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**Assessment of Price Escalation and Adjustment Problems on Federal
Road Construction Projects**

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A Thesis Submitted to School of Graduate Studies in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil Engineering (Construction Technology and Management).

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ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

ADDIS ABABA INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

MSc. IN CONSTRUCTION TECHNOLOGY & MANAGEMENT

**ASSESSMENT OF PRICE ESCALATION AND ADJUSTMENT PROBLEMS ON
FEDERAL ROAD CONSTRUCTION PROJECTS**

By:

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AUTHOR'S DECLARATION

I hereby declare that, the work which is being presented in the thesis entitled “Assessment of price escalation and adjustment problems on federal road construction projects” in partial fulfillment of the requirement for the degree of master of science in construction technology and management is an authentic record of my own work carried out from October, 2011 to December, 2012 under the supervision of Wubishet Jekale Mungesha (Dr.-Eng.), Department of Civil Engineering, Addis Ababa University, Addis Ababa, Ethiopia.

To the best of my knowledge and belief, the thesis contains no material previously published or written by author person except where due reference is made.

Mohammed Gashaw
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signature

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date

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ABSTRACT

Managing large capital construction projects requires the coordination of a multitude of human, organizational, technical, and natural resources. Cost has its proven importance as the prime factor for project success. Price escalation is one of the wide ranging problems that the construction industry is facing currently.

Investigation of factors that might contribute to a price escalation is significant in order to notice attention to specific areas of improvement for federal road construction projects in Ethiopia. Hence, assessment of price escalation and adjustment problems on federal road construction projects needs to be done in order to better support the economic development. Accordingly, this research attempts to assess causes and effects of price escalation, to identify problems of price escalation and adjustment and methods to manage/administer price escalation on federal road construction projects, which can serve as the way forward for future work in coping with these escalations. The data required for this study were collected through self-administered open and close ended questionnaires, desk studies/archival records (four in number) and unstructured interviews.

The statistical method of Relative Importance Index and Spearman's correlation coefficient were used to analyze the collected data through questionnaires. Based on the findings variables were ranked according to their occurrence. In addition the respondent's correlation in ranking variables was studied in order to identify the agreements between respondents.

Poor estimation, improper planning and/or improper implementation of proper planning and project schedule changes are identified as major internal causes of price escalation and also increase in material cost/material price fluctuation, increase in global demand for construction materials, fluctuation in money exchange rates and limited capacity of material producers are identified as major external causes of price escalation in Ethiopian federal road construction projects.

Findings revealed that the major effects of price escalation are higher project costs, cash flow (project financing) problem of the projects, delay and dispute among parties. The study also identified uncompensated increase in cost of construction materials, construction price indices

may over estimate or under estimate the market conditions as at how prices have risen and selection of the most suitable index in using inflation indices are identified as major problems of price escalation and adjustment in Ethiopian federal road construction projects. Finally, based on the analysis of the results, recommendations have been proposed that enables to minimize the problems of price escalation and adjustment on federal road construction projects and favors the construction industry for better performances.

Key words: *price escalation, price adjustment, construction price index, road projects.*

Table of Contents

Author's Declaration.....	i
Acknowledgments.....	ii
Abstract.....	iii
Table of Contents.....	v
List of Tables.....	viii
List of Figures.....	ix
List of Abbreviations.....	x
CHAPTER ONE.....	1
1. Introduction.....	1
1.1. Background.....	1
1.2. Statement of the problem.....	4
1.3. Significance of the study.....	5
1.4. Objectives of the study.....	6
1.5. Research question.....	6
1.6. Methodology of the study.....	6
1.7. Scope and limitation of the study.....	7
1.8. Organization of the thesis.....	8
CHAPTER TWO.....	9
2. Literature review.....	9
2.1. Construction Industry.....	9
2.2. Price Escalation.....	10
2.3. Price Escalation Definitions.....	11
2.4. Construction Contract.....	11
2.5. Relationship between Inflation and Escalation.....	11
2.6. Construction Price Indices.....	12
2.7. Types of Construction Price Indices.....	13
2.7.1. Input Price Indices.....	13
2.7.2. Output Price Indices.....	13
2.8. Factors Causing Price Escalation.....	14

2.8.1.	Internal Factors Causing Price Escalation	15
2.8.2.	External Factors Causing Price Escalation	18
2.9.	Methods of Price Adjustment.....	23
2.9.1.	Basic Prices/Proven Cost Method.....	24
2.9.2.	Indices/Formula Method.....	25
2.10.	Price Escalation Clauses.....	25
2.10.1.	Contract Conditions Made Between Contracting Parties	26
2.11.	Effects of Price Escalation.....	35
2.12.	Problems of Price Escalation and Adjustment	36
2.13.	Managing Price Escalation.....	39
CHAPTER THREE	42
3.	Methodology.....	42
3.1.	General	42
3.2.	Study area description	42
3.3.	Research Process	43
3.4.	Data collection.....	44
3.4.1.	Source of data	44
3.4.2.	Population and participant	44
3.4.3.	Sampling technique.....	45
3.4.4.	Sample size	46
3.4.5.	Data collection tools/Instruments	47
3.4.5.1.	Questionnaire.....	47
3.4.5.2.	Desk study	47
3.4.5.3.	Interview	48
3.5.	Data analysis	48
3.5.1.	Questionnaire analysis	48
3.5.2.	Desk study analysis.....	51
CHAPTER FOUR	52
4.	Analysis of Findings and Discussions.....	52
4.1.	Introduction	52

4.2. Questionnaires Result and Discussion	52
4.2.1. Respondent's Profile.....	52
4.2.2. Experience of Respondents	53
4.2.3. Factors Causing Price Escalation	54
4.2.3.1. Internal Causes of Price Escalation	55
4.2.3.2. External Causes of Price Escalation	58
4.2.4. Effects of Price Escalation	61
4.2.5. Assessment of Price Escalation	64
4.2.6. Methods of Price Adjustment	65
4.2.7. Price Escalation Compensation System.....	66
4.2.7.1 Provisions in Conditions of Contract	66
4.2.8. Price Escalation Administration System.....	67
4.2.9. Problems of Price Escalation and Adjustment.....	67
4.2.10. Methods to Manage /Administer Price Escalation.....	70
4.3. Selected Desk Studies Findings and Discussion	73
CHAPTER FIVE	76
5. Conclusions and Recommendations	76
5.1. Conclusions	76
5.2. Recommendations	78
REFERENCES	82
Appendixes	90
Appendix A: Questionnaire.....	91
Appendix B: Information of the projects	98
Appendix C: Desk Study Analysis.....	100

LIST OF TABLES

Table 1.1: RSDP major physical activities and its scope	3
Table 2.1: Identified causes of price escalation variables for use in the survey	23
Table 2.2: Summary on escalation clauses.....	33
Table 3.1: Rating scale for factors causing price escalation	49
Table 3.2: Rating scale for effects of price escalation.....	49
Table 3.3: Rating scale for price escalation and adjustment problems	49
Table 3.4: Rating scale for methods to manage/administer price escalation	49
Table 4.1: Questionnaire distribution.....	54
Table 4.2: Experience of respondents	54
Table 4.3: Experience of respondents on number of projects executed.....	54
Table 4.4: The results of internal factors causing price escalation.....	55
Table 4.5: Correlations among respondents in ranking internal factors causing price escalation	58
Table 4.6: The result of external factors causing price escalation	59
Table 4.7: Correlations among respondents in ranking external factors causing price escalation	60
Table 4.8: The result of effects of price escalation	62
Table 4.9: Correlations among respondents in ranking effects of price escalation.....	64
Table 4.10: The result of price escalation and adjustment problems	68
Table 4.11: Correlations among respondents in ranking problems of price escalation and adjustment	70
Table 4.12: The result of methods to manage/administer price escalation	71
Table 4.13: Correlations among respondents in ranking methods to manage/administer price escalation.....	73

LIST OF FIGURES

<i>Figure 3.1:</i> Flow chart of the research process	44
<i>Figure 3.2:</i> Sampling technique	45
<i>Figure 4.1:</i> Type of respondents` organization	53
<i>Figure 4.2:</i> Internal causes of price escalation and their relative importance index.....	56
<i>Figure 4.3:</i> External causes of price escalation and their relative importance index.....	60
<i>Figure 4.4:</i> Effects of price escalation and their relative importance index	62
<i>Figure 4.5:</i> Price escalation adjustment problems and their relative importance index	68
<i>Figure 4.6:</i> Methods to manage/administer price escalation and their relative importance index	72
<i>Figure 4.7:</i> Price escalation adjustment in projects on selected case study	74

LIST OF ABBREVIATIONS

ACAF	Asphalt Contractor's Association of Florida
AC	Asphalt Concrete
BaTCoDA	Building and Transport Construction and Design Authority
CBSN	Central Bureau of Statistics Netherland
CPA	Contract Price Adjustment
CPAP	Contract Price Adjustment Provisions
CPI	Consumer Price Index
DBST	Double Bituminous Surface Treatment
DS	Design Standard
EEA	Ethiopian Economic Association
ERA	Ethiopian Roads Authority
ETB	Ethiopian Birr
EUROSTAT	Statistical Office of the European Community
FIDIC	Fédération Internationale des Ingénieurs-Conseils
ICB	International Competitive Bidding
INSEE	Institut National de la Statistique et des Etudes Economiques
MDB	Multilateral Development Banks
MoI	Ministry of Infrastructure
MoWUD	Ministry of Works and Urban Development
NCB	National Competitive Bidding
OECD	Organization for Economic Co-operation and Development
PPA	Public Procurement Agency
PPPAA	Public Property Procurement and Administration Agency
PPI	Producer Price Index
PMBOK	Project Management Body of Knowledge
RII	Relative Importance Index
RSDP	Road Sector Development Program
VAT	Value Added Tax

CHAPTER ONE

1. INTRODUCTION

1.1. Background

The role the construction industry plays in socio-economic development is significant. The industry is a distinct sector of the economy, which makes its direct contributions to economic growth (MoWUD, 2006). It provides the basis upon which other sectors can grow by constructing the physical facilities required for the production and distribution of goods and services. The industry has a significant multiplier effect on the economy as a whole (MoWUD, 2006 and EEA, 2008 cited in Getaneh, 2011).

The construction industry in Ethiopia is challenged by several problems which tend to confront the sector and thus making efforts at developing the construction industry is very difficult and complex. The underlying problems of the construction sector can be classified into two main categories. The first is related to the consequences of the fact that the sector is not viewed and planned in an integrated manner, but rather, operates with fragmented, unrelated and often conflicting components (Wubishet, 2004). The second problem is related to deficiencies and market price fluctuation of the inputs required for the construction (Gebre-Michael, 2002 in Asteway, 2008).

Project cost escalation is a major problem for government agencies. Over the time span between the initiation of a project and the completion of construction many factors influence a project's final costs (Flyvbjerg et al., 2002).

Road construction sector is one of the largest sectors in Ethiopian construction industry. ERA is a federal authority established in 1951 and currently responsible to construct federal road construction projects of the country in collaboration with regional road authorities to achieve the intended objectives of the sector (ERA, 2011(a)).

Recognizing the importance of the road transport in supporting social and economic growth and its role as a catalyst to meet poverty reduction targets, the Government of Ethiopia has placed increased emphasis on improvement of the quality and extent of road infrastructure in the country. To address constraints in the road sector, related to restricted road network coverage and poor condition, the Government formulated the RSDP in 1997.

In the context of Ethiopia's geography, pattern of settlement and economic activity, transport plays a vital role in facilitating economic development. In particular, it is road transport that provides the means for the movement of people, utilization of land and natural resources, improved agricultural production and marketing, access to social services, and opportunities for sustainable growth.

The road network of Ethiopia provides the dominant mode of freight and passenger transport and thus plays a vital role in growing the economy of the country. All sectors of our economy, service and people rely on the availability and satisfactory performance of road.

The primary objective of ERA ongoing program is to restore and expand Ethiopia's road network, which has become an obstacle and major impediment to sustainability of the economic development program. Side by side, the program would assist in developing strong management and technical capacity to manage the road network, and develop the capacity of domestic construction industry (ERA, 2011(a)).

The RSDP has been implemented over a period of thirteen years and in three separate phases until June 2010 and the 4th phase starts from July 2010 to June 2015, as follows:

- RSDP I – Period from July 1997 to June 2002 (5 year plan), completed
- RSDP II – Period from July 2002 to June 2007 (5 year plan), completed
- RSDP III – Period from July 2007 to June 2010 (3 year plan), completed
- RSDP IV – Period from July 2010 to June 2015 (5 year plan), ongoing

This program is basically developed because of the following three main reasons

- The age of road network, year of insufficient maintenance.
- The road network was limited in terms of both and coverage and quality.
- Road transportation cost was very high.

RSDP’s report showed that during their time frame work the sector basically perform the following four main activities as described in table below (ERA, 2011(b)).

Table 1.1: RSDP major physical activities and its scope

Type of work	Scope of work
Maintenance	Periodic works to maintain the road on the existing platform resurfacing, bridge maintenance, clearing drains, patching potholes, line marking.
Rehabilitation	Bringing existing deteriorated road to previous/original condition improving slope / drainage / embankment, complete resurfacing, strengthening pavements.
Upgrading	Changing road category (from seasonal to all weather, secondary to primary, gravel to paved, primary to highway) - adding lanes, changing surfaces, widening intersections, new construction of some part of the road, reconnecting with other feeder roads, and etc.
New Construction	New road built up on new land with major land acquisition, and sometimes major resettlement effort.

All the physical works in the table is performed in all types of road projects, federal, regional and rural road projects (ERA, 2010).

However according to their report only phase II of RSDP was accomplished more than the planned (139%). The other phases Phase I, III and IV accomplished 72%, 89% and 96% respectively (ERA, 2011(a)). Among federal road projects in the past five years only 94.6% physical accomplishments with cost overrun of 58.4% was recorded and only 56% of the roads were found in good conditions (ERA, 2010). The above figures indicated that the RSDP phase I, III and IV are poorly accomplished as opposed to RSDP phase II. This indicates that the performance and also institutional capacity has not been improved from the second phase.

The review of the implementation of RSDP I, II and part of RSDP III, shows that road projects in Ethiopia encounters a number of challenges. In addition to significant project variation, there are

a number of themes contributing to this challenge. The development status of the domestic construction industry and the clarity and comprehensiveness of documents (survey, design, tender and contract documents) used in the process can be considered as the two major factors for the challenges faced by ERA in road construction projects. The immediate consequence of such factors is an increase in project than originally budgeted, among others (Zerfu, 2009 cited in Turkey, 2011).

This research will have a contribution to the assessment of price escalation and adjustment problems in Ethiopian federal road construction projects. This helps to notice attention to specific areas of improvement.

This research work will also attempt to review the current price escalation administration practice in Ethiopia and to identify their causes, effects of price escalation and propose recommendation particularly with focus on Federal road construction projects.

It is anticipated that the findings of this thesis will contribute towards the identification of the causes of price escalation and their impact on the construction industry as well as increasing the awareness of construction managers on price escalations in general, and federal road construction cost management in particular.

1.2. Statement of the problem

Today's construction projects require modern construction technique, technological equipment's, qualified professionals and large amounts of modern construction materials. Therefore, too much amount of money is required and invested to implement the project. In addition, this much money is fall under risk since construction business is risky one. Unless the project is not successfully implemented in quality, cost and time, the failure of it may cause serious damage (moral as well as financial) among the contracting parties.

A project is a unique process, consisting of a set of co-ordinated and controlled activities with an assumed start and known finish dates, undertaken to achieve an objective confirming to specific requirements including constraints of time, cost and resources (Lockyer and Gordon, 1996).

Abebe (2003) stated that in project management the above constraints have been identified as the triple constraints which are managing quality, cost and schedule (time) simultaneously.

Ethiopian federal road construction projects are going to construct under different phases of RSDP. The status of each phases were assessed at different times and the assessment report showed that the programs are achieving satisfactory progress against its objectives and benchmarks (ERA, 2011(b)).

However, the progress of individual projects in their own report showed that most of the time projects are not completed within the planned time, budget and also sometimes within specified quality. Price escalation is also considered as a big problem, which hinders project's progress, since it decreases the contractor's profit leading to huge losses leaving the project in a big trouble. This problem is a result of weak economy, lack of managerial skills, bad planning, increasing the prices of materials and others. For that it is of key importance to exert the utmost effort to accomplish such study, to detect the previously mentioned factors and to treat all the weakness points and from all sides and so giving specific priorities in order to avoid price escalation at construction projects. Therefore, the aim of the paper is to assess the problems related to price escalation and its adjustment.

1.3. Significance of the Study

The important of this research paper is expressed in the following ways. First, it may benefit the different stakeholders involving in construction projects in general and particularly Federal road construction projects related to price escalation. Second, it helps owners, contractors and consultants to know price escalation problems mainly occur in road construction projects and to take remedial measures to reduce its impacts once the problems occurs. Third, it identifies the factors which lead to the occurrence of price escalation problems and the methods to manage price escalation in road construction projects. Generally, the study serves as a benchmark for further studies that take similar or related development challenges.

1.4. Objectives of the Study

The objectives of this particular research will believe to lead to the attainment of the research goal, being:

- ☛ to assess the causes and effects of price escalation on federal road construction projects.
- ☛ to identify problems of price escalation and adjustment on federal road construction projects.
- ☛ to assess the present price escalation administration practices on federal road construction projects.
- ☛ to identify methods to improve the administration of price escalation on federal road construction projects.

1.5. Research Questions

- i. What are the causes and effects of price escalation on federal road construction projects?
- ii. What are the problems of price escalation and adjustment on federal road construction projects?
- iii. How price escalation is administered in federal road construction projects?
- iv. What are the methods to improve the administration of price escalation on federal road construction projects?

1.6. Methodology of the Study

The research work has been started with problem identification, which was done through unstructured literature review, formal and informal discussion with professionals in the federal road construction sector.

Then data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided; and available documentary sources relevant to the research were reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress reports, payment certificates, completion reports and contract documents within ERA.

Finally, after an in-depth review of literature and desk study, a questionnaire was designed and distributed to contractors, consultants and the clients (ERA) to get their professional opinion based on their experience. Upon obtaining the desired data, checking and sorting of data has been done. The data were then analyzed for cross-checking the validity and conformity of the information obtained through the overall research work. This was followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

1.7. Scope and Limitation of the Study

The scope of the study is bounded by three main characteristics location, sector and project management aspect as shown in Figure below.

