated weightings of reinforcement bars for Drainage and Structures are carried out in a similar fashion by estimating the quantities of various size reinforcing bars each project requires based on the BOQ, technical specification and drawings. The estimated quantities are multiplying by rates provided in the respective contracts to arrive at the total estimated amount of reinforcing bars for Drainage and Structures separately. The estimated amounts of reinforcing bars for Drainage and Structures are divided by the contract amounts for Drainage and Structure to determine the weightings of reinforcement bars for Drainage and Structures separately.

The estimated weightings of bitumen, cement and reinforcing bars determined as described above are presented together with their contract weightings to examine the reasonable accuracy of the contract weightings.

Table 4.17 Comparison of Contract Weightings of Bitumen, Reinforcing Steel and Cement against Estimated Weightings

Project	Description	Contract Weightings			Estimated Weightings		
		Drainage	Bituminous Surfacing	Structures	Drainage	Bituminous Surfacing	Structures
		%	%	%	%	%	%
Project 1	Bitumen	-	30.0	-	-	68.0	-
	Steel	20.0	-	15.0	13.0	-	35.0
	Cement	35.0	-	40.0	23.0	-	18.0
Project 2	Bitumen	-	21.75	-	-	47.0	-
	Steel	16.50	-	15.0	18.0	-	8.0
	Cement	16.75	-	6.0	25.0	-	18.0
Project 3	Bitumen	-	9.60	-	-	46.0	-
	Steel	12.0	-	9.60	16.0	-	3.0
	Cement	30.56	-	33.6	17.0	-	4.0
Project 4	Bitumen	-	25.0	-	-	49.0	-
	Steel	20.0	-	20.0	6.0	-	12.0
	Cement	25.0	-	25.0	7.0	-	30.0
Project 5	Bitumen	-	25.0	-	-	51.0	-
	Steel	18.0	-	18.0	15.0	-	0.0
	Cement	35.0	-	35.0	23.0	-	0.0

The findings of the study indicates that the weights of cement, reinforcing steel and bitumen follow suits of equipment and fuel falling outside of the estimated ranges. Specifics of the findings of each project are summarized in the table below.

Table 4.18 Remarks on the Contract Weightings of Bitumen, Cement and Reinforcing Steel

Project	Findings
1	<ol style="list-style-type: none"> 1. The contract weighting of bitumen is substantially lower than the estimated weightings. The contract weighting is nearly half that of the estimated weighting. 2. The contract weighting of reinforcing steel for Drainage is substantially higher than the estimated weightings whereas the contract weighting for Structure is substantially lower than the estimate. 3. The contract weighting of cement is more than double of the estimate indicates for Structures while it is substantially higher that the estimate for Drainage. 4. In general of the contract weightings of bitumen, cement and reinforcing bars are not accurate with an acceptable \pm of 10.0%.
2	<ol style="list-style-type: none"> 1. The contract weighting of bitumen is substantially lower than the estimated weightings. The contract weighting is less than half that of the estimated weighting. 2. The contract weighting of reinforcing steel for Drainage is within \pm of 10.0% range, whereas the contract weighting of reinforcing steel for Structure is more than double of the estimate. 3. The contract weighting of cement is more than double of the estimate for Structures and it is similarly substantially higher that the estimate for Drainage. 4. In general of the contract weightings of bitumen, cement and reinforcing bars are not accurate with an acceptable \pm of 10.0%.
3	<ol style="list-style-type: none"> 1. The contract weighting of bitumen is nearly a quarter of the estimated weighting, similarly it is less than the contract weightings of the other projects. 2. The contract weighting of reinforcing steel for Drainage is not within \pm of 10.0% range, whereas it is nearly thrice of the estimate for Structure. 3. The contract weighting of cement is substantially higher than that of the estimate for both Structures and Drainage. The contract weightings of cement is well out of any reasonable estimated range. 4. In general of the contract weightings of bitumen, cement and reinforcing bars are not accurate with an acceptable \pm of 10.0%.
4	<ol style="list-style-type: none"> 1. The contract weighting of bitumen is nearly half of the estimated weighting.

	<ol style="list-style-type: none"> 2. The contract weighting of reinforcing steel for Drainage is more than thrice of the estimate whereas it is nearly double of the estimate for Structure. 3. The contract weighting of cement is substantially higher than that of the estimate for both Structures and Drainage. 4. In general of the contract weightings of bitumen, cement and reinforcing bars are not accurate with an acceptable \pm of 10.0%.
5	<ol style="list-style-type: none"> 1. The contract weighting of bitumen is nearly half of the estimated weighting. 2. The contract weighting of reinforcing steel for Drainage is above \pm of 10.0% range, while the 18.0% contract weighting of reinforcing steel for Structure is ill considerate of the fact that the contract has no reinforcing steel required for Structure works. 3. The contract weighting of cement is substantially higher than that of the estimate for Drainage, while the 35.0% contract weighting of cement for Structure is again ill considerate of the fact that the contract has no concrete works under Structure works. 4. In general of the contract weightings of bitumen, cement and reinforcing bars are not accurate with an acceptable \pm of 10.0%.

As can be noted from table 1.18 and remarks given under table 1.19 above, the contracts' weighting so chosen by contractors based on weighting ranges estimated during design states by either the design consultants or ERA are substantially outside of the estimate exercised signify the haphazard manner of the estimating practices unguided by an established frameworks.

4.9 Foreign Indices versus Domestic Market Lease Price Trends

The stipulation of the contracts under sub clause 70.4 of CoPA regards indices are appropriate for their purpose and are related to contractor's proposed source of supply of inputs on the basis of which contract price has been computed. This stipulation coupled with the use of foreign indices implies that the contractors' sources of inputs are not other the country of the sources of indices. Despite this stipulation, there are no formidable contractual or legal restrictions from

leasing machineries and purchase of materials from the domestic market or from a source of the contractor's choice.

Hence, it is appropriate to compare the lease market price trends versus the trends of the indices to examine their degree of comparability. Hence, for this study lease prices trends of major construction machineries during the period January 2014 to February 2019 could be obtained from a domestic contractor which may not be a complete indicator of the market trends but it cannot equally be discarded and hence is used as indicative prices for the purpose of comparison of the change in price trends against the change in the trends of the equipment indices of China, USA and Hong Kong which are reference indices in use for CPA of the case study projects.

During the period January, 2014 to February, 2019 lease prices of major construction machineries remain significantly stable except the sharp increase and subsequent gradual up lift of lease price of dozer and sharp upward or sharp downward price movements of excavator notable as can be seen from the chart below.

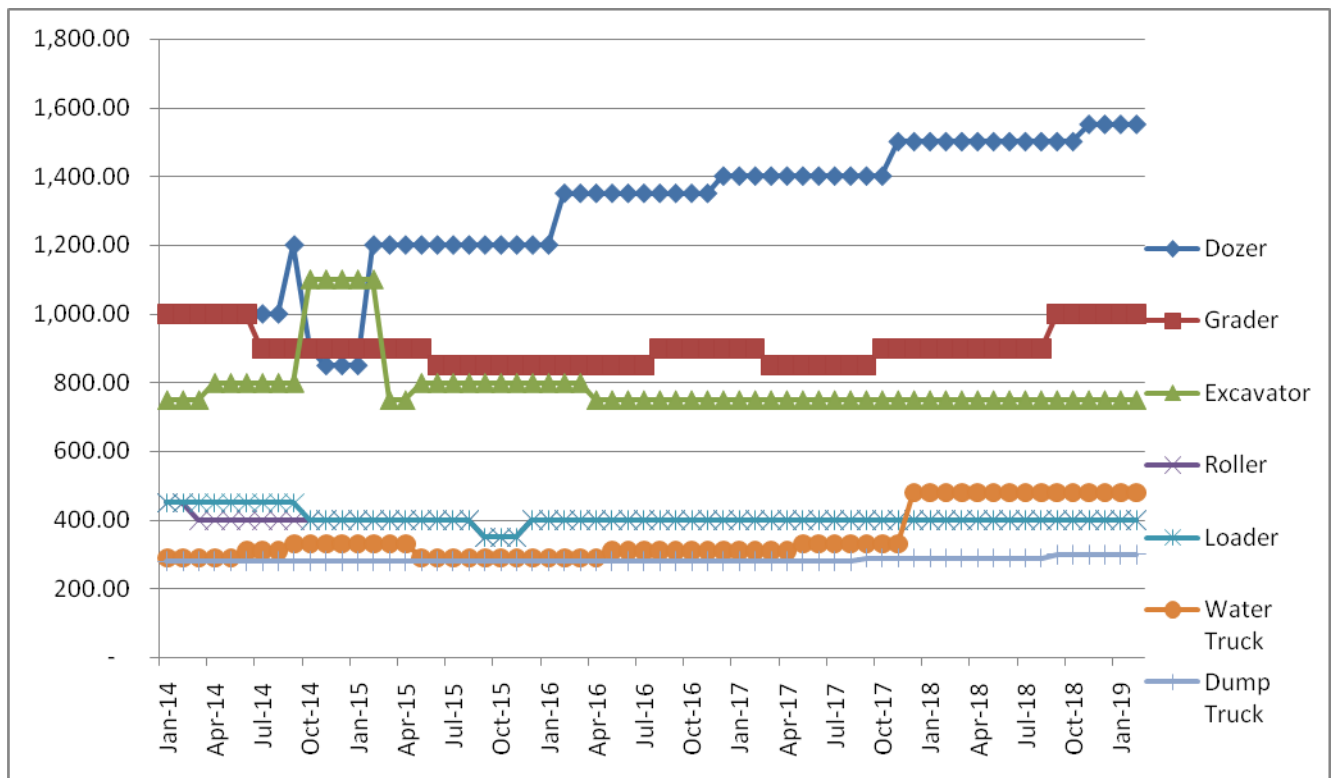


Chart 4.1 Domestic Lease Price Trends of Major Construction Machineries

Therefore, during periods of stable domestic lease prices trends of indices of foreign sources may correspond with the local market situation and may result in a different determination of price adjustments. Hence, such experience may encourage speculative pricing which the likes of CPA are hoped to vanquish them substantially.

Further comparison of the percentage cumulative changes of the indices of equipment of USA, China (ceased after January, 2015) and Hong Kong for the period from January, 2014 to February, 2019 depicts that they have significantly varying trend as shown in the chart below.

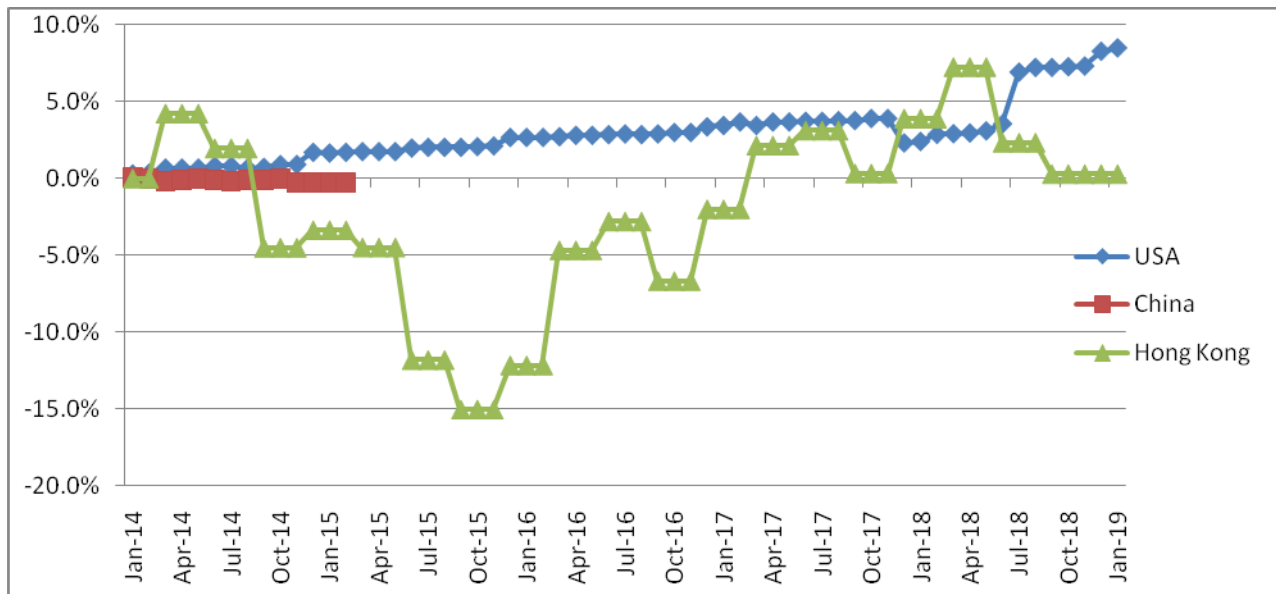


Chart 4.2 Comparison of Cumulative Percentage Changes of Equipment Indices of Hong Kong, China and USA

In summary, the choices of indices of foreign source unless seriously evaluated is another sources of speculative choice and may work against the concept of fair risk allocation, competitive pricing. ERA's acceptance of foreign indices sounds to being capitulate to the choices of contractors in the absence of a domestically available alternative.

4.10 Change of Indices and Costs/Prices

The stipulations under sub clause 70.4 of CoPA and sub clause 13.1 of the SCC require that the indices are subject to the engineers' approval. Moreover, both sub clauses prescribe the procedure to be followed if a contractor desires to order materials from a supplier other than from whom he obtained his original quotations or indices because the original supplier ceases to exist, or a contractor simply chose to purchase from other sources for reasons of his own.

Irrespective of the stipulations which regulate the desire to change original sources of indices or prices, practically contractors are not requested to justify if the sources of their resources or inputs are similar to the sources of indices, implicitly accepting equipments and other merchandise of origins other than the sources of indices or reference prices.

Hence, despite the stipulation that objects the free will of contractors to change base prices of ordinal quotations or reference indices, the practices indicates that contractors' continue using reference prices of original quotations and indices of references as far as they could regularly update current prices or indices from the original sources. Therefore, the reference indices or quotations merely serve as a reference bases and the current indices or prices as contemporary ones to determine CPAs without any verification that the actual sources and reference source are the same.

The stipulations of the contracts or the laws of the land do not practically deny contractors the opportunity of purchasing commodities from the domestic market at local currency even though the contracts bestow up on them payment and CPAs in foreign currency. Similarly, the contracts are not flexible and pro active to investigate and adjust the sources of indices inconsideration of the actual sources of inputs and inconsideration of subcontracting part of the works to domestic contractors.

In practical terms, therefore, the indices and prices quoted by contractors for the purpose of CPA continue to be used and applied as far as they are available from the sources without due regard

to the actual sources construction inputs. Therefore, it is reasonable to say that the reference indices or prices serve for the purpose of CPA only.

4.11 Consistency of Contract Price Adjustment Practices

Based on the findings of the 6 projects studied, it could be concluded that the provisions of the contracts prescribe significantly similar risk allocation related to CPAs except some variations in wordings and financiers prescriptions. Nonetheless, the constituent elements which are detrimental to obliterate over payments or under payments of CPAs are widely varied among the projects. The variation begins with the prescription of wide ranging non adjustable portions among projects and among the major work groups.

In addition, proportion of the local currency portion and foreign currency portion payments and subsequent CPAs to each currency is not dictated by any specific framework or guideline. As a result wide variations are not uncommon in the proportioning of the local currency and foreign currency shares of the contract prices. The choice of prices or indices is a matter merely left to contractor, while ERA plays a passive role usually accepting sources of indices or prices referred by contractors.

4.12 Summary of Findings

Summarized findings of the practices of CPA of the projects studied indicate:

1. There is no guiding frame work institution wide applied to streamline CPA from design phase through project closure. Therefore, the practices of CPA show unreasonable variations or unreasonable similarities.
2. The unreasonable variations include hugely varied ranges of weightings, hugely varied non adjustable portions. Whereas unreasonable similarities include the kind of exactly similar weighting ranges of Project 1 and 5 which may be the consequences of copy pasting.