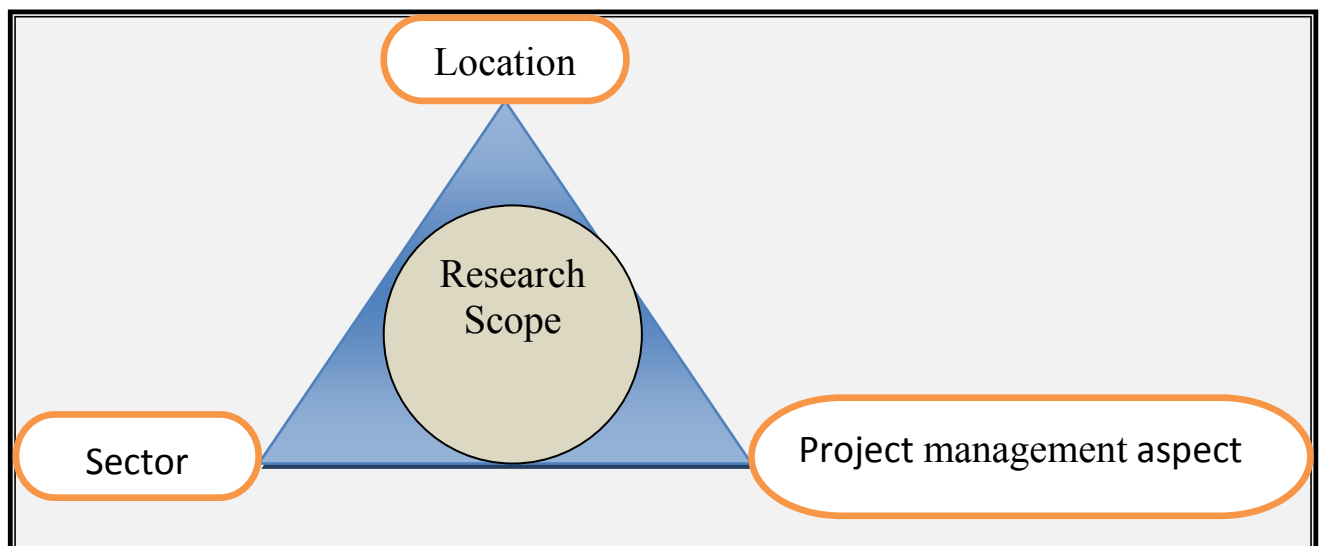


Figure1.1: Scope of the study

In terms of location this study is covered only a single country, Ethiopia. Only Clients, Contractors and Consultants who work in this country are participated in the survey. None of the questionnaires was conducted in other locations.

Among the sectors this study focus on road construction sector particularly Federal road construction projects, South and West regions and it does not include all other types of construction sectors.

From different project management aspects price escalation and adjustment were chosen as the main focus of the study. Regarding this area the scope of the research is limited to assess causes and effects of price escalation, to identify price escalation and adjustment problems and methods to manage/administer price escalation for project success as well as response relationship among respondents.

Due to time and budget the study is limited to cover only 33 federal road construction projects, South and West regions in Ethiopia, in which its construction work was commenced after June 2006.

1.8. Organization of the Thesis

The thesis is organized with five chapters. The first chapter begins the basic research information as an introduction part of the research. The literature review is dealt in chapter two followed by the third chapter which covers research design and methodology in order to achieve the objectives of the study. The fourth chapter encompasses the analysis of findings and discussions part. The last chapter comprises the conclusions made and recommendations forwarded based on the major findings of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Construction Industry

The construction industry is the total through which physical development is achieved, and that is truly the locomotive of the national economy. The more resources, engineering, labor, materials, equipment, capital, and market exchange are provided from within the national economy. The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demand on construction managers to deliver projects on time, within the planned budget and with high quality (Enshassi et al., 2003).

According to Abebe (2003) construction industry employs about 20% of the workforce and covers about 30% of the capital budget of the governments in developing countries. Wubishet (2004) cited in Turkey (2011) in his work, however, indicated that the construction industry accounts even for more than 50% of the capital budget in developing countries. According to him, for instance, in Ethiopia (1997/98 to 2001/02), the industry accounted for 58.2% of the capital budget. It should be noted, in both cases, that the industry covers a fairly large portion of the government's capital expenditure and so it needs to be developed.

Although construction is principally defined by the concept of assembling materials and products, it is in fact multi-tasked. Just as divergent materials come together to form a structure, so too does a diverse group of people come together to make the project possible. To bring together numerous independent businesses and corporate personalities in to one goal oriented process is the particular challenge of the construction industry (Frederick and Nancy, 2009).

According to Chitkara (2004) cited in Fetene (2008) construction project is a mission, undertaken to create a unique facility, product or service within the specified scope, quality, time, and cost.

The guide to the PMI (2004) defines project as a temporary endeavor undertaken to provide a unique product or service. As Sanvido et al. (1992) suggested that not only building construction, Construction project in general is completed as a result of a combination of many events and

interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment.

In developed and developing countries, the construction industry plays a major role in the economy by contributing significantly to the gross domestic product, employing a sizable portion of the working population, accounting for about half of the capital formation, and interacting strongly with other sectors of the economy (Hillebrandt, 1985 in Salleh, 2009).

Wubishet (2005) cited in Getaneh (2011) noted that the construction industry in Ethiopia has been in the process of transformation. This transformation is based on improving the competitiveness of the construction industry and enhancing its ability to fulfill the national development demands. To reveal such transformation is vital to understand the contextual realities and the development trends of the Ethiopian construction industry.

2.2. Price Escalation

Escalation in the construction market in recent years has been extremely volatile, and this trend is expected to continue in the near future due to competition for resources and skilled workers. This situation has created a great deal of uncertainty and nervousness among construction field. The financial success of a construction project can be uncertain and at risk due to changes in escalation rates during construction (Bates, 1996). The success of a building construction project is mainly influenced by to what extent of cost escalation identified and allocated to the construction project. Budgeting for cost escalation is a major problem in the planning phase of projects (Dawood and Bates, 1998).

Literature shows that wide varieties of risk factors influence construction costs and result in substantial increase of project costs than originally budgeted. Expressed as a percentage of estimated cost, this is often termed cost escalation, cost overrun or cost growth, and occurs as a result of many factors some of which are related to each other, but all are associated with some forms of risks (Avots, 1983 and Garry, 2006 in Turkey 2011).

2.3. Price Escalation: Definitions

Different scholars defined project price escalation in construction industry in their works and some of them are outlined as follow:

- Price Escalation is an increase in the cost of any construction elements of the original contract and base cost of a project due to passage of time (Williams et. al., 1999).
- Price Escalation is the increase in any element of project costs when the cost of that element is compared between two different periods (Lock, 2003).
- Price Escalation is the provision in a cost estimate for increases in the cost of equipment, material, labor, etc., due to continuing price changes over time (Jaeger, 1996).
- Price Escalations, which mainly include the increase in the amount of resources in actual or estimated, direct costs of labor and material (Stewart, 1982), are usually treated with provisions and some form of compensation that considers price level changes over time.

Scholars used the word price escalation interchangeably. For the purpose of this research price escalation is defined as an increase in the cost of equipment, material, labor, etc., due to continuing price changes over time.

2.4. Construction Contract

A construction contract is a binding agreement, enforceable in law, containing the conditions under which the construction of a facility will take place. According to Ostwald (2001), the element of risk, the willingness of the parties, the competition, complexity of construction, and urgency may influence the general type of contract selected.

Construction contract types have direct impact on the cost estimation of construction projects. Similarly, the contract type of a project also has a direct impact on the compensation in case of price fluctuation (Tadesse, 2006 in Asteway, 2008).

2.5. Relationship Between Inflation and Escalation

Inflation is the process of continuously rising prices, or equivalently, of a continuously falling value of money. The CPI is the most widely used measure of inflation. It provides information about price changes in the nation's economy to government, business, labor, and private citizens

and is used by them as a guide to making economic decisions. The PPI measures inflation at the wholesale level, and is viewed as a more appropriate general index for heavy construction (Akintola et. al., 2009).

Inflation and escalation, though related, are not interchangeable. While escalation can be driven by general inflation related to the money supply, escalation is also driven by changes in technology, practices, and particularly supply-demand imbalances that are specific to a good or service in a given economy. For example, while general inflation reflected in the CPI in the US was less than 5% for 2003- 2007, steel prices escalated by over 50% because of supply-demand imbalance (URS, 2009).

2.6. Construction Price Indices

Remer et al. (1998) and OECD (1994(a) and 1994(b) stated that construction price indices are calculated by the statistical directorates of countries to meet the demand arising from the need to assess real changes in the output from these activities (i.e. to create a constant value series) which cannot be derived solely through reference to regular building and construction statistics. However in Ethiopia, the indices for use in such a formula are not being generated and it is therefore necessary to utilize proxy indices from suppliers or the government in order to utilize the formula. Sources and types of proxy indices could be a cement factory for cement, minimum labor rate for local labor, government published fuel price for fuel etc. or failing the existence of reliable indices a simplified form of the formula utilizing only the consumer price index, which is published, could be used.

According to OECD (1996) the development and compilation of price indices for construction activity is a complex procedure consisting of a long and varied set of operations. The usefulness of the construction indices compiled also depends on having a clear understanding of the purposes of the indices, and the characteristics of the construction industry in the country where it is located.

The Statistics Directorate of OECD (1994, (a and b)) and EUROSTAT, (1995 and 1996) notes that construction price indices are primarily used for analysis of price movements and price

formation in the construction industry, for price escalation clauses in construction contracts, and for deflation of components of the national accounts.

In broad terms, construction price indices provide measures of changes in the prices of either the inputs to, or outputs of, construction activity.

Besides, according to SSI Turkey (2002), construction price indexes may be used for two distinct purposes:

- The deflation of current expenditure on construction projects to provide estimates of construction expenditure at constant prices.
- As a measure of one component of inflation.

2.7. Types of Construction Price Indices

Different approaches to index number compilation are used depending on the purpose for which the index is required. There are two main types of construction price indices (Lynn Mackenzie, 1994). These are input price indices and output price indices.

2.7.1. Input Price Indices

Input price indices measure changes in the price of inputs to the construction process by monitoring separately the cost of each factor. This generally entails the compilation of a weighted index of the costs of wages and materials (CBSN, 1995).

Input price indices only provide a reflection of changes in the prices of construction inputs (Lynn Mackenzie, 1994). The index is based on prices of a representative selection of basic inputs (labor, plant, materials and transport) that go into the construction work. Hence, the input price index measures the change in the cost of resources to the contractor, and not the change in the price that the client pays (INSEE, 1990).

2.7.2. Output Price Indices

Output price indices measure changes in the prices of what is produced by entities engaged in construction activity. Output price indices cover most of the items normally built into the price paid by purchasers or clients to entities involved in producing the completed output of the

construction activity. These generally include materials, labor, equipment hire, land preparation costs, overheads, profits, and trade margins (INSEE, 1990).

Output price indices are producer price indices for the construction industry. They measure changes in prices paid by clients or purchasers to entities producing construction output. Output price indices take into account changes in productivity, and contractors' profit margins in addition to the input costs. These indices are used to deflate the output value of the construction industry in the national accounts (CBSN, 1990). Output price indices do not include architects and engineers' fees, finance costs, selling expenses, VAT or the cost of the land.

2.8. Factors Causing Price Escalation

Price escalation is a major problem in both developed and developing countries. Several studies of major projects show that Price escalation is common. The causes of price escalation in construction projects are varied, some are not only hard to predict but also difficult to manage (Morris, 1991).

Price escalation does not only occur during the planning and design phases of a project. Project cost growth often manifests itself during construction. Focusing early on internal factors will reduce cost growth at bid time or during construction (Anderson et al., 2006).

Mansfielld, Ugwu and Doran, 1994 (in Fetene, 2008) suggested that in developing countries the lack of proper phasing of construction projects can contribute to the economy to become 'overheated'. This leads to shortage of construction materials as the demand will exceed the supply, this in turn leads to a climb in the cost of construction materials; this inevitably gives rise to project cost overruns, with consequential effects on inflation and a decline on efficient activity in the construction industry.

A better understanding of the price escalation factors is achieved through understanding the forces driving each factor or where the factor originates. With this understanding it is possible to design strategies for dealing with these price escalation factors.

In general, the price escalation factors can be classified based on two broad classification methods. These are internal and external factors (Warsame, 2006). In the following section of

this research, factors which affect the price escalation on construction project will be dealt in detail.

2.8.1. Internal Factors Causing Price Escalation

According to Warsame (2006) internal factors are cost escalation factors that can be directly controlled by the project's sponsoring agency/owner. While numerous internal factors can lead to underestimation of project costs during the planning and design stages of development. The following primary internal factors are well documented (Anderson et al. 2006). Some of the factors are presented below.

A. Delivery/Procurement Approach

According to Harbuck (2004) delivery/procurement approach effects the division of risk between the agency/owner and the constructors, and when risk is shifted to a party who is unable to control a specific risk, project cost will likely increase. The decision regarding which project delivery approach, e.g., design bid-build, design-build, or build operate-transfer and procurement methodology e.g., low bid, best value, or qualifications based selection affects the transfer of project risks (NJDoT, 1999). In addition to the question of risk allocation, lack of experience with a delivery method or procurement approach can also lead to underestimation of project costs (Parsons, 2002).

B. Project Schedule Changes

Project schedule changes particularly extensions, caused by budget constraints or design challenges can cause unanticipated increases in inflation cost effects even when the rate of inflation is accurately predicted (Touran et al., 2004). Agencies/owners must think in terms of the time value of money and recognize that there are two components to the issue: the inflation rate and the timing of the expenditures (BICE, 2003 and Allen et al., 1995). Many agencies and owners have fixed annual or biannual budgets and project schedules must often be adjusted to ensure that project funding is available for all projects as needed. Estimators frequently do not know what expenditure timing adjustments will be made (Callahan, 1998).

C. Engineering and Construction Complexities

Callahan (1998) notes that Engineering and construction complexities caused by the project's location or purpose can make early design work very challenging and lead to internal coordination problems and project component errors. Internal coordination problems can include conflicts or problems between the various disciplines involved in the planning and design of a project (Touran et al., 1994). Constructability problems that need to be addressed may also be encountered as the project develops. If these issues are not addressed appropriately, cost increases are likely to occur (Allen et al., 1995 and Federal-Aid, 2003).

D. Poor Estimation

Poor estimating can lead to project cost underestimation. Estimate documentation must be in a form that can be understood, checked, verified, and corrected. The foundation of a good estimate is the formats, procedures, and processes used to arrive at the cost (Arditi et al., 1985). Poor estimation includes general errors and omissions from plans and quantities as well as general inadequacies and poor performance in planning and estimating procedures and techniques (Merrow, 1988). Errors can be made not only in the volume of material and services needed for project completion but also in the costs of acquiring such resources (Harbuck, 2004 and Carr, 1989).

A study by Hester et al. (1991) indicates that the estimating method and the accuracy of project cost estimates could be a major reason for having cost changes (cited in Turkey, 2011).

Estimating problems are not limited to a particular owner or project type. Research has shown that project costs are consistently under estimated. In one study by Flyvbjerg et al. (2002) it was found that this underestimation occurs in 9 out of 10 transportation infrastructure projects around the world.

E. Inconsistent Application of Contingencies

Donnell (2005) identified inconsistent application of contingencies as a major factor causing price escalation of projects stating that it causes confusion as to exactly what is included in the line items of an estimate and what is covered by contingency amounts.

Furthermore, Donnell (2005) stated that contingency funds are typically meant to cover a variety of possible events and problems that are not specifically identified or to account for a lack of project definition during the preparation of early planning estimates.

Inconsistent application of contingency can be both an internal factor contributing to underestimation during the planning and preliminary design stage and a contributor to cost increases during final design or construction phases of the project (Noor and Tichacek, 2004). During project construction, contingency funds are inappropriately applied to construction cost increases and then not available for their intended purpose (Ripley, 2004).

The level of project risk contingency in estimates has a major impact on their financial outcomes for clients. If contingency is too high it might encourage poor cost management, cause the project to be uneconomic and aborted, or lock up funds that is not available for other projects (Dey, 2001). On the other hand, if the contingency allocation is too low, then it may be too rigid and set an unrealistic financial environment, resulting in unsatisfactory performance outcomes (Touran et al., 2004 in Turkey, 2011).

F. Ambiguous Contract Provisions

According to Harbuck (2004) ambiguous contract provisions dilute responsibility and cause misunderstanding between an owner and project design and construction contractors. Providing too little information in the project documents can lead to cost increases during the execution of the project (Chang, 2002). When the core assumptions underlying an estimate are confused by ambiguous contract provisions forecast accuracy cannot be achieved (Callahan, 1998).

G. Improper Planning and/or Improper Implementation of Proper Planning

This is fact that most of the planning is made by the higher authorities with their mind set-up. Planning made without knowing the ground realities is said to be improper. As the implementation part is going to be performed by the persons in the practical situations. Sometimes the planners make good plans but it fails due to the executing people. The construction cost, if it is estimated in the planning level will get escalated due to a number of reasons (Dainty et al., 2001).

Flyvbjerg et al. (2002) and Molenaar (2005) cited in Turkey (2011) discussed in developing countries lack of proper planning can contribute to the discrepancy of supply and demand. This leads to shortage of construction materials as the demand will exceed the supply, which in turn leads to a climb in the cost of construction materials; this inevitably gives rise to project cost escalation, with consequential effects on inflation and a decline on efficient activity in the construction industry.

2.8.2. External Factors Causing Price Escalation

External cost escalation factors are those factors over which the agency/owner has little or no direct control over their impact. However, the agency/owner needs to consider them when estimating project costs. During the planning and design phase of project development external factors can lead to underestimation of project costs (Warsame, 2006). These factors dealt with as follows.

A. Local Concerns and Requirements

According to Schroeder (2000) local concerns and requirements can affect project costs during the execution phase. Similar to the effects during the planning and design phases, mitigation actions imposed by the local government, neighborhoods, and businesses as well as local and national environmental groups during the construction of a project can extend the project duration affecting inflation allowances or add direct cost. By not anticipating these changes, agencies/ owners can be plagued by project cost increases (Daniels, 1998, Mackie and Preston, 1998).

B. Inflation

In simple terms, inflation is caused by an increase in the stock of money that is available for spending while the quantity of goods available for purchase does not increase by a proportionate amount (Pickrell, 1992).