3. Assumption by ERA of the risk of CPA arising out of the rise of costs of construction inputs without ceiling amounts for all projects except project 2 which is partly financed from the proceeds of OFID and BADEA which prescribe like ceiling limits of the CPA.
4. Non adjustable portions as low as 15.0% is ill considerate of the constituents that make up the non adjustable portions.
5. The weighing ranges provided are substantially wide by any standard and would probably result in speculative choices falling within the same wide range compromising the very foundation of CPAs which are thought to be vanguards against speculative pricing.
6. Wide range of non adjustable portions which seem to have been determined haphazardly. Moreover, equal distribution of the non adjustable portion for local currency and foreign currency disregards the stipulation that local labor costs are unadjusted and contactors tenders are considerate of forecasting and absorbing the risks associated thereof.
7. The use of foreign indices like that for steel and bitumen (usually PPI index of specific category) which are computed in consideration of the various types of each product, their weight, price etc is unlikely to correspond with the typically deformed reinforcement bars steel product and typical type of penetration grade bitumen commonly in use in the country.
8. The use of indices published by like Bureau of Statistic of China whose publications are not available for scrutiny is highly questionable. Similarly, the use of foreign indices merely for the purpose of CPA is not uncommon.
9. Consideration of price fuel and cement which are fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable and is not properly justified. The use of domestically sourced fuel and cement meant that the contract price is tendered accordingly hence; they should only have been referred to determine the local currency portion of CPA.

10. The use of aggregated weighting for DB project would entail adjustment of contact prices using all the parameters of the weightings without consideration to the execution of specific works for which the use of appropriate indices or prices use of s

4.13 Validation of the Study

The findings of the case study projects were put to ERA's central, east and south region directorates and two resident engineers who had been working on the projects to have their feedbacks or validate the findings. No significant comment or feedbacks are received other than minor typographic corrections to challenge the findings. It may not therefore be unreasonable to say that the findings are correct until they are further challenged.

Chapter Five

Conclusion and Recommendation

4.1 Research Questions and Objectives Revisited

First, it is appropriate to examine that the research answer the key questions and objectives stated under section 1.3 and 1.4 respectively. Based on the findings of the case studies, it can be said that:

1. The contacts are reasonable in allocating risks related to rise or fall of construction costs to the party best able to control, however, in doing so, there are flawed practices including in appropriate determination of weightings and non adjustable portions.
2. The weightings fall within wide ranges allowing speculative choices and they do not assure reasonable representation of the actual weight of construction inputs.
3. The reference indices do not tally with the sources of inputs, typically for equipment. Similarly, use of reference prices of domestically sources materials to adjust contract prices of the foreign currency portions does not assure reasonableness.
4. The use of foreign indices for to adjust foreign currency portion of the contract prices is ill considerate of the potential of leasing purchasing from the domestic market whose price trend, as found out from this study, do not correspond with the trend of foreign indices.
5. The practices studied has wide rooms for speculative choices of indices and reference prices compromising the fair risk sharing principle CPA are expected to ensure and avoid speculative pricing. Therefore, the practice, if let go without further intervention measures, could result in under or over payments in the form of CPAs.

4.2 Concluding Remarks

Based on the detailed discussion prescribed under Chapter 2 and the findings of the case study projects, the following concluding remarks can be made against the practices of CPA of contracts awarded to foreign contractors.

1. The absence of institutional wide guiding frame work to streamline CPA practices from design phase through project closure is one case of the wide variation in the non adjustable portions.
2. The use of foreign indices particularly for equipment is driven by the absence of national indices. However, the choices of indices is not proactively determined by ERA but to left to the choices of contractors who may opt speculative choices of sources of indices.
3. The use of varied sources of indices may without consideration to their relevance to the market trends of the country may result in unexpected rise of fall in the amount of CPA amount.
4. The absence of define method to justify the determination the local currency portion and foreign currency portions of contract payments could contribute to the haphazard application of foreign indices or domestic prices for CPA.
5. The unreasonable variations including hugely varied ranges of weightings hugely varied non adjustable portions results in speculative choices of ranges. Similarly, unreasonable similarities of the kind of exactly similar weighting ranges of may be the consequences of copy pasting.
6. Assumption by ERA of the risk CPA arising out of the rise of costs of construction inputs without ceiling amounts is reasonable in consideration of the impracticality of forecasting price trends over long periods of contracts. However, the absence of such limits restricts contractors' motive to negotiate prices, execute works at times when prices are stable.

7. Non adjustable portions as low as 15.0% is ill considerate of the constituents that make up the non adjustable portions. Similarly, the use of similar percentage of non adjustable portions for both local currency and foreign currency portions of CPA is unreasonable and unjustified.
8. The weighing ranges provided are substantially wide by any standard and would probably result in speculative choices falling within the same wide range compromising the very foundation of CPAs which are thought to be vanguards against speculative pricing.
9. Equal distribution of the non adjustable portion for local currency and foreign currency disregards the stipulation that local labor costs are unadjusted and contactors tenders are considerate of forecasting and absorbing the risks associated thereof. Hence, the non adjustable portions should be justified for both the local currency and foreign currency portions of the price adjustments guided by institution wide applicable framework.
10. The use of foreign indices like that for steel and bitumen (usually PPI index of specific category) to adjust local currency portion of CPAs do not concur with the stipulation of the contracts that the sources of indices and sources of actual supply of inputs. Hence, for local currency portion of CPAs
11. The use of indices published by like Bureau of Statistic of China whose publications are not available for scrutiny is highly questionable. Similarly, the use of foreign indices merely for the purpose of CPA should be avoided.
12. Consideration of price fuel and cement which are fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable and is not properly justified. The use of reference prices of domestically sourced commodities like fuel and cement should be restricted to the application of determining the local currency portion of CPA.

13. The use of aggregated weighting for DB project would entail adjustment of contract prices using all the parameters of the weightings without consideration to the execution of specific works for which the use of appropriate indices or prices use of s

4.3 Recommendations

Inconsideration of the findings of this research the following recommendations are forwarded to fill in the gaps, shortcomings and key problems of the practices of CPAs of contracts awarded to foreign contractors.

1. The process of establishing a national indices must be considered as an urgent undertaking in the light of the considerable impact the misapplication of CPAs have on government budget, fair competition and fair pricing.
2. ERA should establish institutional wide guiding frame work to streamline CPA practices from design phase through project closure to ensure consistency in the determination of the local currency portion and foreign currency portions of contracts amounts, price adjustments, weighting methods etc.
3. The local currency portion and foreign currency portion payment proportions must recognize sources of construction inputs and subcontracting to domestic contractors.
4. The use of foreign indices in the absence of national indices should rather be specified by ERA than left to contractor's choice. Such predetermined source should recognize relevance, reputability, accessibility, dependability and convertibility.
5. The maximum amount of the proportion of foreign currency portion of the contract amounts must be determined during contract document preparation and must be specified in the contract with a possible incentive to bidder offering the least foreign currency proportion.

6. Rather than specifying the ceiling limit of CPA arising out of the rise of prices, it should rather amend contract provisions to indemnify ERA against choice of sources of purchase, timing, and stipulate a minimum trigger value say 3.0% of the contract price to commence reimbursement of the rise in the cost of construction inputs.
7. Assumption by ERA of the risk CPA arising out of the rise of costs of construction inputs without ceiling amount restricts contractors' motive to negotiate prices, execute works at times when prices are stable which should be indemnified by proper, time framed stipulation of in contracts which must be made binding for the purpose of CPAs .
8. Non adjustable portions as low as 15.0% is ill considerate of the constituents that make up the non adjustable portions. Similarly, the use of similar percentage of non adjustable portions for both local currency and foreign currency portions of CPA is unreasonable and unjustified.
9. The weighting ranges estimated during design stage must be open for bidder comments and equally must be made negotiable items to ensure that they represent the reasonable share of the various inputs which they are assumed to represent..
10. Equal distribution of the non adjustable portion for local currency and foreign currency must be avoided and each must be determined separately inconsideration of the cost breakdown exercised during design stage and contractors' comments during bids stage.
11. The use of foreign indices like that for steel and bitumen (usually PPI index of specific category) to adjust local currency portion of CPAs of the use of local prices to adjust foreign currency portion of CPA must be disregarded.
12. The use of indices published by like Bureau of Statistic of China whose publications are not available for scrutiny is highly questionable. Similarly, the use of foreign indices merely for the purpose of CPA should be avoided.

13. Consideration of price fuel and cement which are fully purchased from domestic market as an adjustment weight for foreign currency portion of CPA is unreasonable and is not properly justified. The use of reference prices of domestically sourced commodities like fuel and cement should be restricted to the application of determining the local currency portion of CPA.

4.4 Further Study

Further study is necessary to narrow the gap emanating from the limitations of the study and to further validate similar research through statistical methods since case studies offer deep insight through selected studies. Therefore, it is helpful and necessary to cover contracts awarded to domestic contractors and solidify it by appropriately validating the findings through statistical methods.

References

1. Abubaker, J.M (2015). Factors Affecting Cost and Time Overrun in Road Construction Projects in Addis Ababa: MSC Thesis, Addis Ababa University, Addis Ababa
2. ADB (2018). Price Adjustment Guidance Note on Procurement, Asian Development Bank, Philippines
3. AfDB (2007). Rules and Procedures for Procurement of Goods and Works, African Development Bank, Ghana
4. Aurecon (2013). Calculating the Annual Escalation Adjustment for Municipal Infrastructure: Aurecon Ltd, South African
5. Asteway, Y. (2008). Study on the Effects of Unpredictable Price Fluctuation on the Capacity of Construction Contractors, MSC Thesis, Addis Ababa University, Addis Ababa
6. Bunni, N. G. (2003). Risk and Insurance in Construction: Spon Press, USA
7. Bunni, N. G. (2005). FIDIC Forms of Contract: Blackwell Publishing, USA
8. CDC (2016). Construction Development Council of India (2016)
9. Couper, J.R. (2003). Process Engineering Economics: University of Arkansas, USA
10. CSA (2016). Country and Regional Level Consumer Price Index: Central Statistic Agency, Addis Ababa
11. CSA (2019). Country and Regional Level Consumer Price Index: Central Statistic Agency, Addis Ababa
12. DPER (2016). Cost Control - Price Variation Clauses: Department of Public Expenditure Reform, Dublin
13. ERA (1996). The Road Sector Development Program I: Ethiopia Roads Authority, Addis Ababa
14. ERA (2005). The Road Sector Development Program III: Ethiopia Roads Authority, Addis Ababa
15. ERA (2009). Draft Report on Review of Construction Cost Trend: Ethiopian Roads Authority, Addis Ababa
16. ERA (2011). The Road Sector Development Program 13 Years Performance and Phase IVI: Ethiopia Roads Authority, Addis Ababa
17. ERA (2015). First Growth and Transformation Plan Five Years (2003-2007) and EFY 2007 Performance Report: Ethiopian Roads Authority, Addis Ababa

18. ERA (2015). Reviewing and Analyzing the Application of Price Adjustment Formula for ongoing Roads Contracts in Ethiopia: Ethiopian Roads Authority (unpublished), Addis Ababa
19. FDRE (2009). The Ethiopian Federal Government Procurement and Property Administration Proclamation No. 649/2009: Government of the Federal Democratic Republic of Ethiopia, Addis Ababa
20. Fetene N. (2008). Causes and Effects of Construction Cost Overrun on Public Building Construction Projects in Ethiopia, MSC Thesis, Addis Ababa University, Addis Ababa
21. FIDIC (1992). Conditions of Contracts for Works of Civil Engineering Construction: Federation International Des Ingenieurs Conseils
22. FIDIC (1995). Conditions of Contract for Design-Build and Turnkey,": Federation International Des Ingenieurs Conseils
23. Getachew, Y. (2014). The Practice of Construction Risk Management through Insurance in the Ethiopian Federal Road Projects. MSC Thesis, Addis Ababa University, Addis Ababa
24. George, F. (2013). Impacts of Procurement Process on Contractor Selection in Ethiopian Roads Authority: MSC Thesis, Addis Ababa University, Addis Ababa
25. George Stukhart (1982); Inflation and the Construction Industry; Transactions AACE;
26. Getaneh, G (2011). Assessment of Conditions of Contract in Ethiopian Construction Industry; MSC Thesis, Addis Ababa University, Addis Ababa
27. Girmay, K. (2003). Claim in International Projects in Ethiopia Case Study: MSC Thesis, Addis Ababa University, Addis Ababa
28. Gransberg, D.D & Popescu,C.M (2006). Construction Equipment Management For Engineers, Estimators and Owners, Taylor and Francis Group, USA
29. Habtamu G.A (2013). An Investigation in to the Cause and Dynamics of Price Inflation in Ethiopia, Institute of Social Studies, the Netherlands
30. Kahraman, S. (2005). Determination of Price Index for Escalation of Building Construction Costs in Turkey: MSC Thesis, Middle East Technical University, Turkey
31. Kapila, P. & Hendrickson, C. (2001). Exchange Rate Risk Management in International Construction Ventures: Journal of Management in Engineering, October 2001
32. Kitchens, M. (1996). Estimating and Project Management: American Society of Civil Engineers Press, USA

33. Lambeck, R. & Eschemuller, J. (2009). Urban Construction Management: McGraw Hill, USA
34. Ministry of Pen (1960). Civil Code of Ethiopia, Addis Ababa
35. Mohammed, G. (2013). Assessment of Price Escalation and Adjustment Problems on Federal Road Construction Projects: MSC Thesis, Addis Ababa University, Addis Ababa
36. MoT/ERA (2015). The Road Sector Development Program V: Ethiopia Roads Authority, Addis Ababa
37. MoWUD (2013). Urban and Construction Development Growth and Transformation Plan for the Year 2010/11 to 2014/15: Ministry of Works and Urban Development, Addis Ababa
38. Mudroch, J. & Hughes, W. (2001). Construction Contract Law and Management: Spon Press, USA
39. NBC (2018). Annual Report 2017 – 2018: National Bank of Ethiopia, Addis Ababa
40. NBC (2013). Annual Report 2012 – 2013: National Bank of Ethiopia, Addis Ababa
41. NCHRP (2011). Price Indexing in Transportation Construction Contracts: National Cooperative Highway Research, USA
42. PMI (2008). A Guide to the Project Management Body of Knowledge: Project Management Institute, USA
43. SMEC (2008). Contract Administration Manual: Ethiopian Roads Authority, Addis Ababa
44. SMEC (2018). Draft Contract Price Adjustment Review and Procedure, Ethiopian Roads Authority, Addis Ababa
45. OECD (1996). Sources and Methods Construction Price Indices: Organization for Economic Cooperation and Development, France
46. PEC (2009). Standard Procedure and Formula for Price Adjustment, Pakistan Engineering Council, Pakistan
47. Pierce, C.E, Huynh, N.B & Guimaraes, P. (2012). Cost Indexing and Unit Price Adjustment for Construction Materials: University of South Carolina, USA
48. Solomon, S. (2015). The Management of Construction Processes in Developing Countries: A Case Study of the Ethiopian Roads Authority, PHD Thesis, University of Cape Town, South African
49. Stallworthy, E.A & Khahrabanda, O.P. (1985). International Construction: Gower Publishing Company Limited, UK

50. Twort, A. & Rees, G. (2004). Civil Engineering Project Management: Elsevier Butterworth Heinemann, USA
51. Turkey, W. (2011). Risk Factors Leading to Cost Overrun in Ethiopian Federal Road Construction Projects and Its Consequences, MSC Thesis, Addis Ababa University, Addis Ababa
52. Wubishet Jekale (2004). Performances for public construction projects in developing countries: Federal road and building projects in Ethiopia. Doctoral Dissertation, Norwegian university of science and technology, Norway.
53. Wubishet Jekale (2005). Development of Construction Industry in Ethiopia. EACE Journal, Vol. 4, No. 1, Addis Ababa.
54. WB (2012). Standard Bidding Document for Procurement of Small Works, World Bank
55. WB (2015). Standard Bidding Document for Procurement of Works, World Bank
56. www.era.gov.et/performace/
57. www.bls.gov
58. Yadessa, D. (2015). Assessment of the Cause and Effects of Price Escalation of Federal Roads in Ethiopia; MSC Thesis, Addis Ababa University, Addis Ababa
59. Yin, R.K. (2003) Case Study research: Design and Methods (3rd Ed), SAGE publications, Thousand Oaks, California
60. Zhe, H. (1995). Risk Management for Overseas Construction Projects: International Journal of Project Management, Vol. 13, No.4