The longer the expected construction period, the more account will need to be taken of expected inflationary price increases over time. Initial cost estimates will need to allow for the value that will need to be paid at the time the project actually goes ahead. Inflation can act to increase the

original estimates of construction costs. Inflation may have been taken into account in the original estimates, but if the rate of inflation increases above the predicted level during the construction period, then the original cost estimate will be exceeded. Obviously any other factor that delays a project will expose the project to the risk of further inflationary cost increases (Hufschmidt and Gerin, 1999).

Effects of inflation add cost to a project. The time value of money can adversely affect projects when:

- project estimates are not communicated in year-of-construction costs;
- the project completion is delayed and therefore the cost is subject to inflation over a longer duration than anticipated; and/or
- the rate of inflation is greater than anticipated in the estimate.

The industry has varying views regarding how inflation should be accounted for in the project estimates and in budgets by funding sources (Merrow, 1988).

C. Market Conditions

Market conditions can affect the costs of a project, particularly large projects. An unstable construction market would make it difficult for contractors to decide on the optimal level of overhead costs that enables contractors to win and efficiently administer projects (Drew and Skitmore, 2001). Inaccurate assessment of the market conditions can lead to incorrect project cost estimating. Market conditions affect the project costs during the execution phase similar to the effects during the planning phase (Woodrow, 2002). Changing market conditions during the construction of a project that reduces the number of bidders, affects the labor force, and other related elements can disrupt the project schedule and budget (chang, 2002).

D. Force Majeure

This term covers a range of events which are also commonly referred to as “Acts of God”. They include revolution, war, riot, extreme weather, earthquake, landslip, fire, political and economic instability (Akinciand Fischer, 1998). Usually, the contractor is required to insure against such

events happening. Where they do occur, they will normally lead to significant delays occurring and, consequently, cost increases (Chang, 2002).

E. Change in Legislation

Change in legislation during the contract time of the project is one causes of price variation. These additional costs due to changes in legislation are considered during the contract and approved extended completion time. The changes in cost and legislation clause (clause70), in the FIDIC IV general condition of contract is intended to make provision for possible effect of such matters as variation in the cost of labor and materials arising during the execution of the works.

The issue of the effects of subsequent legislation on the construction project is raised in the basis of sub clause 70.7 of the special condition of contract in FIDIC IV. If the Contractors have incurred additional costs related to increment of sales tax, sur tax, VAT and other government and custom taxes during the execution of the contracts caused by subsequent legislation, they are entitled to compensation of some amount to the additional cost incurred. The additional cost incurred due to subsequent legislation should be requested separately in addition to the additional cost due to price escalation.

F. Fluctuation in Money Exchange Rates

The exchange rate is particularly relevant if contracting services or other elements of the project are being purchased. If exchange rates change beyond the level predicted by the project sponsor (and the companies providing the services) then the cost of the project can increase. It can of course operate in the opposite way where the project sponsor takes advantage of a strengthening of his own currency.

A study conducted in Nigeria revealed that, about 50 percent of the building materials and components incorporated into construction or parts of the materials ingredients required for the manufacture of the materials are sourced from overseas and this brings to closer attention the issue of foreign exchange and its inherent problems in construction industry and the need for local sourcing of building materials (Udeh, 1991).

In the building construction sector, material as an indispensable resource constitute about 60 percent of the total cost of building (Omenge and Udegbe, 2000).

A common finding of studies is that cost is affected by a large number of factors essentially demand and supply. However, Ogunsemi (2002) submits that in Nigerian Construction Industry in the recent past, many projects have been subjected to cost and time overruns. Considering the relationship between construction industry and the national economy, it becomes necessary that the cost of construction be within the reach of the average citizen. However, some economic indicators are very significant to the overall cost of construction. Some of these indicators include; exchange rate of local currency to other currencies in the world, inflation rate and interest rate charge on loan among others.

G. Increase in Global Demand for Construction Materials

One of the most fundamental factors determining the prices of any products or services including construction is the relationship between demand and supply in which the market prices are determined by the equilibrium conditions. However, this equilibrium is not static. It is determined by dynamic forces of the market and evolves over time as some sectors become more attractive than the others (Sanderson, 2006).

In the last decade, the capability of material sources has not increased as much as demand has increased. This gap in the supply-demand equilibrium has resulted in increases in material prices. Steel, asphalt, cement, and aggregates are some of the most strongly affected commodities (Ajibade, 2009).

H. Limited Capacity of Material Producers

The availability of material sources is falling short of the market demand. Some of the materials which are affected by this gap in demand and supply are cement, asphalt, and steel, among others. Material producers design the capability of their production facilities based on a prediction of future demand. If there is a large uncertainty in future demand, material producers typically design their production facilities short of expected demand (Damnjanovic, 2008).

I. Local or Municipal Regulations

Local municipality regulations can affect project schedule. Local regulations restrict working hours. The disposal of waste, borrow-pits, and use of certain class of machinery is governed by local regulations, which are often stringent (Wimsatt, 2008).

J. Increase in Material Cost

Costs of materials and oil-based fuels significantly impact the overall price of bid items. With demand for construction in both domestic and international markets increasing in past several years, the prices of construction materials have also increased. This can be attributed to a number of factors including limited capacity to produce materials, lack of competition, and price of energy. In fact, the prices of some materials are in direct correspondence to the prices of oil-based fuels (e.g., asphalt) and energy in general (ACAF, 2008).

K. Shortage of labors / skilled workers

The current high volume of construction is creating a high demand for skilled construction workers. Labor shortages can have severe consequences especially sectors like construction, given the inter-relatedness of the production process and the backward and forward linkages that are involved (Henson and Newton, 1995). The shortages of skilled labor increase the contractor's risk, by increasing the likelihood of delay. The most obvious and direct consequence is that the construction job does not get started or completed in a timely fashion.

From section 2.8 of the literature review, the following table consists of causes of price escalation are identified as variables for use in the survey.

Table-2.1: Identified causes of price escalation variables for use in the survey

No.	Internal Factors	External Factors
1	Delivery/procurement approach	Local concerns and requirements
2	Project schedule changes	Force Majeure
3	Engineering and construction complexities	Change in Legislation
4	Poor estimating	Fluctuation in money exchange rates
5	Inconsistent application of contingencies	Increase in global demand for construction materials
6	Ambiguous contract provisions	Limited capacity of material producers
7	Improper planning and/or improper implementation of proper planning	Local or municipal regulations
8		Increase in material cost
9		Shortage of labors / skilled workers

2.9. Methods of Price Adjustment

Price adjustment is a method of transferring the risk associated with increasing material prices from the contractor to the contracting agency (Brown, 2011). Price adjustment allows the price of material to fluctuate without imposing additional risk to the agency or the contractor.

The construction industry has been challenged with the rise of construction delivery costs which in some cases do not tally with the budgeted ones owing to the continuous and unpredictable change of the macroeconomic environment. Given such a situation, contractual clauses have been formulated to cater for optimum recovery of price escalations. Subsequently, various increased cost adjustment methods have been developed and reviewed from time to time (Finsen, 2005).

In projects of reasonably long duration (lasting over one year) undertaken in areas which suffer from persistent inflation, Employers consider it reasonable to compensate Contractors for losses which they might suffer as a result of increases in the prices of Labor, Materials, Fuel, Plant etc.

There are a number of methods of calculating such CPA. Whichever method is used it usually provides for both increases and decreases in prices and can accordingly result in either an increase or a decrease in the contract price. Unfortunately, the norm is that CPA tends to be an escalation of the contract price (ERA, 2006).

Owing to its complex nature, domestic construction projects are accompanied by frequent price escalation due to rises of prices of materials, labor and equipment. There are two alternative methods commonly employed in the local context to determine such variations practiced in the construction industry. The first adjustment method is “Basic Prices” or proven cost method and the second are based upon “Price Indices” or adjustment method (ERA, 2006).

2.9.1. Basic Prices/Proven Cost Method

In using base date prices, the difference between the current date prices and base date prices will be established for each items allowed for adjustment.

When this method is used the Contractor is required, at tender stage, to list those elements of his costs which he requires to be subject to CPA. In support of this he includes a list of the actual costs and suppliers of the various elements upon which he based his tender. When the Contractor purchases these materials he presents proof of the actual price paid and receives compensation for the difference between the "Basic Cost" and the "Actual" invoiced cost of those same items. It is therefore important to ensure that all purchases are from the suppliers identified at the time of the tender. Any change in suppliers is likely to result in an invalid comparison of prices and accordingly overcompensation (ERA, 2006).

It is important, when using this method, that the Employer verifies the authenticity and reliability of the suppliers and prices quoted as the base prices. Any change in supplier is likely to result in different base prices, which will complicate the calculation of CPA.

Although this is the method generally used on European Union funded projects, it is not the preferred method as it has the potential for abuse by:

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

2.9.2. Indices/Formula Method

The amount payable to the contractor shall be adjusted for rises or falls in the cost of labor, goods and other inputs to the Works, by the addition or deduction of the amounts determined by the adjustment formula.

With this 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 to the Contractor (ERA, 2006). To address these problems, the MoWUD 1994 (amendment of MoI 2004), FIDIC 1999, MDB FIDIC 2006, PPA 2006 and PPPAA 2011 form of contracts provide an adjustment formula for price escalation.

2.10. Price Escalation Clauses

An escalation clause is a clause in a contract that guarantees a change in the contract price once a particular factor beyond the control of either party results in an increase or decrease in the Contractor's costs. It is also referred to as "Rise and Fall" which indicates that if the price of certain costs fall then the contract price will be adjusted in the client's favor. What goes up may also go down after all (David and Dirk, 2011).

A price escalation clause allows the parties an opportunity to plan for the uncertainty and allocate how and to what extent the additional costs will be absorbed. Another issue that usually walks hand in hand with price escalations (i.e. supply and demand) is material shortages. The contract should also contain a companion provision allowing for time extensions for material shortages. While many contracts allow for time extensions for unforeseeable circumstances that cause delay, depending on the circumstances, material shortages may be foreseeable (Gaudet, 2002).

2.10.1. Contract Conditions Made Between Contracting Parties

In most case price escalations is administered in Ethiopia by using the following contractual clauses. These are:

A. BATCoDA 1987 Contract Form

Clause 70: Changes in Cost and Legislation, Sub clause (1) Increase or Decrease of Costs

The only adjustments to be allowed are on the difference between the basic prices and market prices of the materials and goods listed in the appendix to the bill of quantities after the bid pricing date.

- The Rates contained in the priced bill of quantities are based upon the market prices of the materials and goods specified in the appendix to the bill of quantities and current at the date of bid pricing (Basic Price).
- If the market price of any of the materials or goods specified in the basic price shall be increased or decreased after the said date of the bid pricing, then the net amount of the difference between the basic price and the market price payable by the contractor.

B. MoWUD 1994 Contract Form

Clause 70, Sub clause (1) Changes in Cost and Legislation

The contract price shall be considered to have been calculated in the manner set out below and shall be subject to the adjustment in the events specified here under:-

- The rate contained in the priced Bill of Quantities are based upon the rates of wages and other emoluments and expenses applicable at the site date of bid pricing.
- If the said rates of wages and other emoluments and expenses are increased or decreased by any Act, Statute, Decree, Regulation and the like after the said date of bid pricing, then the net amount of the increased or decreased of the emoluments and expenses shall, after due consultation.
- By the Engineer and shall form an addition or deduction as the case may be to or from the Contract Price and be paid to or allowed by the Contractor accordingly.

- The rates contained in the priced Bill of quantities are based upon the rates of the Contractor's compulsory contributions payable at the date of bid pricing under or by virtue of any Act, statute, Decree, Regulation and the like applicable at the Site.
- If any of the said rates of contribution shall be increased or decreased after the said date of bid pricing or if any new compulsory contribution becomes payable after that date, then the net amount of the difference between what the contractor actually pays in respect of works people engaged upon or in connection with the works and what he would have paid in respect of such persons had any of the said rates not become payable as aforesaid shall form an addition or deduction as the case may be to or from the contract price and be paid to or allowed by the Contractor accordingly.

MoWUD 1994 conditions assume the market to be a stable one. In the absence of such an adjustment, contractors are obliged to cover the incurred extra expenses offsetting the balance from their profit margin. These conditions do not explicitly address an increase or decrease in cost of labor or materials with respect to the country's market but rather dealt with only increase or decrease of rates of wages and other emoluments and expenses subsequent to change in legislation. It used to amend and ratifies price rise/falls from time to time to address adjustments attributed to price escalation. However, these provisions were later put in to effect through 'Construction Conditions Amendment 001/1996 E.C' by MoI in March 2004. The directive comprises nine amendment clauses where provisions on advance payment and price escalation are dealt with among others.

Most local contractors have been discouraged because of this wrong assumption. However, the issue is brought to attention according to clause 4 of the construction condition amendment of 2004. According to the amendment of MoI (2004) the price adjustment is based on correctly recorded price rise/falls against the basic material price indices stated in the contract i.e. appendix to the BOQ.

C. PPA 2006 Contract Form

Clause 47: Price Adjustments

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

$$P_n = A + b \frac{L_n}{L_o} + c \frac{M_n}{M_o} + d \frac{E_n}{E_o} + etc.$$

Where:

P_n is a price adjustment factor to be applied to the amount in each specific currency for each payment certificate;

“A” is a constant, specified in the Contractor’s Bid, representing the non-adjustable portion in contractual payments;

b, c, d, etc., are weightings or coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) in the Works or sections thereof, net of Provisional Sums, as specified in the Contractor’s Bid; the sum of A, b, c, d, etc., shall be one;

L_n , M_n , E_n , etc., are the current cost indices or reference prices of the cost elements in the specific currency of origin at the date 28 days prior to the deadline for bid submission; and

L_o , M_o , E_o , etc., are the base cost indices or reference prices corresponding to the above cost elements at the date 28 days prior to the last day of the period to which a particular Interim Payment Certificate is related.

If a price adjustment factor is applied to payments made in a currency other than the currency of the source of the index for a particular indexed input, a correction factor 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 current index.

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

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

D. FIDIC 2006 MDB Contract Form

Clause 13: Variations and Adjustments, Sub clause 13.8: Adjustment for Changes in cost

If this Sub-clause applies, the amounts payable to the contractor shall be adjusted for rises or falls in the cost of labor, 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 provision as of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The formula is the same as that of the PPA, and the application is also similar to it except some additional clarifications as described below.

If the Contractor fails to complete the works within the Time for Completion, adjustment of prices thereafter shall be made using either:

- Each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or
- The current index or price: whichever is more favorable to the employer the weightings (coefficients for each of the factors of cost stated in the table(s) so adjustment data shall only be adjusted if they have been rendered unreasonable, Unbalanced or inapplicable, as a result of Variations.

E. PPPAA 2011 Contract Form

Clause 62: Price Adjustments

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

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

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

- In case of default on the part of the Contractor causing delay in original scheduled completion, the rate of Price Adjustment will be frozen at the original scheduled date of completion; however Price Adjustment will be applicable till actual completion. While computing Price Adjustment beyond the scheduled completion period, in the event the rate is reduced, then that reduced rate will be applied.
- The Price Adjustment will be payable in full for the extended period if the Contractor has been granted an extension of time for no fault on the part of the Contractor, duly approved by the Public Body.

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

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

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

Where:

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

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

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

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

BLI = Benchmark Average Labor Category Earnings Index applicable to the Works either: at the bid closing date, or if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

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

MMI = The most recently available selected Material Price Index on the date on which the Public Body received notification of the proposed increased price from the Contractor;

BMI = Benchmark selected Material Price Index applicable to the Works either: at the bid closing date, or if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

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

MEI = The most recently available selected Equipment Price Index on the date on which the public Body received notification of the proposed increased price from the Contractor;

BEI = Benchmark selected Equipment Price Index applicable to the Works either: at the bid closing date, or if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

D = The fraction of the Contract Price subject to adjustment in accordance with movements of the Average Fuel Price Index

MFI = The most recently available Average Fuel Price Index on the date on which the Public Body received notification of the proposed increased price from the Contractor;

BFI = Benchmark Average Fuel Price Index applicable to the Works either: at the bid closing date, or if the Contract Price has been adjusted previously, the date on which the Public Body received notification from the Contractor in respect of the last adjustment to effect the current Contract Price;

BC = Current Contract Price applicable to the Works

Q = Quantity;

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

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

Table 2.2: Summary of Contract Forms

<i>No.</i>	<i>Conditions of contract</i>	<i>Description</i>
1	BATCoDA (1987) Clause 70	<p style="text-align: center;"><i>Increase or decrease of costs</i></p> <ul style="list-style-type: none"> • The current market prices at the date of bid pricing (basic prices) shall be supported by bona-fide quotation from suppliers. • Only the net amount of the price difference between the base price and the current price at the time of the adjustment will be payable to the contractor.
2	MoWUD (1994) Clause 70	<p style="text-align: center;"><i>Changes in Cost and Legislation</i></p> <p>changes must be for adjustment of changes in cost and legislation, the following are the conditions for payments:</p> <ul style="list-style-type: none"> • Changes must be Act, Statute, Decree, Regulation and the like • Net difference of costs shall be payable in addition to or deduction from the contract price • The contractor shall give written notice • The adjustments are calculated with reference to date of bid pricing
3	PPA (2006) Clause 47	<p style="text-align: center;"><i>Price Adjustments</i></p> <ul style="list-style-type: none"> • Prices shall be adjusted only for fluctuations in of costs the input only if provided in the SCC. • These inputs have to be proposed and submitted by the contractor along his bid and is subjected to the approval of the engineer • It would be applied only if it is provided in the special conditions of contract • Provisional of each cost element (labor, materials, equipment usage, etc) are net of provisional sum • Price adjustment of cost elements are made in comparison of their current cost at the time of the adjustment with their prices at the date 28 days prior to the deadline for bid submission • The sources of indices shall be those listed in the contractor's bid and approval by the engineer • Price adjustment is recommended for contracts having completion time exceeding 18 months

<p>4</p>	<p>FIDIC (2006) MDB Clause 13.8</p>	<p style="text-align: center;"><i>Adjustment for Changes in cost</i></p> <p>The formula is the same as that of the PPA, and the application is also similar to it except some additional clarifications as described below.</p> <p>If the contractors fails to complete the works within the time of completion, adjustment of price thereafter shall be made using either:</p> <ul style="list-style-type: none"> • Each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or • The current index or price: whichever is more favorable to the employer the weightings (coefficients for each of the factors of cost stated in the table(s) so adjustment data shall only be adjusted if they have been rendered unreasonable, Unbalanced or inapplicable, as a result of Variations.
<p>5</p>	<p>PPPAA (2011) Clause 62</p>	<p style="text-align: center;"><i>Price Adjustments</i></p> <ul style="list-style-type: none"> • Request for price adjustment in relation to a particular work items under this Contract may be filed by the Contractor after twelve (12) months from the effective date of the Contract where it is verified that the performance of the contract requires more than 18 months, which adjusted price takes effect as the new Contract Price in relation to that work item on the expiration of 30 days from the date on which the Public Body receives notification of that adjusted price from the Contractor, unless another date is agreed in writing between the Parties. • Price Adjustment shall be applicable as payable in full for the original scheduled completion period. • Unless specifically stated otherwise in the Contract, the basis for compensation will be only those categories of inputs, which are specifically listed as specified items in the SCC. • Contractor shall submit to the Public Body for review and approval all calculations and supporting information necessary to determine the price adjustment. • The fraction for each specified element and exact combination of elements that will be applied in the formula for price adjustment shall be determined in the SCC.