Annex A: Equipment Hourly Depreciation Cost Estimation

Equipment Item	Purchase Price ⁽¹⁾	Registration & Other Taxes ⁽²⁾	Total Investment	Salvage Value ⁽³⁾	Total Depreciation	Useful Life ⁽⁴⁾	UF	Annual Use ⁽⁵⁾	Annual Depreciation	Hourly Depreciation
	Birr	Birr	Birr	Birr	Birr	Years		Hours	Birr	Birr/h
	(1)	(2)	(3)=(1)+(2)	(4)	(5)=(3)-(4)	(6)	(7)	(8)	(9)=(5)/(6)	(10)=(9)/(8)
Dump truck	2,100,000.0	63,000.0	2,163,000.0	210,000.0	1,953,000.0	7.0	0.7	1,747.2	279,000.0	159.7
Water truck	2,250,000.0	67,500.0	2,317,500.0	225,000.0	2,092,500.0	7.0	0.7	1,622.4	298,928.6	184.3
Asphalt distributor	2,400,000.0	72,000.0	2,472,000.0	240,000.0	2,232,000.0	7.0	0.7	1,747.2	318,857.1	182.5
Excavator (325 C)	7,200,000.0	216,000.0	7,416,000.0	720,000.0	6,696,000.0	10.0	0.7	1,747.2	669,600.0	383.2
Roller (15 t)	2,300,000.0	69,000.0	2,369,000.0	230,000.0	2,139,000.0	7.0	0.7	1,747.2	305,571.4	174.9
Pneumatic Roller loader (2.5m3)	2,900,000.0	87,000.0	2,987,000.0	290,000.0	2,697,000.0	7.0	0.6	1,497.6	385,285.7	257.3
Asphalt Plant	2,150,000.0	64,500.0	2,214,500.0	215,000.0	1,999,500.0	7.0	0.7	1,747.2	285,642.9	163.5
Dozer (D8R)	25,000,000.0	750,000.0	25,750,000.0	2,500,000.0	23,250,000.0	9.0	0.6	1,497.6	2,583,333.3	1,725.0
Crusher plant 100	11,000,000.0	330,000.0	11,330,000.0	1,100,000.0	10,230,000.0	10.0	0.7	1,747.2	1,023,000.0	585.5
Grader (140H)	16,000,000.0	480,000.0	16,480,000.0	1,600,000.0	14,880,000.0	9.0	0.7	1,622.4	1,653,333.3	1,019.1
Wagon drill	6,420,000.0	192,600.0	6,612,600.0	642,000.0	5,970,600.0	10.0	0.7	1,747.2	597,060.0	341.7
Aggregate spreader	5,400,000.0	162,000.0	5,562,000.0	540,000.0	5,022,000.0	9.0	0.5	1,248.0	558,000.0	447.1
Paver (AP1050)	2,300,000.0	69,000.0	2,369,000.0	230,000.0	2,139,000.0	9.0	0.5	1,248.0	237,666.7	190.4
	10,230,000.0	306,900.0	10,536,900.0	1,023,000.0	9,513,900.0	9.0	0.6	1,497.6	1,057,100.0	705.9

⁽¹⁾Purchasing price of the equipments at local market

⁽²⁾Assumed 3% of the purchase price

⁽³⁾Assumed 10% of the purchase price

⁽⁴⁾It is fixed based on empirical experience and annual depreciation was calculated using the Straight-Line Method

⁽⁵⁾

Annual use was calculated using the assumed utility factor UF

$AU = U.F \times 8 \text{ h/day} \times 26 \text{ day/month} \times 12 \text{ months/year} = U.F \times 2496$

Annex A: Equipments Maintenance and Repair Cost Estimation

No.	Item	Depreciation Cost	Maintenance and Repair Cost ⁽¹⁾
		ETB/hr	ETB/hr
1	Dump truck	159.68	39.92
2	Water truck	184.25	46.06
3	Asphalt distributor	182.50	45.62
4	Excavator (325 C)	383.24	95.81
5	Roller (15 t)	174.89	43.72
6	Pneumatic Roller (14 t)	257.27	64.32
7	Loader (2.5m3)	163.49	40.87
8	Asphalt Plant	1,724.98	431.25
9	Dozer (D8R)	585.51	146.38
10	Crusher plant 100 t/h	1,019.07	254.77
11	Grader (140H)	341.72	85.43
12	Wagon drill	447.12	111.78
13	Aggregate spreader	190.44	47.61
14	Paver (AP1050)	705.86	176.47

- (1) In the absence of detailed actual cost data, hourly maintenance and repair costs were estimated using approximate method. For all equipments the maintenance and repair costs have been assumed to be 25% of the depreciation cost.

Annex A: Equipment Hourly Investment Cost Estimation

Equipment Item	Purchase Price	Reg. & Other Taxes(1)	Total Invest.	Cost of Tyres/ Chains	Cost of Blades /Buckets	Salvage Value ⁽²⁾	Total Ini. Cost	UL	UF	Annual Use	Average Annual Value (AAV) ⁽³⁾	Annual Invest. Cost ⁽⁴⁾	Hrl. Inv. Cost
	Birr	Birr	Birr	Birr	Birr	Birr	Birr	Years		Hours	Birr	Birr	Birr
Dump truck	2,100,000.	63,000.0	2,163,000	170,000.		210,000.	1,993,000.	7.0	0.7	1,747.2	1,228,857.	79,875.7	45.
Water truck	2,250,000.	67,500.0	2,317,500	170,000.		225,000.	2,147,500.	7.0	0.7	1,622.4	1,323,574.	86,032.1	53.
Asphalt distributor	2,400,000.	72,000.0	2,472,000	170,000.		240,000.	2,302,000.	7.0	0.7	1,747.2	1,418,285.	92,188.6	52.
Excavator	7,200,000.	216,000.	7,416,000	520,000.	365,000	720,000.	6,531,000.	10.0	0.7	1,747.2	3,916,050.	254,543.	145.
Roller (15 t)	2,300,000.	69,000.0	2,369,000	155,000.		230,000.	2,214,000.	7.0	0.7	1,747.2	1,363,714.	88,641.4	50.7
Pneumatic Roller	2,900,000.	87,000.0	2,987,000	128,000.		290,000.	2,859,000.	7.0	0.6	1,497.6	1,758,000.	114,270.	76.3
Loader (2.5m3)	2,150,000.	64,500.0	2,214,500	165,000.	80,000.0	215,000.	1,969,500.	7.0	0.7	1,747.2	1,217,574.	79,142.	45.3
Asphalt Plant	25,000,000	750,000.	25,750,000	0.0		2,500,000.	25,750,000	9.0	0.6	1,497.6	15,416,666	1,002,083.	669
Dozer (D8R)	11,000,000	330,000.	11,330,000	690,000	410,000.	1,100,000.	10,230,000	10.0	0.7	1,747.2	6,121,500.	397,897.	228.
Crusher plant	16,000,000	480,000.	16,480,000	0.0	0.0	1,600,000.	16,480,000	9.0	0.7	1,622.4	9,866,666.	641,333.	395.
Grader (140H)	6,420,000.	192,600.	6,612,600	175,000		642,000.0	6,437,600.	10.0	0.7	1,747.2	3,829,580.	248,922.	142.
Wagon drill	5,400,000.	162,000.	5,562,000	195,000	205,000.	540,000.0	5,162,000.	9.0	0.5	1,248.0	3,107,777.	202,005.	163.
Aggregate spreader	2,300,000.	69,000.0	2,369,000	170,000		230,000.0	2,199,000.	9.0	0.5	1,248.0	1,323,888.	86,052.8	69.0
Paver	10,230,000	306,900.	10,536,900	450,000		1,023,000.	10,086,900	9.0	0.6	1,497.6	6,058,500.	393,802.	263.

Annex A: Equipments Operational Cost Estimation

	DT	WT	A.Dist	Exc.	Roller	P.Roller	Loader	A.Plant	Dozer	Crusher	Grader	W.Drill	A.Spred.	Paver
FUEL														
Type of fuel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
Hourly fuel consumption	7.0	7.0	7.0	25.0	12.0	12.0	15.0	60.0	39.0	45.0	27.0	18.0	12.0	18.0
Unit cost of fuel	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Sub-total fuel cost	123.2	123.2	123.2	440.0	211.2	211.2	264.0	1,056.0	686.4	792.0	475.2	316.8	211.2	316.8
LUBRICANTS														
Engine oil cost (12% of FUEL)	14.8	14.8	14.8	52.8	25.3	25.3	31.7	126.7	82.4	95.0	57.0	38.0	25.3	38.0
Cost of other lubricants (50% of engine oil cost)	7.4	7.4	7.4	26.4	12.7	12.7	15.8	63.4	41.2	47.5	28.5	19.0	12.7	19.0
Sub-total cost of lubricants	22.2	22.2	22.2	79.2	38.0	38.0	47.5	190.1	123.6	142.6	85.5	57.0	38.0	57.0
TIRES/CHAINS														
Cost of new set of tires/Chains ('000.0)	170.0	170.0	170.0	520.0	85.0	128.0	165.0	0.0	690.0	0.0	105.0	195.0	170.0	210.0
Useful life of tires	2,500.0	3,500.0	4,000.0	3,000.0	5,000.0	5,000.0	5,000.0	0.1	3,500.0	0.1	2,200.0	3,800.0	1,800.0	1,800.0
Depreciation of tires/Chain	68.0	48.6	42.5	173.3	17.0	25.6	33.0	-	197.1	-	47.7	51.3	94.4	116.7
Repair (10% of depreciation)	6.8	4.9	4.3	17.3	1.7	2.6	3.3	-	19.7	-	4.8	5.1	9.4	11.7
Sub-total cost of tires	74.8	53.4	46.8	190.7	18.7	28.2	36.3	-	216.9	-	52.5	56.4	103.9	128.3
BLADES														
Cost of new blades/shovel ('000.0)				365.0			80.0		410.0			265.0		
Useful life of blades/shovel				1,200.0			1,200.0	1,200.0	1,200.0			1,000.0		
Depreciation of blades/shovel				304.2			66.7	-	341.7			205.0		
Replacement of blades /shovel (8% of depreciation)				24.3			18.0		27.3			16.4		
Sub-total blades	-	-	-	328.5	-	-	84.7	-	369.0			221.4	-	-
Total operating cost	97.0	75.6	68.9	598.4	56.7	66.2	168.5	190.1	709.4	142.6	138.0	334.9	141.9	185.4

Annex A: Equipments Total Cost/Fuel Cost Ratio Estimation

Item No.	Equipment Description	Depreciation Cost	Maintenance and Repair Cost	Investment Cost	Operating Cost*	Fuel Cost	Total Cost*	Total Cost/ Fuel Cost
		ETB/Hr	ETB/Hr	ETB/Hr	ETB/Hr	ETB/Hr	ETB/Hr	Ratio
1	Dump truck, 16 m3	159.68	39.92	45.72	96.98	123.20	342.30	2.78
2	Water truck	84.25	46.06	53.03	75.60	123.20	358.95	2.91
3	Asphalt distributor	182.50	45.62	52.76	68.93	123.20	349.81	2.84
4	Excavator (325 C)	383.24	95.81	145.69	598.37	440.00	1,223.11	2.78
5	Roller (15 t)	174.89	43.72	50.73	56.72	211.20	326.06	1.54
6	Pneumatic Roller)	257.27	64.32	76.30	66.18	211.20	464.06	2.20
7	Loader (2.5m3)	163.49	40.87	45.30	168.49	264.00	418.14	1.58
8	Asphalt Plant	1,724.98	431.25	669.13	190.08	1,056.00	3,015.43	2.86
9	Dozer (D8R)	585.51	146.38	227.73	709.41	686.40	1,669.03	2.43
10	Crusher plant 100 t/h	1,019.07	254.77	395.30	142.56	792.00	1,811.69	2.29
11	Grader (140H)	341.72	85.43	142.47	138.04	475.20	707.66	1.49
12	Wagon drill	447.12	111.78	161.86	334.87	316.80	1,055.63	3.33
13	Aggregate spreader	190.44	47.61	68.95	141.90	211.20	448.90	2.13
14	Paver (AP1050)	705.86	176.47	262.96	185.36	316.80	1,330.64	4.20
Average								2.53

Annex A: Major Earthmoving Equipments Lease Cost/Fuel Cost Ratio

Period	Fuel Consumption/Hr (Liter)							Fuel Price (ETB/ltr)	Average No. of Equipments Available on Site							Aggr. E/F Cost Ratio
	39	27	25	12	15	7	7		7	8	9	13	8	13	27	
	Dozer	Grader	Exc.	Roller	Loader	WT	DT		Dozer	Grd.	Exc.	Roller	Loader	WT	DT	
									E/F Cost Ratio per each Equipment per Month							
Jan-14	1,000	1,000.	750.0	450.0	450.0	290.0	280.0	17.75	1.44	2.09	1.69	2.11	1.69	2.33	2.25	2.05
Feb-14	1,000	1,000	750.0	450.0	450.0	290.0	280.0	18.55	1.38	2.00	1.62	2.02	1.62	2.23	2.16	1.96
Mar-14	1,000	1,000	750.0	400.0	450.0	290.0	280.0	18.55	1.38	2.00	1.62	1.80	1.62	2.23	2.16	1.93
Apr-14	1,000	1,000	800.0	400.0	450.0	290.0	280.0	18.55	1.38	2.00	1.73	1.80	1.62	2.23	2.16	1.94
May-14	1,000	1,000	800.0	400.0	450.0	290.0	280.0	18.55	1.38	2.00	1.73	1.80	1.62	2.23	2.16	1.94
Jun-14	1,000	1,000	800.0	400.0	450.0	310.0	280.0	19.00	1.35	1.95	1.68	1.75	1.58	2.33	2.11	1.92
Jul-14	1,000	900.0	800.0	400.0	450.0	310.0	280.0	19.00	1.35	1.75	1.68	1.75	1.58	2.33	2.11	1.90
Aug-14	1,000	900.0	800.0	400.0	450.0	310.0	280.0	19.00	1.35	1.75	1.68	1.75	1.58	2.33	2.11	1.90
Sep-14	1,200	900.0	800.0	400.0	450.0	330.0	280.0	19.00	1.62	1.75	1.68	1.75	1.58	2.48	2.11	1.94
Oct-14	900.0	900.0	1,100.	400.0	400.0	330.0	280.0	18.09	1.28	1.84	2.43	1.84	1.47	2.61	2.21	2.06
Nov-14	850.0	900.0	1,100.	400.0	400.0	330.0	280.0	16.10	1.35	2.07	2.73	2.07	1.66	2.93	2.48	2.31
Dec-14	850.0	900.0	1,100.	400.0	400.0	330.0	280.0	17.49	1.25	1.91	2.52	1.91	1.52	2.70	2.29	2.12
Jan-15	850.0	900.0	1,100.	400.0	400.0	330.0	280.0	17.49	1.25	1.91	2.52	1.91	1.52	2.70	2.29	2.12
Feb-15	1,200	900.0	1,100.	400.0	400.0	330.0	280.0	16.10	1.91	2.07	2.73	2.07	1.66	2.93	2.48	2.35
Mar-15	1,200	900.0	750.0	400.0	400.0	330.0	280.0	16.10	1.91	2.07	1.86	2.07	1.66	2.93	2.48	2.26
Apr-15	1,200	900.0	750.0	400.0	400.0	330.0	280.0	16.10	1.91	2.07	1.86	2.07	1.66	2.93	2.48	2.26
May-15	1,200	900.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	2.07	1.99	2.07	1.66	2.57	2.48	2.22
Jun-15	1,200	850.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	1.96	1.99	2.07	1.66	2.57	2.48	2.21
Jul-15	1,200	850.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	1.96	1.99	2.07	1.66	2.57	2.48	2.21
Aug-15	1,200	850.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	1.96	1.99	2.07	1.66	2.57	2.48	2.21
Sep-15	1,200	850.0	800.0	350.0	350.0	290.0	280.0	16.10	1.91	1.96	1.99	1.81	1.45	2.57	2.48	2.15
Oct-15	1,200	850.0	800.0	350.0	350.0	290.0	280.0	16.10	1.91	1.96	1.99	1.81	1.45	2.57	2.48	2.15