2.11. Effects of Price Escalation

The impact on the construction industry of the recent, unprecedented price escalation has been multi-fold. Certainly, cries have come from the contractor and subcontractor community of eroded or eliminated profit margins, as well as significant project losses. In addition to lost fees, and damaged or destroyed construction businesses, the ripple effect of this dramatic price escalation has included numerous other impacts (ENR, 2004 and 2005).

Price fluctuation can have effect on contractors, clients/owners and the project itself. The major effects of price fluctuation on contractors, if not well compensated is cash flow (project financing) problem of the projects (Stukhart, 1982 and Abdo, 2006 in Asteway, 2008).

A. Delayed and Cancelled Projects

In the world of private development, material price escalation has been significant enough to cause many developers to rethink the “numbers” necessary to make a private development worthwhile. Delayed projects, reduced-in-scope projects, or cancelled projects have been the result. The same impact is being felt in the public construction sector.

For public projects that must be funded by bond issues, significant project price increases present special problems. In a number of projects, between the time a bond was approved by the voters and the time bids were received for construction projects, material prices increased significantly and bids came in at prices much beyond the approved contract amounts. Public bodies are then faced with the alternatives of putting projects on hold while supplemental funding is sought, canceling the project if additional money is not available, or attempting to scale-down the project scope (Van der Schans, 2005).

B. Reduced Numbers of Bidders

In part because of the current level of activity in the construction industry, but also in part because of escalation fears, owners are finding fewer bidders for their projects. States where asphalt supplies have been impacted are seeing fewer bidders for highway and paving projects. Owners are seeing more “one bidder” projects and an overall reduction in the number of bidders for projects (ENR, 2006).

C. Higher Project Costs

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

D. Dispute Among Parties

Disputes are insidious often resulting in time overrun, cost escalation, litigation, and complete abandonment of projects (Sambasivan and Soon, 2007). Many construction disputes are arising out of disagreement and delay of hardship and expense during the construction project. Disputes in construction may be caused by one or a combination of several reasons. Most of the typical disputes are caused by factors such as unrealistic contract duration and costs, impact and ripple effects of delays, evaluation of the quality and quantity of works, differences in the interpretation of plans and specifications, unfulfilled duties, inefficiency and disruption (Groton, 1997).

The following effects of price escalation are identified and summarized as variables for use in survey.

- ▶ Delay
- ▶ Cancelled Projects
- ▶ Reduced Numbers of Bidders
- ▶ Higher Project Costs
- ▶ Cash flow (project financing) problem of the projects
- ▶ Dispute among parties

2.12. Problems of Price Escalation and Adjustment

Price escalation in transport projects is one of the most important problems in transport planning. The conventional price escalation study has been carried out by academics at universities and research institutes. The study results, including recommendations and new

methods for better cost estimation are published in scholarly articles, books and journals. In some cases, the transport organizations or authorities employ academics and/or private consultants to study the price escalation of their projects (Priemus et. al., 2008).

According to Flyrbjerg and Bent (2005) the independent government auditors are responsible for monitoring the accountability, effectiveness and efficiency of public spending. They give recommendations to the Parliament on how to improve the use of the national budget. In some countries, government auditor provides detailed investigations to explain the causes of price escalation and study the frequency and magnitude of price escalation. Even though, the academics and the independent government auditors have the same main interest which is price escalation in transport projects.

The construction industry has been challenged with the rise of construction delivery costs which in some cases do not tally with the budgeted ones owing to the continuous and unpredictable change of the macroeconomic environment. Given such a situation, contractual clauses have been formulated to cater for optimum recovery of cost escalations. Subsequently, various increased cost adjustment methods have been developed and reviewed from time to time (Finsen, 2005).

Fixed price contracts were no longer suitable for such an economic environment since contractors were at risk with regard to recovery of profit due to cost escalation. Contracts were then subject to a cost-escalation provision in which a contractor was compensated for all increases in costs since the base date of tendering. Since then, several methods for cost recovery have been tried and these include traditional method and CPI based formulae. However each of these methods has shortcomings with regards to optimum cost recovery (Atkinson, 1992).

The rapidly rising costs lead to the complications of "price escalation." In the absence of fair and balanced contracts, coupled with the lack of suitable "dispute resolution mechanisms," rising costs cause serious disputes on price escalation. This paralyzes on-going projects and seriously affects the prospects of maintaining and developing future business relationships. Problems relating to construction price escalation include clients resist honoring the escalation clauses; escalation clauses do not adequately compensate increase in prices and uncompensated increase in cost of construction materials (Flyvbjerg et. al., 2004).

The contract price adjustment formula is a method of compensation or reimbursing for price fluctuation in labor costs, material prices, plant and equipment and fuel (De Vynck, 2002). CPAP stipulates that the purpose of the formula was to provide for the needs of contractors who required a clear-cut, agreed recovery formula method to avoid dissension and disputes with employers and subcontractors and provide a reasonable reimbursement of unusual price fluctuations.

This formula is based on the CPI by the Central Bureau of Statistics. The CPI number measures relative price changes from one time period to another. The problem with the CPI is that it may overestimate or under estimate the market conditions as at how prices have risen and selection of the most suitable index to use was the main problem in using inflation indices. When the formula is used, no attempt is made to calculate the actual amount of loss involved; consequently, the sums recoverable by the formula method will differ from these recoverable under traditional method and will be usually greater (Ramus et al., 2006).

Trickey (1983) contended that by relying on an incorrect index could give very misleading results. Since no audit of the amount of cost increase is done for each individual item, one would wonder whether clients pay the real losses incurred. CPAP clearly states that the formula cannot precisely reflect the actual cost fluctuations on any particular piece of work or contract.

De Vynck (2002) noted that the proportions and indices applied are indicative of average price movements and do not represent any particular contract. In low inflation environment, CPI formulae may operate satisfactory.

The following problems in price escalation and adjustment are identified and summarized as variables:

- ▶ Clients resist honoring the escalation clauses
- ▶ Escalation clauses do not adequately compensate increase in prices
- ▶ Uncompensated increase in cost of construction materials
- ▶ Construction Price Indices may overestimate or under estimate the market conditions as at how prices have risen
- ▶ Selection of the most suitable index in using inflation indices

2.13. Managing Price Escalation

In order to measure or manage escalation on construction projects, it is first important to understand the driving forces behind it. This is especially critical in the current situation, where price fluctuations have been so volatile that it has been difficult to predict or estimate what bid prices might actually be (Peter and William, 2006).

As can be seen, cost escalation in the construction market is a cumulative effect of a number of different factors. Many of the strategies will demand new ways of approaching construction design and procurement, and a redistribution of the risk allocation in projects.

A. Recognition

The first step is to recognize that escalation is a real threat to construction programs and projects, and to acknowledge its existence. There is still a high degree of wishful thinking in project budgeting, hoping that escalation is not going to remain high. Project owners must first:

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

B. Cost Risk Allocation

The dominant escalator in the current market is poor risk allocation. Traditional bidding methods place a bulk of the risk on those who are least able to absorb any fluctuations in cost. To manage cost escalation and minimize the impact of future cost increases or other factors which will surely arise to put additional pressure on the market, project owners need to change how they think about, and handle projects. Perhaps the most important thing project owners can do to minimize the impact of the volatile construction market is to become partners in the risk. This takes the burden of handling market volatility off the back of the contractors and vendors and in turn reduces the pressure for bidders to charge premiums (Peter and William, 2006).

The first step is for project owners to take more responsibility for the risk associated with material price fluctuations. Because the owner is much more diversified, they are better able to

handle the risk. This can be done in a number of ways at each level of the design and build process. To help absorb the risk for the contractors, project owners can:

- Use fluctuation clauses, which allow for shifts in material costs; in other words, the owner agrees to cover the cost of materials and does not require the contractor to submit a fixed price for something they may not be able to purchase for quite some time.
- Pre-purchase materials and suppliers partnership to limit the impact of future price fluctuations
- Provide dedicated float for schedule slippage by understanding that, due to the current market and transient material shortages, some scheduling delays may be inevitable.
- Reduce the bid award period to accommodate shorter price locks.
- Negotiate subcontracts along with the contractors.
- Use Cost-Plus contracts.
- Consider locally available materials in design.

To help absorb the risk for the architects and engineers, project owners can:

- Limit the redesign clause. This has some far reaching consequences, in that owners must be willing to take more responsibility for the final design and not count on redesign to catch changes in scope.

At the program level, project owners can:

- Develop program-wide contingencies and risk management protocols. This requires first recognizing the types of risk that exist and then ensuring that all members of the project team understand and are trained on how to deal with them.

At all levels of the project, the key thing for the project owner to do is to actively manage design and cost, by ensuring that all participants in the design process are fully aware of budgetary constraints as well as the impact of any changes or delays on overall project cost (Atkeson et.al., 2001).

The following are methods/tools to manage/administer price escalation identified and summarized as variables for use in survey:

- ▶ Consider fluctuation/escalation clauses
- ▶ Bulk material purchases and suppliers partnerships
- ▶ Use Cost-Plus contracts
- ▶ Develop program-wide contingencies and risk management protocols
- ▶ Regular cost monitoring throughout the project
- ▶ Consider locally available material in design

CHAPTER THREE

3. METHODOLOGY

3.1. General

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

Accordingly this chapter provides a general description of the research strategy adopted for this thesis, as well as justification of the methodology.

3.2. Study Area Description

ERA is a federal road authority under the Ministry of Transport and Communication for the Development and Management of major highways and link roads (called federal road construction projects) throughout the country. The geographical organization of ERA constitutes five regions (North, South, Central, East and West) which sub divide in to districts. They develop RSDP to expand Ethiopian road network which is divide in to different phases (phase I-IV) beginning from 1997 up to 2015.

Until May, 2012, there are total of 471 projects in federal road network of the country, which were completed, under construction, under design, under procurement and feasibility study. Among those around 282 projects are after June 2006.

Currently the country's total road coverage stands at 49,000 kilometers (up to June, 2010) and this figure will be boosted up to 136,044 kilometers, under the new Government's Growth and Transformation Plan, in the upcoming five years (2010-2015). Among those federal road network covers 27,850 kilometers from 471 projects (ERA, 2010).

3.3. Research Process

The strategy followed in this research was first started with problem identification which has been done through unstructured literature review, archival study and informal discussion with colleagues and professionals in the sector; and then the research design was formulated.

Then data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided; and available documentary sources relevant to the research were reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress reports, completion reports and contract documents within Ethiopian Roads Authority. The document search was mainly intended to collect values of price escalation and their causes from some upgrading, rehabilitation and new projects which was completed/ substantially completed and ongoing projects through random selection and focusing on projects with higher price escalation values for further investigation - to identify important price escalation variables.

Finally, after an in-depth review of literature and desk study, a questionnaire was designed and distributed to contractors, consultants and the employers (ERA) to get their professional opinion based on their experience. Upon obtaining the desired data, checking and sorting of data has been done. The data were then analyzed for cross-checking the validity and conformity of the information obtained through the overall research work. This was followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

A descriptive and exploratory survey design was used in this study. It was attempted to collect data from the relevant population (ERA, consulting firms and contractors) to evaluate the perception of different stakeholders on the issues of price escalation, ranking of project price escalation variables, its consequences, and the current practice of price escalation administration/management in federal road construction projects.

The whole research document is classified into five (5) major parts and show in figure 3.1 below:

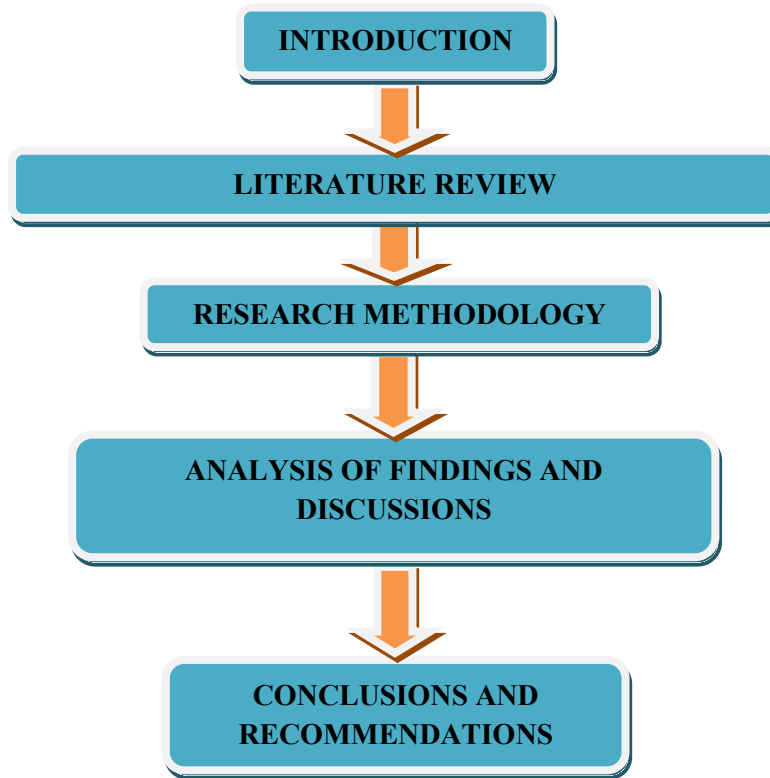


Figure 3.1: Flow chart of the research process

3.4. Data Collection

3.4.1. Source of Data

Primary data's were collected through questionnaire and interview, while secondary data's were collected through archival documents/literatures (journals, reports, researches, text books and case studies).

3.4.2. Population and Participants

The population of the study is road construction projects in South and West regions whose constructions were started after June 2006 and their construction progress was more than 70% completed accordingly (33 projects) were identified and its participants under Ethiopian Federal Road Network. The basis of selecting these particular regions were based on the information and document availability as well as price escalation was more occurred in the regions. The

information's about the projects are shown in Appendix B. Here Client (Regional Directorate, Counterpart Engineers, Federal road network planners and programmers), Consultants (General Managers, project coordinators, resident engineers, project supervisors) and Contractors (project managers, project management teams, General Managers) were the key participants of the study.

3.4.3. Sampling Technique

A stratified random sampling followed by systematic random sampling technique was used to select a representative sample from the population for questionnaire. In the Figure below the populations are classified in to three strata. The strata is based on physical activities that is Rehabilitation (4 projects), Upgrading (18 projects) and New construction (11 projects) where 3, 14 and 8 respectively were considered for the study (Fig. 3.2). This is done to make homogeneous characteristics in one group and to include heterogeneous characteristics. From each stratum the sample was selected through systematic random sampling.

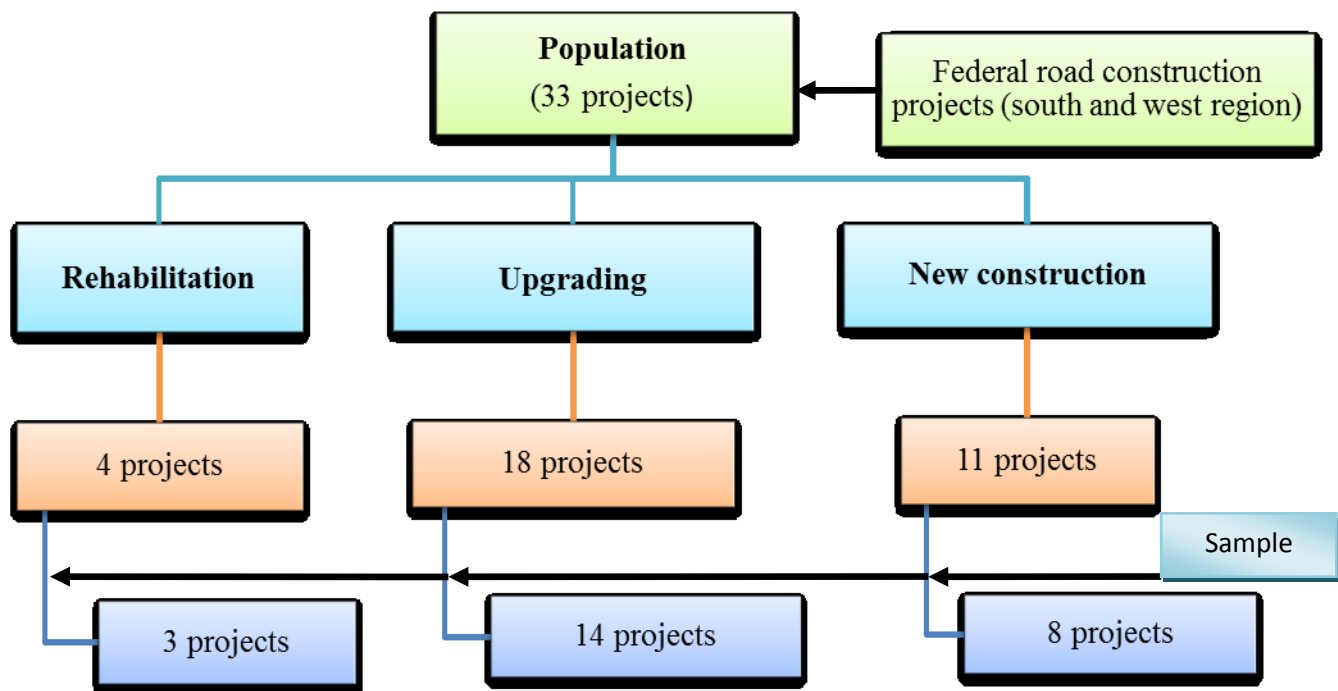


Figure 3.2: Sampling technique

3.4.4. Sample Size

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

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

Moore et al, (2003) showed that the sample size can be calculated using the following equation:

$$n = \frac{n^1}{1 + \frac{n^1}{N}} \dots \dots \dots \text{equation 3.1}$$

$$n^1 = \frac{S^2}{E^2}, s^2 = p(1-p) \dots \dots \dots \text{equation 3.2}$$

Where:

N- Total population = 33

n = sample size from finite population,

n¹= sample size from infinite population,

S²= the variance of the population elements, **S² = p(1 - p)**.....equation 3.3

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

E= Standard error of the sampling distribution

Assumptions:

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

Hence solving for n^1

$$s^2 = P(1-p) = 0.5(0.5) = 0.25$$

$$E^2 = 0.05^2 = 0.0025$$

$$n^1 = \frac{s^2}{E^2} = \frac{0.25}{0.0025} = 100$$

$$n = \frac{n^1}{1 + \frac{n^1}{N}} = \frac{100}{1 + \frac{100}{88}} = 24.8 \sim 25$$

$$n = 25$$

The sample size formula used above provides the minimum number of responses to be obtained. Addition of 10% of the sample size was made to compensate for non-response rate. For desk study four projects were selected and analyzed.