Nov-15	1,200	850.0	800.0	350.0	350.0	290.0	280.0	16.10	1.91	1.96	1.99	1.81	1.45	2.57	2.48	2.15
Dec-15	1,200	850.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	1.96	1.99	2.07	1.66	2.57	2.48	2.21
Jan-16	1,200	850.0	800.0	400.0	400.0	290.0	280.0	16.10	1.91	1.96	1.99	2.07	1.66	2.57	2.48	2.21
Feb-16	1,350	850.0	800.0	400.0	400.0	290.0	280.0	14.16	2.44	2.22	2.26	2.35	1.88	2.93	2.82	2.53
Mar-16	1,350	850.0	800.0	400.0	400.0	290.0	280.0	14.16	2.44	2.22	2.26	2.35	1.88	2.93	2.82	2.53
Apr-16	1,350	850.0	750.0	400.0	400.0	290.0	280.0	14.16	2.44	2.22	2.12	2.35	1.88	2.93	2.82	2.52
May-16	1,350	850.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.22	2.12	2.35	1.88	3.13	2.82	2.55
Jun-16	1,350	850.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.22	2.12	2.35	1.88	3.13	2.82	2.55
Jul-16	1,350	850.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.22	2.12	2.35	1.88	3.13	2.82	2.55
Aug-16	1,350	900.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.35	2.12	2.35	1.88	3.13	2.82	2.56
Sep-16	1,350	900.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.35	2.12	2.35	1.88	3.13	2.82	2.56
Oct-16	1,350	900.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.35	2.12	2.35	1.88	3.13	2.82	2.56
Nov-16	1,350	900.0	750.0	400.0	400.0	310.0	280.0	14.16	2.44	2.35	2.12	2.35	1.88	3.13	2.82	2.56
Dec-16	1,400	900.0	750.0	400.0	400.0	310.0	280.0	14.16	2.54	2.35	2.12	2.35	1.88	3.13	2.82	2.57
Jan-17	1,400	900.0	750.0	400.0	400.0	310.0	280.0	15.18	2.36	2.20	1.98	2.20	1.76	2.92	2.64	2.40
Feb-17	1,400	900.0	750.0	400.0	400.0	310.0	280.0	15.75	2.28	2.12	1.90	2.12	1.69	2.81	2.54	2.31
Mar-17	1,400	850.0	750.0	400.0	400.0	310.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.71	2.45	2.21
Apr-17	1,400	850.0	750.0	400.0	400.0	310.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.71	2.45	2.21
May-17	1,400	850.0	750.0	400.0	400.0	330.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.88	2.45	2.24
Jun-17	1,400	850.0	750.0	400.0	400.0	330.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.88	2.45	2.24
Jul-17	1,400	850.0	750.0	400.0	400.0	330.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.88	2.45	2.24
Aug-17	1,400	850.0	750.0	400.0	400.0	330.0	280.0	16.35	2.20	1.93	1.83	2.04	1.63	2.88	2.45	2.24
Sep-17	1,400	850.0	750.0	400.0	400.0	330.0	290.0	16.35	2.20	1.93	1.83	2.04	1.63	2.88	2.53	2.27
Oct-17	1,400	900.0	750.0	400.0	400.0	330.0	290.0	16.35	2.20	2.04	1.83	2.04	1.63	2.88	2.53	2.28
Nov-17	1,500	900.0	750.0	400.0	400.0	330.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	2.88	2.53	2.29
Dec-17	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Jan-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Feb-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49

Mar-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Apr-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
May-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Jun-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Jul-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Aug-18	1,500	900.0	750.0	400.0	400.0	480.0	290.0	16.35	2.35	2.04	1.83	2.04	1.63	4.19	2.53	2.49
Sep-18	1,500	1,000	750.0	400.0	400.0	480.0	300.0	16.35	2.35	2.27	1.83	2.04	1.63	4.19	2.62	2.54
Oct-18	1,500	1,000	750.0	400.0	400.0	480.0	300.0	16.35	2.35	2.27	1.83	2.04	1.63	4.19	2.62	2.54
Nov-18	1,550	1,000	750.0	400.0	400.0	480.0	300.0	16.35	2.43	2.27	1.83	2.04	1.63	4.19	2.62	2.55
Dec-18	1,550	1,000	750.0	400.0	400.0	480.0	300.0	17.60	2.26	2.10	1.70	1.89	1.52	3.90	2.44	2.37
Jan-19	1,550	1,000	750.0	400.0	400.0	480.0	300.0	17.60	2.26	2.10	1.70	1.89	1.52	3.90	2.44	2.37
Feb-19	1,550	1,000	750.0	400.0	400.0	480.0	300.0	17.60	2.26	2.10	1.70	1.89	1.52	3.90	2.44	2.37
Average E/F Cost Ratio									2.05	2.05	1.95	2.05	1.66	3.08	2.50	2.30

Annex B: Estimate of Weightings of Steel for Drainage (Based on Quantities of the Respective Projects Contract Documents)

Project	Dia 300/750 (ton)	Dia 900 (ton)	Dia 1060 (ton)	Dia 1200 (ton)	Drain Cover (ton)	Lining/M anhole (ton)	Mild Steel (ton)	High Yield Steel (ton)	Contract Rate (ETB)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Steel
Project 1	-	26.0 9	17.28	33.5 3	101.75	419.00	624. 63	22.07				
	Mild Steel								27,600.0	17,239,750.46	128,464,404.3	14%
	High Yield Steel								27,600.0	609,132.00		
Project 2	3.4	-	16.4	73.3	322.3	468.0	903. 4	-	-			
	Mild Steel								32,272.8	29,156,324.5	126,660,089.5	23%
	High Yield Steel								-	-		
Project 3	0.5	188. 4	339.2	235. 5	75.0	729.9	1,56 8.5	234.5				
	Mild Steel								39,222.9	61,521,541.9	431,235,545.2	16%
	High Yield Steel								39,222.9	9,197,767.7		
Project 4	-	-	103.6	30.2	37.8	-	199. 8	141.5				
	Mild Steel								28,000.0	5,594,477.3	159,154,742.9	6%
	High Yield Steel								28,000.0	3,961,160.0		
Project 5	-	55.4	4.9	13.5	-	170.2	244. 0	51.7				
	Mild Steel								34,500.0	8,419,672.3	66,625,941.7	15%
	High Yield Steel								34,500.0	1,781,925.0		

Note: in the absence of a unit rate for mild steel the contract rate of high yield steel is used for Project 5.

Annex B: Estimate of Weightings of Cement for Drainage (Based on Quantities of the Respective Projects Contract Documents)

Project 1	Cement Quantity (Qtl)				Stone Pitching (Qtl)	Masonry (Qtl)	Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30							
	1,274.0	66,251.0	4,316.4	-							
* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 35.0% based on the Contractor's unit rate breakdown.											

Project 2	Cement Quantity (Qtl)				Stone Pitching (Qtl)	Masonry (Qtl)	Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30							
	546.0	-	100,889.9	-							
* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 23.64% based on the Contractor's contract price breakdown.											

Project 3	Cement Quantity (Qtl)				Stone Pitching (Qtl)	Masonry (Qtl)	Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30							
	-	105,206.4	71,299.4	-							
* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 28.65% the Contractor offers for works payable on day work basis.											

Project 4	Cement Quantity (Qtl)				Stone Pitching (Qtl)	Masonry (Qtl)	Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage	% Weight of
	C-15	C-20	C-25	C-30							

										(ETB)	Cement
	C-15	C-20	C-25	C-30							
	1,201.2	1,240.0	13,491.0	5,684.0	926.8	15,419.5	37,962.5	293.8	11,153,371.5	159,154,742.9	7%
* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 30.0% based on the Contractor's unit rate breakdown.											

Project 5	Cement Quantity (Qtl)				Stone Pitching (Qtl)	Masonry (Qtl)	Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30							
	-	5,534.0	32,588.3	-	4,715.6	5,443.1	48,280.9	315.0	15,208,495.2	66,625,941.0	23%
* Rate = Base Price which is ex-factory price excluding VAT multiplied by OH & Profit Margin of 25.0% the Contractor offers for provisional sum and day work items.											