3.4.5. Data Collection Tools/Instruments

Among the different tools used to collect data, case studies, self-administered questionnaire in the form of both close and open-ended questions and informal interviews were used to collect all the relevant data used to answer the research question.

3.4.5.1. Questionnaire

In collecting the necessary data from the sampled population through questionnaire, the researcher prepared a total of fourteen questions under six parts. The first part is related to respondent's general information, the second part sought information from respondent on factors causing price escalation, the third part addresses the possible effects of price escalation, the fourth part related to price escalation adjustment, the fifth part addresses price escalation adjustment problems while the last part states about managing or administering price escalation.

More than 71 Self-administered questionnaires were distributed and collected among the sampled population. The detail of Questionnaires design is shown in Appendix A.

3.4.5.2. Desk study

The researcher selected four projects as a desk study from two regions of ERA's projects, each takes two projects. The purpose of the desk study is to supplement the gap not covered by the survey. The projects are Wacha-Maji (Project "A"), Delbena-Jinka (project "B"), Alaba-Humba

(Project “C”) and Assossa-Kurmuk (Project “D”), and codes of each projects are shown in brackets as stated. Projects A, B, C, and Dare selected from South and West Regions respectively.

Archival documents like completion report, progress report, payment certificates and contract documents are used as data source for each case. The general information’s about the selected projects (desk study) are shown in Appendix C.

3.4.5.3. Interview

Informal interviews were used for the case studies parts. The interviews were used to fulfill some missing data in the archival documents and data’s. The interviewees were any concerned body available at the organization office by the time of document analysis.

3.5. Data Analysis

The procedure used in analyzing of data was aimed at establishing the relative importance of the various factors that causing price escalation, its effect, problems of price escalation adjustment and managing/administering price escalation of federal road construction projects in Ethiopia. There are three steps in analyzing the data:

- Calculating RII
- Ranking of each factors based on RII
- Determining degree of correlations in ranking the variables among Clients, Consultants and Contractors.

In the analysis, the “Relative Importance Index” methods were adopted to determine the ranking relative importance of variables for federal road construction projects of Ethiopia. The method was adopted in this study within various groups of respondents (Clients, Consultants and Contractors). The five point scale (0, 1, 2, 3, and 4) was used to calculate the relative importance index for each variable which was then used to determine the relative ranking.

3.5.1. Questionnaire Analysis

The data collected through questionnaire were analyzed through percentage method for question number two in part one, average score method for question number three, four and five in part

one and part two, part three, part five, and part six question was analyzed through relative importance index. The five ordinal measure of agreement of Likert scale represent the following rating:

Ordinal scale used for the measurement of rate of occurrence for factors causing price escalation:

Table 3.1: Rating scale for factors causing price escalation

Item	Never	Seldom	Sometimes	Often	Always
Scale	0	1	2	3	4

Ordinal scale used for the measurement of the degree of significances for effects of price escalation on road construction projects:

Table 3.2: Rating scale for effects of price escalation

Item	No significance	Minor significance	Average significance	High significance	Extreme significance
Scale	0	1	2	3	4

Ordinal scale used for the measurement of the occurrences of price escalation adjustment problems on federal road construction projects:

Table 3.3: Rating scale for price escalation and adjustment problems

Item	Never	Sometimes	Usually	Frequently	Most Frequently
Scale	0	1	2	3	4

Ordinal scale used for the measurement of the degree of importance of methods to manage/administer price escalation on federal road construction projects:

Table 3.4: Rating scale for methods to manage/administer price escalation

Item	Unimportant	Less important	Important	Very important	Extremely important
Scale	0	1	2	3	4

The relative importance index is computed as (Cheung et al, 2004; Iyer and Jha, 2005; Ugwu and Haupt, 2007):

$$\text{Relative importance index (RII)} = \frac{\sum W}{A * N} \dots \dots \dots \text{equation 3.4}$$

Where:

W is the weight assigned to each factor by the respondents (ranging from 0 to 4)

A is the highest weight (i.e. 4 in this case)

N is the total number of respondents (56 in this case)

The value of relative importance index had range from 0 to 1, where 1 is extremely important and 0 is unimportant.

Spearman's Rank Correlation Coefficient method, which number varies between -1 and +1, was used to know owners, consultants and contractors perceptions of factors causing price escalation, its effect, price escalation adjustment problems and methods to manage/administer price escalation on federal road construction projects.

As spearman's rank correlation (r_s) is a technique to test the direction and strength of the relationship between two variables, the method was adopted in this study to show the degree of agreement between the respondents. It is calculated using the following formula:

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} \dots \dots \dots \text{equation 3.5}$$

Where:

r_s is Spearman's Rank Correlation Coefficient,

d is the difference in the factors ranks given by the respondents and

n" is the number of data pairs.

- A correlation coefficient of **+1** means perfect positive correlation (agreement).
- A correlation coefficient close to **0** means no correlation.
- A correlation coefficient of **-1** means perfect negative correlation (disagreement).

3.5.2. Desk Studies Analysis

To analyze the data's of archival records the researcher used the following procedure:

- Read their Completion Reports, Progress Reports, contract documents and payment certificates thoroughly
- Identify the causes, effects and problems of price escalation encountered during the course of action and the methods to manage/administer price escalation.

CHAPTER FOUR

4. ANALYSIS OF FINDINGS AND DISCUSSIONS

4.1. Introduction

This part of the research deals with the analysis and discussion of the data gathered from the desk study and questionnaire survey. It includes the assessment of the causes and effects of price escalation, problems of price escalation adjustment and methods to manage or administer price escalation in federal road construction projects.

4.2. Questionnaires Finding and Discussion

A self-administered 71 questionnaires were sent to individuals/organizations in the sample space to investigate price escalation for federal road construction projects of Ethiopia. Among those 56 was answered by respondents. Although the result mentioned below may not represent the whole projects under federal road network of the country, respondents were presented with a range of questions designed to identify factors causing price escalation, effects of price escalation, problems in its adjustment and methods or tools to manage/administer price escalation.

4.2.1. Respondent's Profile

Sample description deals with several important issues closely connected with the purpose of current research. It helps to forecast general validity and reliability of data collected from the respondents. The data contains responses of highly experienced participants which work in companies of different size and operate in different parts of the country and moreover all the respondents deal with road construction projects might be able to provide relevant data in order to answer research questions.

The respondents profile includes respondent's type or origin in the organization, Experience on road construction projects and number of road construction projects executed in federal road construction projects.

Small numbers of questionnaires were distributed for Clients (only 15 questionnaires) because for Federal road construction projects there was only one Client (ERA). Therefore the researcher

concludes that the 15 questionnaires may represent the client’s perception towards this research questions. While Contractors and Consultants takes equal numbers of questionnaires respondent’s (each 28 questionnaires) because each sample project contains one Contractor and one consultant and equal proportion of those respondent’s make the sample unbiased.

Table 4.1: Questionnaire distribution

S.N	Participants	Distributed	No. of response	Percent	Cumulative	Response rate (%)
1	Clients	15	14	25.00	25.00 %	93.33
2	Contractors	28	22	39.28	64.28 %	78.57
3	Consultants	28	20	35.71	100 %	71.43
Total		71	56	100		78.87

The overall response rate for the survey was 56 (78.87%). The response rate in the survey was 20 (71.43%) for Consultants, 22 (78.57%) for Contractors and 14 (93.33%) for clients. Figure 4.1, Shows that among 56 questionnaire respondent’s 20 (35.71%) were Consultants, 22 (39.28%) Contractors and 14 (25.00%) Clients, Therefore most of the respondents were contractors.

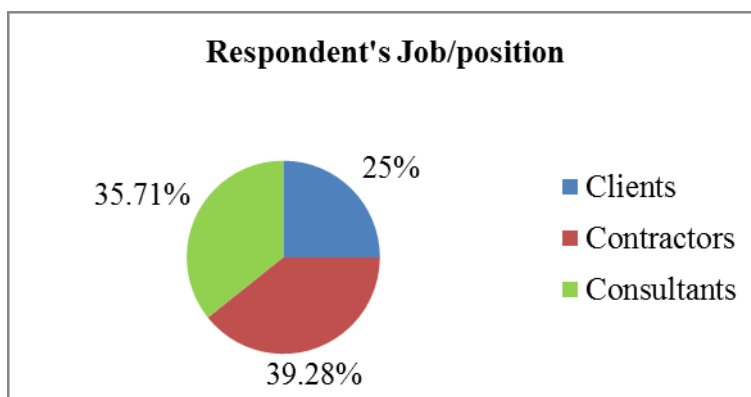


Figure 4.1: Type of respondents` organization

4.2.2. Experience of Respondents

Table 4.2 shows that 39% (22) of the respondents firm have experience less than 5 years at road construction works, 29% (16) of respondents have experience between 5 to 10 years, 18% (10) of respondents have experience from 10 to 15 years and 14% (8) have experience more than fifteen years.

Table 4.2: Experience of respondents (years)

Experience (yrs.)	Client		Consultant		Contractor		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 5	6	43	6	30	10	45	22	39
5-10	5	36	6	30	5	23	16	29
10-15	3	21	5	25	2	9	10	18
Greater than 15	-	-	3	15	5	23	8	14
Total							56	100

Table 4.3 shows that for this study 28% (16) of the respondents they execute less than 5 road construction projects, 36% (20) of the respondents they execute between 5-10 projects and the same percentage of respondents they execute more than 10 projects.

Table 4.3: Experience of respondents on number of projects executed

Experience (projects)	Client		Consultant		Contractor		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 5	5	36	5	25	6	27	16	28
6-10	5	36	6	30	9	41	20	36
More than 15	4	28	9	45	7	32	20	36
Total							56	100

4.2.3. Factors Causing Price Escalation

This section deals with the analysis of the information gathered from the questionnaire survey including identification of rate of occurrences of factors causing price escalation. The factors were grouped into two groups; these groups are internal causes and external causes. Lists of factors causing price escalation were presented to the respondents to score them according to the rate of occurrence on the scale of 0 to 4. Here under each individual factors causing price

escalation Relative Importance Index (RII) perceived by all respondents was computed for over all analysis.

From the ranking assigned to each factors causing price escalation, the most important ones contributing to the causes of price escalation for federal road construction projects of Ethiopia were identified.

4.2.3.1. Internal Causes of Price Escalation

This part of the questionnaire is intended to identify first the respondent's perspective towards the internal causes of price escalation. The table below (Table 4.4) shows, arithmetical ranks of internal factors causing price escalation for which were ranked by the respondent's (Clients, Consultants and Contractors).

The statistical analyses of internal factors causing price escalation for federal road construction projects of Ethiopia have been done using their relative importance index and the correlations between the respondents in ranking the factors have been calculated.

The table below (Table 4.4) the statistical results of respondents in ranking internal factors causing price escalation and relative importance index with their respective rank has been indicated.

Table 4.4: The results of internal factors causing price escalation

Internal factors causing price escalation	Client		Contractor		Consultant		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Poor estimating	0.68	1	0.68	1	0.58	4	0.65	1
Improper planning and/or improper implementation of proper planning	0.59	3	0.57	4	0.70	1	0.62	2
Project schedule changes	0.61	2	0.60	3	0.64	2	0.62	2
Engineering and construction complexities	0.52	4	0.45	6	0.60	3	0.52	4
Ambiguous contract provisions	0.43	5	0.61	2	0.43	7	0.49	5
Delivery/procurement approach	0.34	6	0.53	5	0.49	5	0.45	6
Inconsistent application of contingencies	0.36	7	0.39	7	0.49	5	0.41	7

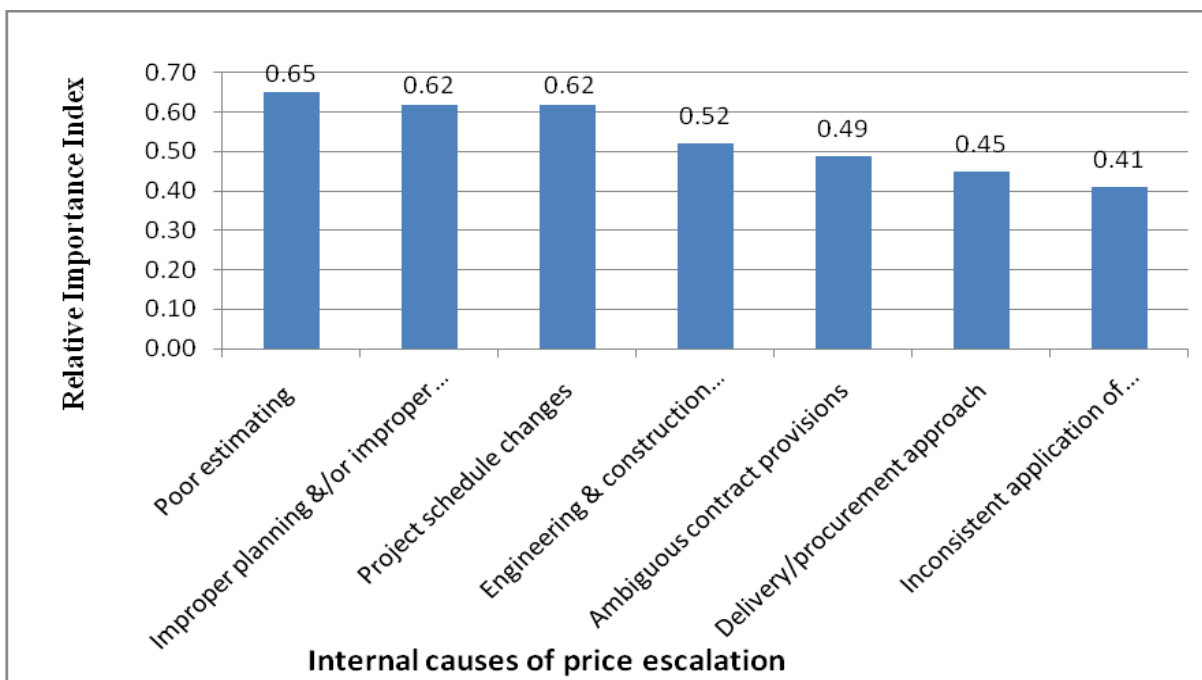


Figure 4.2: Internal causes of price escalation and their relative importance index

As we can see from the combined result shown on figure 4.2, the major internal factor causing price escalation which have been occur on the projects are poor estimating with a RII of 0.65 respectively. This result is identical in terms of order with the clients and contractors, which reflect the importance of this factor.

Construction cost estimate is complex. Comprehensive exercise based on detailed and accurate information is required to achieve reliable levels of comfort. Accurate estimates of project costs provide an essential part of the proper basis for management decisions and control. This result is in line with the results of Hester et al. (1991). More accurate estimations shall enable contractors to produce more reliable cash flow forecasts, which is one of the main factors affecting the overall success of a construction project. Furthermore, owners shall also produce better predictions for the budget allocations of their projects. It is convenience that the owners' primary goal is estimating project cost should be to ensure that the estimating methods will lead to finish the project within budget. The estimation of time and required resource is very critical and important risk. Therefore, proper estimating of the project is crucial to the construction industry.

Improper planning and/or improper implementation of proper planning and project schedule changes pointed out as the second important internal causes of price escalation with RII value of 0.62. Proper planning with respect to client organization during feasibility study preparation of alternatives for achieving specified objectives successfully in terms of time and cost, and with respect to contractor's organization during implementation phase of a project reasonable work planning (activity + allocated time) and strategies used in accomplishing the project within planned time and cost has been identified as significant impact on the success of a project. Like this study result Flyvbjerg et al. (2002) and Molenaar (2005) study finding also showed that proper planning as a leading significant factor. Planning and scheduling are continuing processes during construction and match with the resources and time to develop the work to minimize price escalation and disputes.

While inconsistent application of contingencies place the last rank with RII value of 0.41 and delivery/procurement approach ranked as the second one from the last with RII value of 0.45. However, contingency budgeting is done in order to provide funds for minor change orders, without forcing the client to request additional funds or reallocate funds from other projects. A contingency amount can be planned for and budgeted at project award.

The agreements between the respondents (i.e. between client-consultant, client-contractors and contractors-consultants) in ranking the internal factors have been calculated through spearman's rank correlation coefficient.

The Spearman's rank correlation coefficient in the table below (Table 4.5) shows that relatively there is a moderate positive agreement between Contractors-Consultants, weak negative agreement among Clients-Contractors and no agreement between Clients-Consultants in ranking internal factors causing price escalation of federal road projects in Ethiopia. The moderate relationship between contractors and consultants indicates that they have moderately similar response rank on some internal cause of price escalation.

The reason for the negative and weak agreement between clients and contractors is that their response on ranking of internal causes of price escalation. One of the reason could be resentment as a result of miscommunication that exists between the clients and contractors.

The reason for no correlation between clients and consultants is that their opposite response on the frequency (rank) of the occurrence of the internal causes of price escalation. This could be due to the difference in exposure and the general feeling to the threats of causes of price escalation between clients and consultants in construction projects.

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

Respondents	Spearman's rank correlation coefficient (r's)		
	Clients	Consultants	Contractors
Clients	1.00	0.00	-0.14
Consultants	0.00	1.00	+0.50
Contractors	-0.14	+0.50	1.00

4.2.3.2. External Causes of Price Escalation

A total of nine (9) external factors causing price escalation of a project were identified under this category. These factors were ranked based on its relative importance index assigned by the respondents (Table 4.6). The table below shows external causes of price escalation, its relative importance index and their ranks between respondents of clients, contractors and consultants.

The statistical analyses of external causes of price escalation in construction projects have been done using their relative importance index and agreements between respondents in ranking the external causes has been done through spearman's correlation coefficient.

Figure 4.3 shows the results of relative importance index of the external factors causing price escalation. Based on statistical result increase in material cost (material price fluctuation) is very critical for the causes of price escalation of a project with relatively high relative importance index of 0.90 which indicates the high importance of materials in the project. Increase in material cost (material price fluctuation) is one of the clearest factors that cause price escalation of the project. This result coincide with result of ACAF (2008) that increase in material cost (material price fluctuation) is one of the important causes of price escalation.

The fluctuation in the cost of construction materials is associated with the location of project country, the economic level, and the volume of required materials. The result of this factor

differs from country to country. In Ethiopia the markets are limited, increases the problems of materials.

The second important factors ranked by respondents were increase in global demand for construction materials. The closures will lead to shortage of construction materials. If the contractor was not well prepared for such situation, the project will be delayed. This result reflects the importance of materials in the construction process.

From table 4.6, it can observe that fluctuation in money exchange rate is ranked by both clients itself and consultants as secondary influential factors for price escalation of a project. This confirmed that since the exchange rate has been deregulated, the prices of all materials and services have been increasing. Foreign exchange rate volatility may also impact on global trade patterns and thus affect a country's balance of payments position.

While local or municipal regulations ranked as a least external causes of price escalation with relative importance index of 0.37. In ranking this cause there is a perfect agreement between consultants and contractors (Table 4.6).

Table 4.6: The result of external factors causing price escalation

External factors causing price escalation	Client		Contractor		Consultant		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Increase in material cost (material price fluctuation)	0.93	1	0.90	1	0.88	1	0.90	1
Increase in global demand for construction materials	0.86	3	0.88	2	0.69	3	0.81	2
Fluctuation in money exchange rates	0.89	2	0.78	3	0.70	2	0.79	3
Limited capacity of material producers	0.68	4	0.69	4	0.60	4	0.66	4
Shortage of labors / skilled workers	0.52	6	0.65	5	0.46	7	0.54	5
Change in Legislation	0.63	5	0.49	7	0.50	5	0.54	5
Force Majeure	0.46	7	0.55	6	0.50	5	0.50	7
Local concerns and requirements	0.52	6	0.41	8	0.45	8	0.46	8
Local or municipal regulations	0.45	8	0.26	9	0.41	9	0.37	9

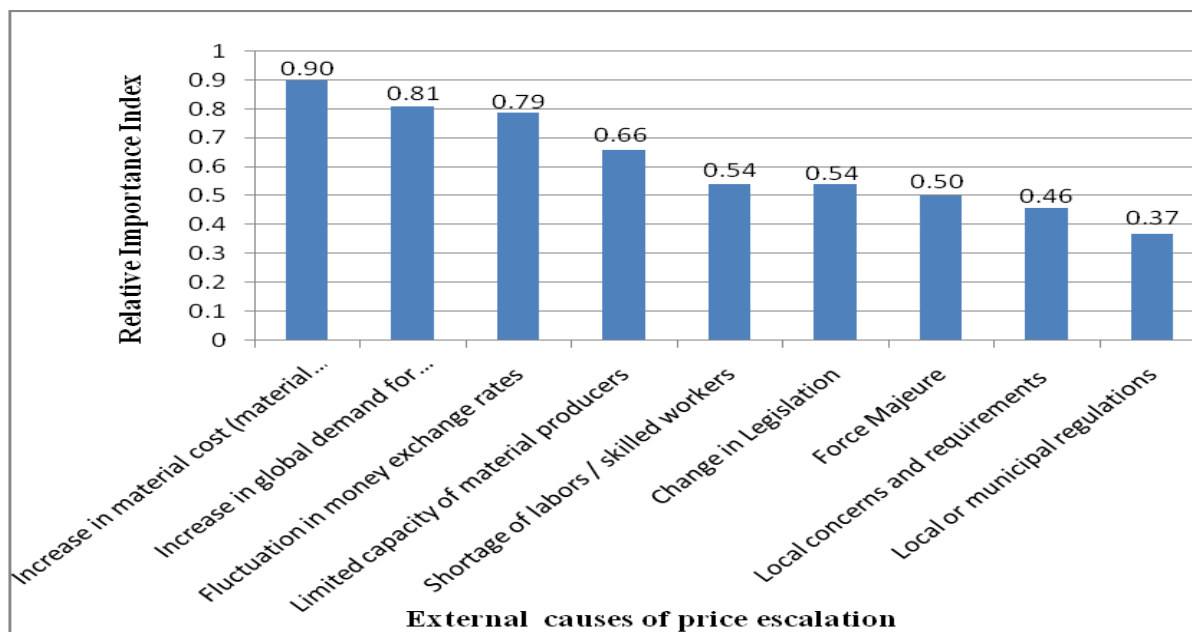


Figure 4.3: External causes of price escalation and their relative importance index

The agreements between the respondents (i.e. between client-consultant, client-contractors and contractors-consultants) in ranking the external factors have been calculated through spearman’s rank correlation coefficient.

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

Respondents	Spearman’s rank correlation coefficient (r’s)		
	Clients	Consultants	Contractors
Clients	1.00	+0.39	+0.21
Consultants	+0.39	1.00	+0.94
Contractors	+0.21	+0.94	1.00

The Spearman’s rank correlation coefficient in the above table (Table 4.7) shows that relatively there is a very strong positive agreement between Contractors-Consultants and weak positive agreements between Clients-Contractors and among Clients-consultants in ranking external factors causing price escalation on federal road projects in Ethiopia. The strong correlation between consultants and contractors indicates that they have the same attitude and perception towards the external causes of price escalation.

The weak correlation of contractors to clients and consultants implies that contractors have too different attitudes with the owners and consultants. The contractor was the mainly challenged party due to the occurrence of the cause of price escalation.

4.2.4. Effects of Price Escalation

The degree of effects of price escalation varies on the stakeholders in the construction industry; all the parties involved are affected by price escalation. The first victim of price escalation would be the project owner since he has envisaged his construction project to be realized within an allocated cost and time frame.

Price escalation does not affect only those parties that are involved directly in the construction of a project, but its effects pass to the construction industry as a whole and consequently to the national economy of the country.

A section of the questionnaire containing potential effects identified from literature was presented to respondents. Respondents were requested to indicate the most recurrent effects of price escalation from the listed potential effects on a 5-point Likert's scale as ranked from 0-4 (when 4 represents extreme significant effects while 0 is less significant), based on their experience to evaluate the frequencies of the effects in Federal road construction projects.

From each of these responses to identify the consequential effects of price escalation, results were analyzed in order to identify the major ones among the potential effects. The result of this analysis based on their relative importance index of the parties involved in the survey.

The statistical analyses of project effects of price escalation on federal road construction projects of Ethiopia have been done using their relative importance index and the correlations between the respondents in ranking the effects have been calculated.

From the ranking assigned to each effect, the most important effects of price escalation on federal road construction projects of Ethiopia were able to be identified. The table below (Table 4.8) shows, arithmetical rank of effects which were ranked by the respondent's (Clients, Consultants and Contractors). The rank was based on the value of relative importance index assigned to effects.

Table 4.8: The result of effects of price escalation

Effects of price escalation	Client		Contractor		Consultant		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Higher Project Costs	0.89	1	0.88	1	0.85	1	0.87	1
Cash flow (project financing) problem of the projects	0.77	2	0.84	2	0.70	3	0.77	2
Delay	0.73	3	0.77	3	0.71	2	0.74	3
Dispute among parties	0.71	4	0.57	4	0.64	4	0.64	4
Reduced Numbers of Bidders	0.55	6	0.47	5	0.48	5	0.50	5
Cancelled Projects	0.61	5	0.28	6	0.38	6	0.42	6

Based on the result of statistical analysis through relative importance index, higher project costs, cash flow (project financing) problem of the projects, delay, dispute among parties, reduced numbers of bidders and cancelled projects are listed from high to low according to their degree of importance respectively.

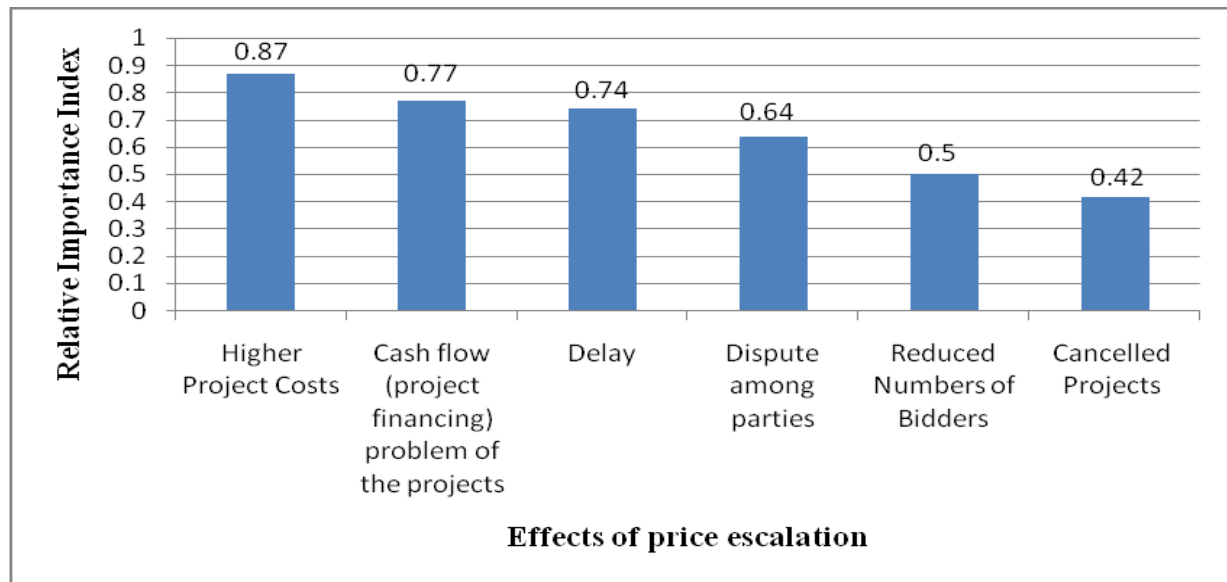


Figure 4.4: Effects of price escalation and their relative importance index

The result of statistical analyses in figure above indicated that a higher project cost takes the highest rank with RII value of 0.87. Excessive cost escalation requires additional budget, this in

turn eat up the scarce financial resources of the country, which lead to further budget short fall for construction projects. This prevents the planned increase in property and service production from taking place, and this phenomenon in turn affects, in a negative way, the rate of national growth.

Cash flow (project financing) problem of the projects which means the contractor's cash flow (cash in and cash out) pointed out as the second important effects with RII value of 0.77. This indicates the high importance of cash for the progress of project. Any shortage of cash for the contractor will cause many problems such as slow progress and work decline in productivity. Also the contractors will not be able to purchase the needed equipment and materials for work.

Delay places the third rank with RII value of 0.71. This result is identical in terms of order with the clients and contractors, which reflects the importance of this effect. One of the common effects of price escalation is delay; this in turn affects clients and contractors. In case of delay, the cost of required materials or equipment may increase, or these goods may run out from the local markets, then the price escalations may occur. Furthermore, lengthy delays increase cost escalations tremendously.

From table 4.8, it can observe that dispute among parties is ranked by clients, consultants and contractors as the fourth one with the same RII value of 0.64. Large scale projects usually involved very complex phasing planning and designing, financing and legal aspects. Overlapping and interrelation between the parties involved usually occurred. Thus, this resulted in an increasing number of disputes and related costs between the main contractor and the project owner.

Price escalation will also be a source of dispute among stakeholders and it will lead to adversarial relationship among project participants. To solve these disputes, it takes additional time that affects the project schedule and hence affects the total duration of the project. To the industry as a whole, price escalations could bring about a drop in construction activities, bad reputation, and inability to secure project finance easily from public authorities in the future. All these effects undermine the capability and sustainability of the construction industry.

The agreements between the respondents (i.e. between client-consultant, client-contractors and contractors-consultants) in ranking the effects have been calculated through spearman's rank correlation coefficient.

The Spearman's rank correlation coefficient in the table below (Table 4.9) shows that relatively there is a very strong positive agreement between Consultants-Contractors and weak negative agreements between Clients-Contractors and among Clients-consultants in ranking effects of price escalation on federal road projects in Ethiopia. The reason for weak and negative correlation may be due to resulting effects, which are directly related with who is affected.

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

Respondents	Spearman's rank correlation coefficient (r's)		
	Clients	Consultants	Contractors
Clients	1.00	-0.26	-0.31
Consultants	-0.26	1.00	+0.94
Contractors	-0.31	+0.94	1.00

4.2.5. Assessment of Price Escalation

It is common to come across construction projects experiencing price escalation as a result of multitude factors related to basic construction materials price hike.

In the recent years in Ethiopia, as a result of the successive economic growth, the price of materials on market is observed to be very unstable. Price of everything has greatly increased and is being increased. The construction sector is one of the victims of this high price rise of inputs.

The major components of construction cost directly involved consist of material, labor and equipment costs. And these components can be further divided into sub categories and then to single items.

The questionnaire was developed in such a manner that the respondents give their response by selecting and listing the items that showed price escalation. And the respondents have selected and listed the major materials that showed price escalation on federal road construction projects. According to the respondents the major construction inputs they encountered price escalation in

the federal road construction projects are cement, fuel, foreign labors, local labors, reinforcement, bitumen and equipment.

Increase in work men's wage cannot be a cause of price escalation in the Ethiopian case. If there is an increase in work men's wage due to inflation or due to some other problems in the country, this increased wage rate will be shouldered by the contractor, it will not pass to the project owner as in the case of rise in the cost of cement, fuel, reinforcement bar and asphalt. In the Ethiopian construction industry the contractor can be compensated for the increase in the cost of cement, fuel, reinforcement bar and asphalt. Recently ERA allowed adjustment for foreign labor and equipment cost components. For other items, unless and otherwise specified in the special conditions of contract, price increase is not compensable for contractors.

From the response of respondents (clients, consultants and contractors) on the questionnaire survey, it can be seen that the occurrence of price escalation on construction inputs especially on construction materials is common.

4.2.6. Methods of Price Adjustment

There are two methods of price adjustments; proven (base price) and indices (formula) normally used in the domestic construction industry. Previous projects using proven/base price adjustment methods. Sub-clause 47.1 of PPA 2006, Sub-clause 13.8 of FIDIC 1999 and FIDIC 2006 MDB and clause 62 of PPPAA 2011 edition provide price indices/formula method for adjustment.

Among the respondents 7%, 15% and 14% of clients, consultants and contractors believe the use of proven/base price adjustment method is better. The majority of clients, consultants and contractors (93%, 85% and 86%) respond in favor of price indices/formula method of adjustment.

It is known that there are no established domestic price indices. Therefore among those respondents in favor of price indices/formula methods; 31%, 65% and 63% of clients, consultants and contractors respectively showed the need of establishing local price indices and revise it periodically. On the contrary majority of clients (69%), 24% of consultants and 32% of contractors suggests the use of foreign indices. And 11% of consultants and 5% of contractors suggests that for foreign inputs such as bitumen, equipments and foreign labors, foreign indices can be used. However, for local inputs there is no choice than using proven by ensuring that they are quoted from reliable sources if local indices are not available.

4.2.7. Price Escalation Compensation System

The major components of construction cost directly involved consist of material, labor and equipment costs. While there is a change in cost rise or fall of these direct cost components, provisions provide price adjustment clauses. However, only four material components comprising, cement, bitumen, reinforcement bar and fuel are allowed for price adjustment in the local context. Recently ERA allowed adjustment for foreign labor and equipment cost components.

In Ethiopia, the federal road construction projects are governed by the standard conditions of contract by MoWUD 1994 (amendment of 2004), PPA of the ministry of finance and economic development standard bidding document for the procurement of works issued in January 2006, FIDIC IV, FIDIC 1999 and MDB FIDIC 2006. And these conditions of contracts contain provisions that clearly give way to compensate price escalations that occur on due course of construction projects.

4.2.7.1. Provisions in Conditions of Contract

International contract forms especially FIDIC has been intensively used for the last two decades on major infrastructure projects such as road projects. The survey tried to show the usage of contract forms in the federal road construction projects in relation to different FIDIC editions. For this purpose, three subsequent editions (FIDIC IV, FIDIC 1999 and FIDIC 2006 MDB) were forwarded with MoWUD 1994 and PPA 2006 which are currently applicable locally.

The Ethiopian standard conditions of contract, MoWUD 1994, has a special category of condition which says "changes in cost and legislation" and described in clause 70 and it is dealt in detail in section 2.10.1. It should be noted that for any compensation to be made, the changes in cost of inputs must be changed by legislative bodies. On the other hand, the Ethiopian economy is led by free market economy policy in which market prices are not centrally governed. Market prices are mostly governed by the direct costs, demand and supply relation. The standard conditions of contract for construction projects by public procurement agency, PPA 2006 provides another clause for price adjustment. In sub clause 47.1 of this document it says: "price shall be adjusted for fluctuations in the cost of inputs only if provided in the special

conditions of contract". Here it can be seen that the provision is open to entertain cost changes regardless of the absence of any act, statute, decree, regulation or the like.

Among the respondents, in most of the federal road construction projects, the Harmonized MDB FIDIC 2006 has been the most dominating general condition. The PPA 2006 is the next condition of contract mostly used in the Ethiopian federal road construction projects. The difference between the ICB and NCB version of PPA 2006 shows that, Z_o/Z_n (adjustment coefficient) included in sub clause 47.2 of ICB while it is omitted in the NCB version.

4.2.8. Price Escalation Administration System

According to the respondents 36%, 20% and 14% of clients, consultants and contractors respectively rated the current price escalation administration system (practice) in federal road construction projects as very good. It is rated good by 50%, 35% and 36% of clients, consultants, contractors respectively. 14% of clients, 25% of consultants and 36% of contractors believe current price escalation administration system (practice) in federal road construction projects rating it satisfactory. It is rated poor by few contractors (14%) and 20% of consultants respectively.

4.2.9. Problems of Price Escalation and Adjustment

There are five price escalation adjustment problems of the project were identified and ranked from the view of clients, consultants and contractors. Table 4.10 shows the results of relative importance index and the ranking of price escalation adjustment problems between respondents of client, contractor and consultant.