Annex B: Estimate of Weightings of Steel for Structures (Based on Quantities of the Respective Projects Contract Documents)

Project	Concrete Parapets (m)	Mild Steel (ton)	High Yield Steel (ton)	Contract Rate (ETB)*	Amount (ETB)	Contract Amount - Structures	% Weight of Steel
Project 1	117.80	43.39	106.11				
	Mild Steel			27,600.00	1,197,685.44	11,646,477.37	35%
	High Yield Steel			27,600.00	2,928,636.00		
Project 2	270.00	218.96	257.00				
	Mild Steel			31,323.60	6,858,615.46	178,952,095.60	8%
	High Yield Steel			31,323.60	8,050,165.20		
Project 3	42.00	13.62	5.60				
	Mild Steel			41,191.19	560,859.24	23,655,402.22	3%
	High Yield Steel			41,191.19	230,670.66		
Project 4	632.40	110.35	161.97				
	Mild Steel			28,000.0	7,624,825.60	61,101,548.09	12%
	High Yield Steel			28,000.0			
Project 5	-	-	-				
	Mild Steel			-	-	1,087,965.50	0%
	High Yield Steel			-	-		

*Contract Rates are unit rates provided in the contract BOQ.

Annex B: Estimate of Weightings of Cement for Structures (Based on Quantities of the Respective Projects Contract Documents)

	Cement Quantity (Qtl)				Parapet (Qtl)	Cyclopean (Qtl)	Stone Pitching (Qtl)	Masonry (Qtl)	Estimated Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30									
Project 1	156.4	-	-	5,054.9	282.7	-	-	549.0	6,043.0	340.2	2,055,840	11,646,477	18%

* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 35.0% based on the Contractor's unit rate breakdown.

	Cement Quantity (Qtl)				Parapet (Qtl)	Cyclopean (Qtl)	Stone Pitching (Qtl)	Masonry (Qtl)	Estimated Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30									
Project 2	5,348	-	37,354	3,080	648	12,046	96	55,097	113,668	290.6	33,026,750	178,952,095	18%

* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 23.64% based on the Contractor's contract price breakdown.

	Cement Quantity (Qtl)				Parapet (Qtl)	Cyclopean (Qtl)	Stone Pitching (Qtl)	Masonry (Qtl)	Estimated Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30									
Project 3	0	198	-	448	101	-	-	1,957	2,704	321.5	869,400	23,655,402	4%

* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 28.65% the Contractor offers for works payable on day work basis.

	Cement Quantity (Qtl)				Parapet (Qtl)	Cyclopean (Qtl)	Stone Pitching (Qtl)	Masonry (Qtl)	Estimated Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30									
Project 4	445	2,927	-	8,652	1,518	-	-	47,872	61,413	293.8	18,043,205	61,101,548	30%

* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 30.0% based on the Contractor's unit rate breakdown.

	Cement Quantity (Qtl)				Parapet (Qtl)	Cyclopean (Qtl)	Stone Pitching (Qtl)	Masonry (Qtl)	Estimated Total Cement (Qtl)	Rate* (ETB/Qtl)	Amount (ETB)	Contract Amount - Drainage (ETB)	% Weight of Cement
	C-15	C-20	C-25	C-30									
Project 5	-	-	-	-	-	-	-	-	-	315.0	-	1,087,965	0%

* Rate = Base Price excluding VAT multiplied by OH & Profit Margin of 25.0% the Contractor offers for provisional sum and day work items.

Annex B: Estimate of the Weightings of Bitumen for Bituminous Surfacing (Based on the Quantities of the Respective Projects Contract Documents)

	Bitumen Type	Unit	Use	Estimated Quantity	Rate* (ETB) per unit (R)	Estimated Amount of Bitumen (ETB)	Contract Amount - Bituminous Surfacing (ETB)	Estimated Weight of Bitumen	Remark
				Q	R	E	C	W	
Project 1	MC-30	lt	Prime coat	398,767	25.21	34,925,287	51,555,848	68%	prices quoted for 80/100 penetration grade bitumen and kerosene at the base date are used to determine the Rate but considering the proportion of each material required to produce the cutbacks which are 47.0% : 53.0% (Bitumen : Kerosene) for MC-30 and 85.0%:15.0% (Bitumen: Kerosene) for MC-3000.
	MC-3000	lt	DBST-1st	553,966	26.49				
	MC-3000	lt	DBST-2nd	384,816	26.49				

* Rate = price quoted by NOC - Ethiopia exclusive of VAT multiplied by OH & Profit Margin of 35.0% based on the Contractor's unit rate breakdown.

	Bitumen Type	Unit	Use	Estimated Quantity	Rate* (ETB) per unit (R)	Estimated Amount of Bitumen (ETB)	Contract Amount - Bituminous Surfacing (ETB)	Estimated Weight of Bitumen	Remark
				Q	R	E	C	W	
Project 2	MC-30	lt	Prime coat	611,065	19.43				prices quoted for 80/100 penetration grade bitumen and kerosene at the base date
	MC-3000	lt	DBST-1st	187,076	20.64				

	MC-3000	lt	DBST-2nd	129,514	20.64	74,299,747	158,746,553	47%	are used to determine the Rate but considering the proportion of each material required to produce the cutbacks which are 47.0% : 53.0% (Bitumen : Kerosene) for MC-30 and 85.0%:15.0% (Bitumen: Kerosene) for MC-3000.
	80/100	kg	AC	2,648,800	21.12				

* Rate = price quoted by NOC - Ethiopia exclusive of VAT multiplied by OH & Profit Margin of 23.64% based on the Contractor's contract price breakdown.

Project 3	Bitumen Type	Unit	Use	Estimated Quantity	Rate* (ETB) per unit (R)	Estimated Amount of Bitumen (ETB)	Contract Amount - Bituminous Surfacing (ETB)	Estimated Weight of Bitumen	Remark
				Q	R	E	C	W	
	MC-30	lt	Prime coat	763,213	25.89	69,727,154	150,000,776	46%	prices quoted for 80/100 penetration grade bitumen and kerosene at the base date are used to determine the Rate but considering the proportion of each material required to produce the cutbacks which are 47.0% : 53.0% (Bitumen : Kerosene) for MC-30 and 85.0%:15.0% (Bitumen: Kerosene) for MC-3000.
	MC-3000	lt	DBST-1st	1,052,160	26.84				
	MC-3000	lt	DBST-2nd	809,354	26.84				

* Rate = price quoted by NOC - Ethiopia exclusive of VAT multiplied by OH & Profit Margin of 28.65% the Contractor offers for works payable on day work basis.

Project 4	Bitumen Type	Unit	Use	Estimated Quantity	Rate* (ETB) per unit (R)	Estimated Amount of Bitumen (ETB)	Contract Amount - Bituminous Surfacing (ETB)	Estimated Weight of Bitumen	Remark

				Q	R	E	C	W	
	MC-30	lt	Prime coat	752,523	20.50	50,431,944	102,334,332	49%	prices quoted for 80/100 penetration grade bitumen and kerosene at the base date are used to determine the Rate but considering the proportion of each material required to produce the cutbacks which are 47.0% : 53.0% (Bitumen : Kerosene) for MC-30 and 85.0%:15.0% (Bitumen: Kerosene) for MC-3000.
	MC-3000	lt	DBST-1st	943,112	21.83				
	MC-3000	lt	DBST-2nd	660,178	21.83				

* Rate = price quoted by NOC - Ethiopia exclusive of VAT multiplied by OH & Profit Margin of 30.0% based on the Contractor's unit rate breakdown.

	Bitumen Type	Unit	Use	Estimated Quantity	Rate* (ETB) per unit (R)	Estimated Amount of Bitumen (ETB)	Contract Amount - Bituminous Surfacing (ETB)	Estimated Weight of Bitumen	Remark
				Q	R	E	C	W	
Project 5	MC-30	lt	Prime coat	919,999	23.10	139,247,977	271,896,819	51%	prices quoted for 80/100 penetration grade bitumen and kerosene at the base date are used to determine the Rate but considering the proportion of each material required to produce the cutbacks which are 47.0% : 53.0% (Bitumen : Kerosene) for MC-30 and 85.0% : 15.0% (Bitumen: Kerosene) for MC-3000.
	MC-3000	lt	DBST-1st	403,195	23.29				
	MC-3000	lt	DBST-2st	282,237	23.29				
	80/100	kg	AC	4,367,210	23.36				

* Rate = price quoted by NOC - Ethiopia exclusive of VAT multiplied by OH & Profit Margin of 25.0% the Contractor offers for provisional sum and day work items.