Table 4.10: The result of price escalation and adjustment problems

Price escalation adjustment problems	Client		Contractor		Consultant		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Uncompensated increase in cost of construction materials	0.43	3	0.65	1	0.60	1	0.56	1
Construction Price Indices may overestimate or under estimate the market conditions as at how prices have risen	0.61	1	0.48	4	0.56	4	0.55	2
Selection of the most suitable index in using inflation indices	0.55	2	0.45	5	0.58	3	0.53	3
Escalation clauses do not adequately compensate increase in prices	0.30	4	0.59	2	0.59	2	0.49	4
Clients resist honoring the escalation clauses	0.09	5	0.57	3	0.43	5	0.36	5

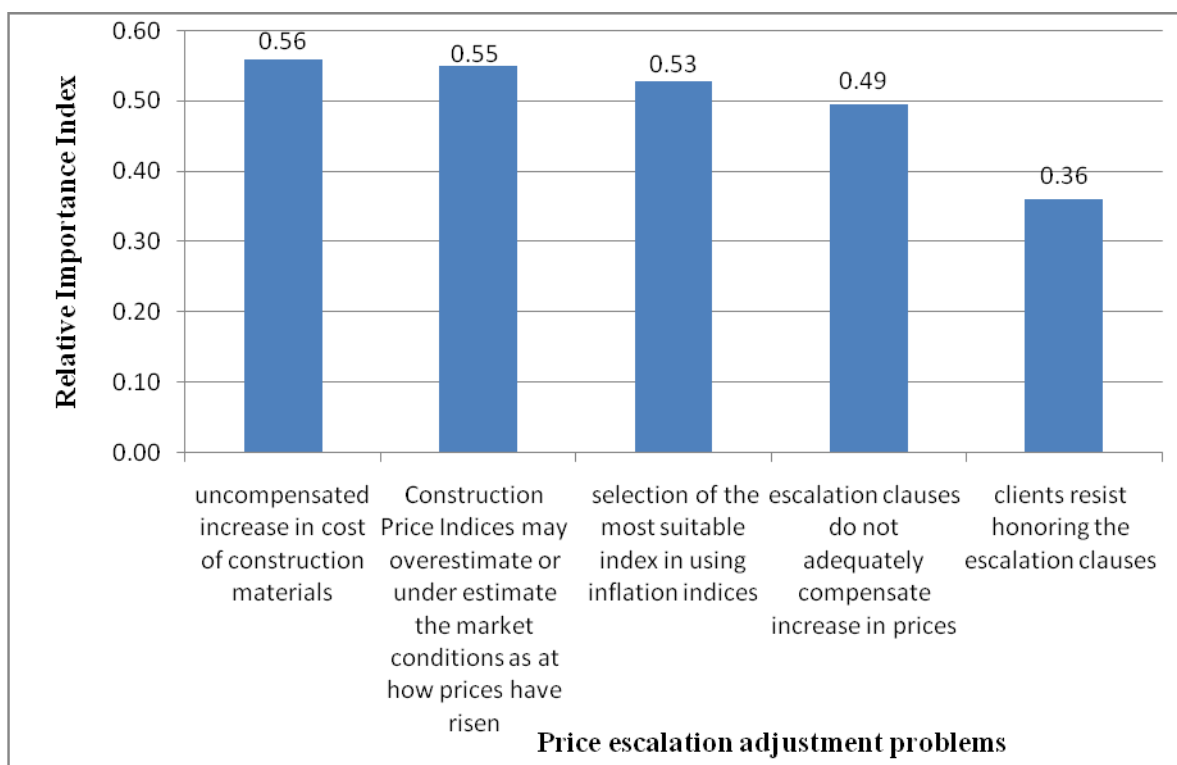


Figure 4.5: Price escalation adjustment problems and their relative importance index

Figure 4.5 shows the result of survey analysis of price escalation adjustment problems. The statistical analysis of price escalation adjustment problems of construction projects has been done using their relative importance index.

Based on result of analysis uncompensated increase in cost of construction materials, construction Price Indices may overestimate or under estimate the market conditions as at how prices have risen, selection of the most suitable index in using inflation indices, escalation clauses do not adequately compensate increase in prices and clients resist honoring the escalation clauses and ranked on their degree of importance respectively.

Based on the combined relative important index and rank as shown on figure 4.5, the important and top ranked problems of price escalation adjustment are discussed below.

Uncompensated increase in cost of construction materials with a relative importance index of 0.56 became the main important problems of price escalation adjustment. This is because of escalation of material prices are affects the liquidity of projects and cost performance of projects. The cost of construction materials are increases from time to time because of a limited suppliers, factories, shortage of raw materials and cost of transportation from foreign countries.

Construction price indices may overestimate or under estimate the market conditions as at how prices have risen and selection of the most suitable index in using inflation indices with RII value of 0.55 and 0.53 became the important problems next to uncompensated increase in cost of construction materials. The greatest difficulty of dealing with inflationary effects in economic appraisals is being able to arrive at realistic measures of current inflation and being able to forecast what it is likely to be over the study period for the proposal. The difficulties are compounded by the fact that not all goods increase or decrease in price by a similar amount and certainly not simultaneously. Inflation rates can change very quickly. Some of these difficulties can be overcome by the use of general indices compiled from data collected by statisticians. Many of these major indices emanate from government departments.

Table 4.10 shows that the respondents, consultants ranked escalation clauses do not adequately compensate increase in prices with RII value of 0.59 as the second important problem of price adjustment. This result is in full conformity with the respondent contractors, but in the case of

clients, the value of the importance index is (0.3) slower than consultants and contractors, which means that consultants and contractors are more technically aware of these elements and give them greater priority than others.

The agreements between the respondents (i.e. between client-consultant, client-contractors and contractors-consultants) in ranking the problems have been calculated through spearman's rank correlation coefficient.

Table 4.11: Correlations among respondents in ranking problems of price escalation adjustment

Respondents	Spearman's rank correlation coefficient (r's)		
	Clients	Consultants	Contractors
Clients	1.00	-0.90	-0.70
Consultants	-0.90	1.00	+0.60
Contractors	-0.70	+0.60	1.00

The Spearman's rank correlation coefficient in the above table (Table 4.11) shows that relatively there is a moderate negative agreement between Clients-Contractors, very strong negative agreement among Clients-Consultants and moderate positive agreements between Consultants-Contractors in ranking problems of price escalation adjustment on federal road construction projects in Ethiopia.

There is a strong disagreement between clients and consultants, contractors and clients. The possible reasons could be adversarial relationship and hostility as a result of miscommunication and the general feeling of apprehension that exists between the parties.

4.2.10. Methods to Manage/Administer Price Escalation

The statistical analyses of methods to manage/administer price escalation in construction projects have been done using their relative importance index and agreements between respondents in ranking the methods has been done through spearman's correlation coefficient.

Figure 4.6 shows the results of relative importance index of the Methods to manage/administer price escalation. Based on statistical result consider fluctuation/escalation clauses is very significant for the price escalation management/administration of a project with relatively high

relative importance index of 0.82. From table 4.12, it can be observed that considering fluctuation/escalation clauses is ranked by both contractors themselves and consultants as a primary method for the price escalation management/administration. While Use Cost-Plus contracts ranked as a least method with a relative importance index of 0.46. In ranking this factor, there is a perfect agreement between clients and consultants (Table 4.12).

Table 4.12: The result of methods to manage/administer price escalation

Methods to manage/administer escalation	Client		Contractor		Consultant		Combined	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Consider fluctuation/escalation clauses	0.77	2	0.9 1	1	0.79	1	0.8 2	1
Consider locally available material in design	0.79	1	0.7 2	3	0.60	2	0.7 0	2
Regular cost monitoring throughout the project	0.79	1	0.7 3	2	0.59	3	0.7 0	2
Develop program-wide contingencies and risk management protocols	0.66	3	0.7 2	3	0.48	5	0.6 2	3
Bulk material purchases and suppliers partnerships	0.57	4	0.6 6	4	0.56	4	0.6 0	4
Use Cost-Plus contracts	0.41	5	0.5 5	5	0.43	6	0.4 6	5

From the result in the table above, the following figure was developed to show the ranks of methods for the price escalation management/administration. Table 4.12 shows the statistical results of methods to manage/administer price escalation relative importance index and their respective ranks. From the table, it is observed that there are some factors which have similar relative importance indexes and the ranks of those methods place at the same level of importance.

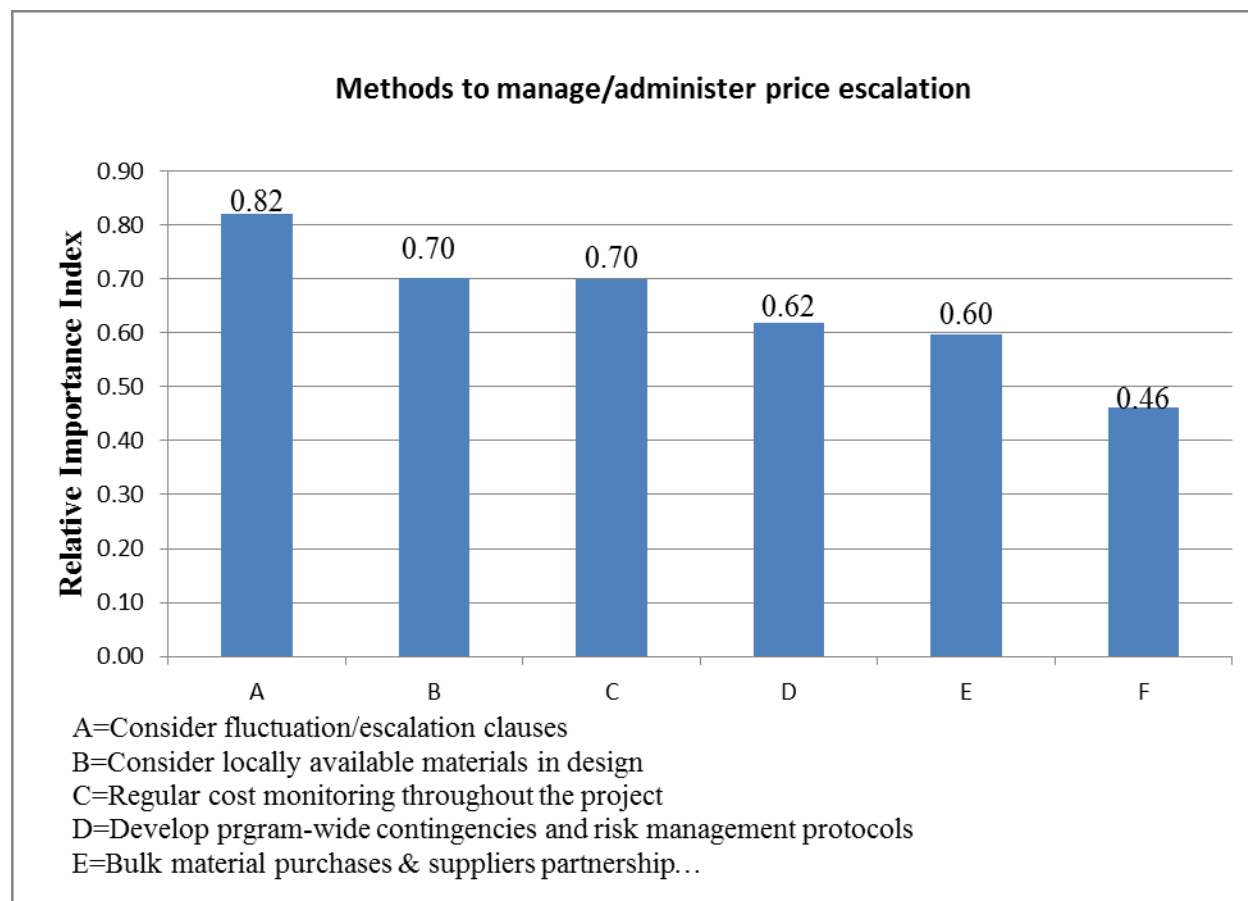


Figure 4.6: Methods to manage/administer price escalation and their relative importance index

As discussed earlier consider fluctuation/escalation clauses dominantly lead methods to administer price escalation as a very important one for the road construction projects. Consider locally available material in design and regular cost monitoring throughout the project placed as second important methods. Therefore bulk material purchases and suppliers' partnerships followed by use cost-Plus contracts 4th and 5th important methods to manage/administer price escalation respectively.

The agreements between the respondents (i.e. between client-consultant, client-contractors and contractors-consultants) in ranking the methods have been calculated through spearman's rank correlation coefficient.

The Spearman's rank correlation coefficient in the table (Table 4.13) shows that relatively there is a moderate positive agreement between Contractors-Consultants, very weak negative

agreement between Clients-Contractors and moderate negative agreement between Clients-Consultants in ranking methods to manage/administer price escalation which has a significant contribution to the successful performance of federal road construction projects in Ethiopia.

Table 4.13: Correlations among respondents in ranking methods to manage/administer price escalation

Respondents	Spearman's rank correlation coefficient (r's)		
	Clients	Consultants	Contractors
Clients	1.00	-0.60	-0.06
Consultants	-0.60	1.00	+0.69
Contractors	-0.06	+0.69	1.00

4.3. Selected Desk Studies Finding and Discussion

The desk studies were collected from four projects selected from the population that was carried out in Federal road construction projects particularly in south and west regions. In collecting all the relevant data archival records like completion report, progress report, payment certificates, contract documents and unstructured interviews were used as a source of data. The detail description of selected desk study projects is found in appendix C.

During the desk study, investigation of the extent of price escalation was done by reviewing the payment certificates, progress reports and completion reports for selected Federal road construction projects.

According to the selected projects for desk study in the research suffered price escalation in their execution. Moreover, data received from the four upgrading and rehabilitation road construction projects desk study indicated that the average initial contract amount was 543.32 million birr, while the average final costs of those projects (i.e including price escalation adjustment only) reached 705.33 million birr leaving an average price escalation of 162.01 million birr or 35.7 % of the initial average cost. The price escalation adjustments in projects on the selected desk study (listed in Appendix C) are represented in Figure 4.7 below.

On the basis of data obtained from the desk study, Fluctuation in money exchange rates, poor estimation, improper planning and/or improper implementation of proper planning, shortage of labors, unforeseen ground conditions, shortage of materials like cement, fuel, adverse weather conditions and shortage of professionals and skilled man power were some of the factors that causes price escalation in Ethiopian federal road construction projects.

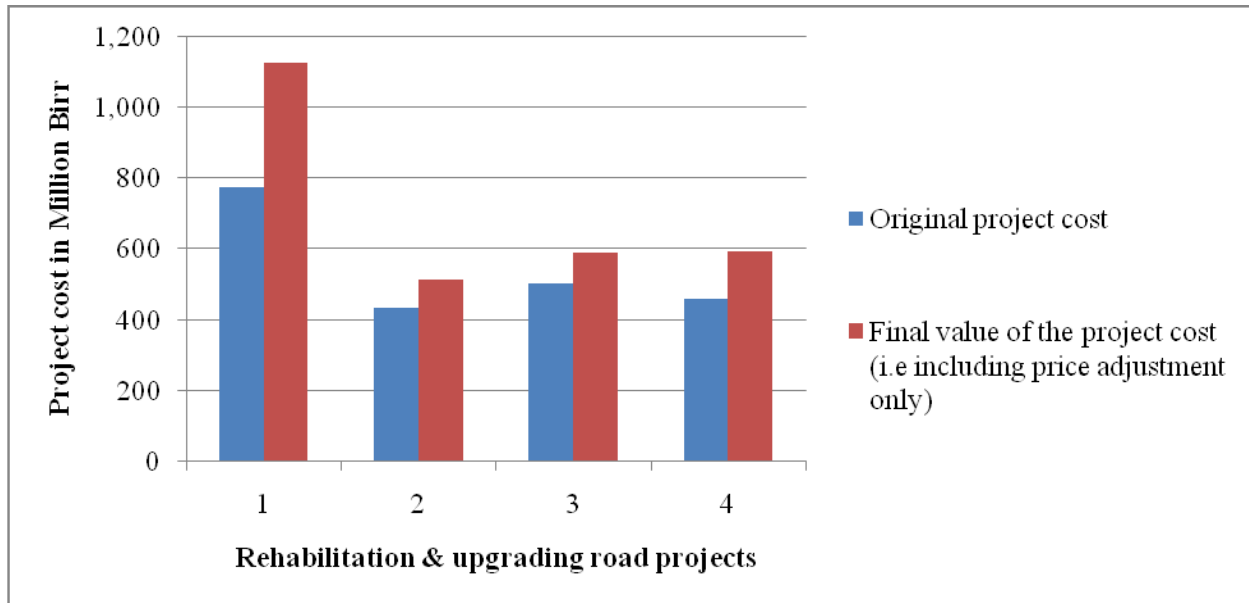


Figure 4.7: price escalation adjustment in projects on selected desk study

The result of the desk study shows that one of the common effects of price escalation is delay; this in turn affects clients and contractors. Furthermore, lengthy delays increase cost of the project tremendously.

Excessive price escalation requires additional budget, this in turn consume the scarce financial resources of the country, which lead to further budget short fall for construction projects.

Projects suffer excessive delay from price escalation, which subsequently lead to additional price increase as the duration of a project is extended the price of materials will rise which subsequently lead to additional costs.

Generally desk study findings are summarized as follows:

Causes of price escalation

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

Effects of price escalation

- Delay
- Higher project costs

In some projects the total price adjustment amount cannot be more than 20% of the basic contract price.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This chapter presents the conclusions and recommendations of the research which are based on the results of data analysis and discussion made on the previous chapter.

The objectives of the research were to assess the causes and effects of price escalation, to identify problems of price escalation adjustment, to assess the present price escalation administration system and to forward recommendations which can assist in improving the price escalation administration on federal road construction projects. To achieve these objectives, the study used desk study and questionnaire survey as a research instruments. The information gathered from the survey was analyzed using the relative importance index and correlated using spearman's correlation coefficient.

Based on the results from the analysis the following conclusions have been derived and summarized in accordance with the objectives of the research.

The first objective of this research was to assess the causes and effects of price escalation. To achieve this, a questionnaire survey containing factors causing price escalation (i.e. internal and external) which were identified from literatures and desk study were ranked by respondents based on the frequency of occurrence. The results showed that:

Poor estimation, improper planning and/or improper implementation of proper planning and project schedule changes are identified as major internal causes of price escalation in Ethiopian federal road construction projects.

Besides, increase in material cost/material price fluctuation, increase in global demand for construction materials, fluctuation in money exchange rates and limited capacity of material producers are identified as major external causes of price escalation in Ethiopian federal road construction projects.

Finally the major effects of price escalation identified in this research are higher project costs, cash flow (project financing) problem of the projects, delay and dispute among parties.

The second objective of this research was to identify the problems of price escalation and adjustment. The questionnaire survey results indicated that uncompensated increase in cost of construction materials, construction price indices may over estimate or under estimate the market conditions as at how prices have risen and selection of the most suitable index in using inflation indices are identified as major problems of price escalation and adjustment in Ethiopian federal road construction projects.

The third objective of the research is to assess the current price escalation administration system (practice). From the results of questionnaire survey the respondents groups; 36%, 20% and 14% of clients, consultants and contractors respectively, showed the current price escalation administration system (practice) in federal road construction projects as very good. And it is rated good by 50%, 35% and 36% of clients, consultants and contractors respectively. However, 14% of contractors and 20% consultants believe the current price escalation administration system (practice) in federal road construction projects as poor.

The last objective was to recommend how to improve the administration of price escalation in federal road construction projects. To achieve this, a questionnaire survey containing methods to manage/administer price escalation which were identified from literatures and desk study were ranked by respondents based on the degree of importance. The findings revealed that:

Consider fluctuation/escalation clauses, consider locally available materials in design, regular cost monitoring throughout the project and develop program wide contingencies and risk management protocol are identified as major methods to manage/administer price escalation in Ethiopian federal road construction projects.

Based on the survey result, it was found that the major construction inputs they encountered price escalation in federal road construction projects are cement, fuel, foreign labors, local skilled and unskilled labors, reinforcement bar, bitumen, and equipment. However, only four material components comprising, cement, bitumen, reinforcement bar and fuel are allowed for

price adjustment in the local context. Recently ERA allowed adjustment for foreign labor and equipment cost components.

From the results of questionnaire survey the majority of respondent groups, 93%, 85% and 86% of clients, consultants and contractors respectively, showed their agreement with price indices/formula method of price adjustment. However, the remaining 7% clients, 15% consultants and 14% contractors respondents agreed with proven/base price adjustment method is better. On the other hand, there is no price index in Ethiopia.

5.2. Recommendations

The objective of this research was to generate findings from the hypothesized problems addressed in the literature review through questionnaire survey and desk study. In addition, one of the objectives of this thesis was to forward recommendations to improve the administration of price escalation in federal road construction projects based on the finding of the study. Therefore the recommendation will focus in addressing the major problems identified through the research processes.

The other recommendation is to contracting parties in order to focus and discuss continuously on those identified factors and problems during their construction progress meetings for the successful implementation of federal road construction projects. In addition they should strongly focus on construction management capacity building to realize the management success (completion of a project within time and budget according to the technical specification).

Based on the findings of the research, the following recommendations are expected from key role players in construction projects.

For Clients (ERA)

- ☛ The clients should invest their effort in planning phase of the projects. Proper planning of a project in terms of time, cost, quality and resource should be addressed. All the resources required for the construction of a project should be arranged in well manner before commencement of construction.
- ☛ Update construction cost estimates based on experience and analysis of construction components (labor, materials, equipment, etc.) i.e. cost estimates should be based on

feedback from the experience and understanding of the project conditions rather than on historical data adjusted for inflation increases over each year

- ☛ The clients should determine the required duration of project and impose realistic duration to avoid time and cost overruns.
- ☛ The clients are recommended to have technical staff who is able to manage the different stages of any project and to follow the performance percentages, and also able to compare the actual performance with the planned one.
- ☛ The clients should properly anticipate the future price instability and device some mechanisms to share the risks of escalation.
- ☛ Consider price escalation effects seriously by experienced professionals and make a decision on the way that price escalation effect is fairly shared through provision of appropriate price adjustment clauses in special conditions of contract.

For Consultants

- ☛ Consultants are advised to hire a qualified technical staff to manage the project in a good way, so he would be able to overcome any technical or management problems that happen.
- ☛ It is also advised for consultant to have high qualification to give suitable instruction in a suitable time and to be able to answer any question stated by contractor to avoid price escalation.
- ☛ Study the likely occurrence of price escalation and device mitigation plan before the project suffers.
- ☛ The consultant should continue their regular progress meeting but focus on the effectiveness of each meeting.

For Contractors

- ☛ For site management and supervision i.e. administrative and technical staff should be assigned as soon as project is awarded to make arrangements to achieve completion within specified time with the required quality, and estimated cost.

- ☛ During execution of a project contractors should focus on planning (work breakdown structure, scheduling, resource allocating, etc.) effort and project managers leading ability which improves effective site management in utilizing and coordinating man power, equipment and materials towards the success of a project.
- ☛ To be aware about construction materials, so they are advised to purchase the construction materials on time. It is also better for them to have time schedule for material delivery process to the site in order to avoid shortage or lack of materials.
- ☛ Adequate qualified technical staff with appropriate experience of the project in order to be able to follow the different technical and managerial aspects of the project.
- ☛ Contractors should have enough cash before beginning in any project to avoid the financial problems. Also it is advised to monitor financial spending of the project and payments because any problem in financial aspect will lead to delay and cost escalation.
- ☛ The contractor should consider price escalation effects critically before tender submission and should agree on the way that price escalation effects is fairly shared through provisions in conditions of contract.
- ☛ Contractors are recommended to have a time schedule that clarifies their needs for equipment and materials in the site, so it would be ready where needed without delay. So they would be able to detect performance in the work and to follow the time schedule continuously.

For All Parties

- ☛ Develop a more definitive policy and approach to calculation of price escalation i.e. establish a consistent guidelines and better techniques required for monitoring, forecasting and calculation of price indices.
- ☛ To improve the quality and reliability of project cost estimates there needs to be a best practice cost estimation standard that agencies can use to benchmark against and if necessary upgrade their own manuals, processes and procedures in relation to project cost estimation.
- ☛ All parties should work together to recover the compensation system and the method of price adjustment calculation should be fair and consistent across all parties.

For Government

- ☛ The government should create an environment of economic stability that is adequate to encourage investors, especially in the production of construction materials to be produced from local materials and production of enough quantity and quality of construction materials in the local market, this will restrict excessive price fluctuations associated with imported construction materials.
- ☛ The Ethiopian statistics agency or other regulatory body should collect and publish current indices at a certain period. This to mean every market fluctuation for materials and labor rates should be registered and documented for indices preparation to be suitable for adjustment system by formula method.

For Further Study

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

- ☛ Develop the current research by increasing the sample size and studying the area more in depth. Also collect the data from the selected project sites not from the branch offices. This makes the data more reliable. If questionnaire is used as a tool for data collection the level of knowledge and level of understanding of the respondents in responding the questions should be put under consideration. Whereas archival records are used as data collection tools, reports of different contracting parties should be reviewed in order to obtain multiple evidences.

Another recommended area of further study is:

- ☛ A study on construction price indices in Ethiopia.
- ☛ Assessment of conditions of contract with related to price escalation adjustment formula as compared to best international practices.
- ☛ A study on various estimating techniques or methods to the construction industry of Ethiopia.

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APPENDIXES

Appendix- A: Questionnaire

Appendix- B: Information of the Projects

Appendix- C: Desk Study Analysis

Addis Ababa
University
(Since 1950)



**Addis Ababa University
Addis Ababa Institute of Technology
School of Graduate Studies**

Department of Civil Engineering

Msc. Program in Construction Technology & Management

(Questionnaire)

Assessment of price escalation and adjustment Problems on Federal Road Construction Projects

Dear Sir/Madam,

The aim of this questionnaire is to obtain professional opinion on issues of price escalation and its adjustment in federal road construction projects. This is to identify factors that cause price escalation and their consequential effects on Federal Road Construction Projects in Ethiopia and recommend possible remedial measures that minimize the problem (price escalation). This questionnaire is required to be filled with exact and relevant facts as much as possible. All data included in this questionnaire will be used only for academic research purpose and will be strictly confidential.

For unclear questions (if there is) or any questions related to the questionnaire use my addresses.

Sincerely

Submitted by: Mohammed Gashaw

Supervised by: Wubishet Jekale (Dr.- Ing)

Address: Mob. No. +251 913 00 16 89/ +251 931 54 79 00`

E-mail - mymain.2002@yahoo.com

May, 2012

Part one: General / Organization Information

1.1. Company Name (optional): _____

1.2. Type or origin of your organization (Please indicate with “√” when appropriate)

- Project Owner/Client Domestic Consultant Foreign Consultant
 Domestic Contractor Foreign Contractor

Others (please specify) _____

1.3. Years of experience of the respondent:

- Less than 5 years From 6 to 10 years
 From 10 to 15years Over 15 years

1.4. If foreign consultant/contractor, how long have your organization been involved in Ethiopian road construction sector?

- Less than 5 years 6-10 years more than 10 years

1.5. How many road projects you have been involved in?

- Less than 5 projects 6-10 projects more than 10 projects

Part Two: Factors causing price escalation

The following tables consist of lists of possible causes of price escalation in construction projects identified from literatures. Based on your experience what is the likely contribution of these factors to price escalation in federal road construction projects that you have involved in? Please express your opinion on rate of occurrence (frequency of occurrence) based on the representative numbers listed below by marking (√) under each preference.

0=Never, 1=Seldom, 2=Sometimes, 3=Often, 4=Always

S.N	Factors Causing price escalation	Rate of Occurrences				
		0	1	2	3	4
I. Internal Factors						
1	Delivery/procurement approach					
2	Project schedule changes					
3	Engineering & construction complexities					
4	Poor estimating					
5	Inconsistent application of contingencies					
6	Ambiguous contract provisions					
7	Improper planning &/or improper implementation of proper planning					
II. External Factors						
1	Local concerns and requirements					
2	Force Majeure					
3	Change in Legislation					
4	Fluctuation in money exchange rates					
5	Increase in global demand for construction materials					
6	Limited capacity of material producers					
7	Local or municipal regulations					
8	Increase in material cost (material fluctuation)					
9	Shortage of labors / skilled workers					

5.2. The following are lists of major construction inputs. For which items price escalation adjustment is made?

- | | | |
|--|--|------------------------------------|
| <input type="checkbox"/> Cement | <input type="checkbox"/> Bitumen | <input type="checkbox"/> Equipment |
| <input type="checkbox"/> Fuel | <input type="checkbox"/> Reinforcement | |
| <input type="checkbox"/> Foreign labor | <input type="checkbox"/> Local labor | |

Others (please specify)-----

5.3. The two methods mostly practiced for adjustment is proven and formula (price indices). Which method you prefer as suitable for Ethiopian construction industry?

- Proven (base price) method Formula (price indices) method

If you prefer Indices (formula) method of adjustment, how best is it to apply without any established price indices by the responsible public bodies in the country?

- Establish new local price indices and revise periodically
 Use foreign price indices

If any, please specify?-----

5.4. Condition of contract is one of the main integral parts of contract document in construction contracts. Which contract form you/your firm use currently?

- Ministry of Works and Urban Development, MoWUD 1994 contract form

Public Procurement Agency

- PPA 2006 PPPAA 2011

Fédération Internationale des Ingénieurs-Conseils (FIDIC)

- FIDIC 1987
 FIDIC 1999
 FIDIC 2006, MDB (Multilateral Development Banks) Harmonized edition

If any, Please specify-----

5.5. What do you think on current price escalation administration system (practice) on federal road construction projects?

Excellent Very good Good Satisfactory Poor

Part Five: Price Escalation Adjustment Problems in Road Construction Projects

Below are numbers of Price Escalation Adjustment Problems in Road Construction Projects. From your experience, please express your opinion on rate of occurrences in road construction projects based on the representative numbers listed below. (Please tick the appropriate box).

0= Never, 1= Sometimes, 2= Usually, 3= Frequently and 4= Most Frequently.

No.	Price Escalation Adjustment Problems	Rate of Occurrences				
		0	1	2	3	4
1	Clients resist honoring the escalation clauses					
2	Escalation clauses do not adequately compensate increase in prices					
3	Uncompensated increase in cost of construction materials					
4	Construction Price Indices may overestimate or under estimate the market conditions as at how prices have risen					
5	Selection of the most suitable index in using inflation indices					
If others, please specify in the following table						
1						
2						
3						
4						

Appendix- B: Information of the Projects

S.No.	Name of projects	Project type	Region	Client	Consultant	Contractor
1	Allaba - Humbo	Rehabilitation	South	ERA	Beza	Keangnam
2	Arbaminch - Dilbena	Upgrading	South	ERA	TCDSC	SUR
3	Butajira - Hosa'ana	Upgrading	South	ERA	DHV	CRBC
4	Delbena - Jinka	Upgrading	South	ERA	Mouchelparkman/ CWCE	SATCON
5	Dera - Magna	New	South	ERA	Roughton	IRCON
6	Endato - Gasera	New	South	ERA	BEZA	YENCOMAD
7	Ginear - Beredimtu	Upgrading	South	ERA	HAMDA	YENCOMAD
8	Hosa'ana- Sodo	Upgrading	South	ERA	ICT	Keangnam
9	Humbo - Arbaminch	Rehabilitation	South	ERA	AEC	DMC
10	Keyafer - Turmi	New	South	ERA	CWCE	SMS
11	Modjo - Awash Arba	Rehabilitation	South	ERA	Carl Bro	Keangnam
12	Shashemene - Ashka Robe	Upgrading	South	ERA	CDSCo/Net consulting	Berhe Hagos
13	Shashemene- Wondo - Gemeto	Upgrading	South	ERA	TCDSC	DMC
14	ShehHussein-Mechita	New	South	ERA	BEZA	SATCON
15	Wozeka- Gidello	Upgrading	South	ERA	TCDSCo	ERA Own force
16	Addis - Ghion – Jima	Rehabilitation	West	ERA	D/WI/TYPSA	Dragados /J & P
17	Assossa - Bluenile	New	West	ERA	Muachel Parkman/CWCE	Sinohydro
18	Assossa - Kurmuk	New	West	ERA	Arabia/ MCE	Sinohydro
19	Bluenile - Guba	New	West	ERA	WSP/AEC	Sinohydro
20	Bonga - Mizan	Upgrading	West	ERA	ICT	Keangnam
21	Dembi - Bedelle	Upgrading	West	ERA	Panaf	MEDROC
22	Elia - Adura	New	West	ERA	CORE	SATCON
23	Gambella- Itanga - Jikao	Upgrading	West	ERA	CORE	ERCC
24	Gilgel - Debate	New	West	ERA	BEST	Alemayehu Ketema
25	Gore - Gambella	Upgrading	West	ERA	SABA	CCC
26	Jimma - Bonga	Upgrading	West	ERA	LEA	Keangnam
27	Mekenajo - Nejo	Upgrading	West	ERA	RITES	SIETCO
28	Mendi - Assossa	Upgrading	West	ERA	HEC	YENCOMAD
29	Metu- Gore	Upgrading	West	ERA	AEC	CJCIETC
30	Nejo - Mendi	Upgrading	West	ERA	Metaferia	CRBC
31	Nekemte - Mekenajo	Upgrading	West	ERA	Span/Stanley	Sinohydro
32	Tongo - Gedami	New	West	ERA	UNICONE/HEC/ HAMDA JV	Berhe Hagos
33	Wacha - Maji	New	West	ERA	SABA	CWE

S.No.	Consultant	No. of projects Executed	Contractor	No. of projects Executed
1	AEC	2	Alemayehu Ketema Construction	1
2	Arabia/ MCE	1	Berhe Hagos	1
3	BEST	1	CJCIETC	1
4	BEZA	3	CRBC	2
5	Carl Bro	1	CWE	1
6	CDSCo/Net consulting	1	DMC	2
7	CORE	2	Dragados /J & P	1
8	DHV	1	ERA Own Force	1
9	D/WI/TYPSA	1	ERCC	1
10	HAMDA	1	Keangnam	1
11	HEC	1	MEDROC	1
12	ICT	2	SATCON Const.	3
13	LEA	1	SIETCO	1
14	Metaferia	1	Sinohydro Const.	4
15	Mouchelparkman/ CWCE	3	SMS	1
16	Panaf	1	SUR Const. Plc	1
17	RITES	1	YENCOMAD Const.	3
18	Roughton	1		
19	SABA	2		
20	Span/Stanley	1		
21	TCDSC	3		
22	UNICONE/HEC/ HAMDA JV	1		
23	WSP/AEC	1		

Appendix C Desk Study Analysis

	Project "A"	Project "B"
Project name:	Wacha – Maji Road Upgrading Project	Delbena- Jinka Road Upgrading Project
Financier:	Federal Democratic Republic of Ethiopia and African Development Bank	Federal Democratic Republic of Ethiopia (45.6%) and Federal Republic of German (54.4%)
Road classification:	Collector DS5	DS4
Type of road pavement:	Gravel/DBST	DBST
Length:	174.278km	120km
Location:	Southern Nations Nationalities and peoples Regional state, Benchi Maji Zone (West Region)	Southern Nations Nationalities and Peoples Regional State, South omo zone (South Region)
Owner:	Ethiopian Roads Authority (ERA)	Ethiopian Roads Authority (ERA)
Contractor:	China International Water and Electric Corporation	SATCON Construction Plc
Consultant:	SABA Engineering Plc.	Mouchel Parkman in association with Civil Works Consulting Engineers
To date work progress:	100%	93.71% (112.45km)
Original Project Cost:	ETB 775,524,986.83	ETB 434,567,292.42
Original Completion Time:	3.5years (1277 calendar day)	3 years (1095 calendar days)

Detailed project description	<p>The project scope consists of the upgrading of the existing gravel surfaced road by some realignment improvements to the horizontal curve and the vertical profile. The work also includes improvement in geometric conditions, drainage provisions, structures along the route and double surface treatment at intermittent sections. The project largely includes Rolling and Mountainous terrain.</p>	<p>The project scope consists of the upgrading of the existing gravel road to a double bitumen surface treatment by some realignment improvements to the horizontal curve and vertical profile. Major works are construction of two new bridges, earth works, minor drainages, sub base, course and wearing course. The entire road length will be significant economic benefit to the south western areas of Ethiopia by facilitating access for goods and products from the Nation, Nationalities & Peoples of Regional State (SNNPRS) to Addis Ababa, the capital.</p>
	<p>The design of which has been initially carried out by an international consultant, Gannet Fleming in association with a local consultant, PANAF Consult. The review of detailed design and tender documents preparation were done by SABA Engineering Plc. Continuously claims regarding to extension of time and additional payment was happened.</p>	<p>According to the report to date the contractor has made 7 claim cases for which determination has been made accordingly. Adverse weather conditions, delays in provisions of design, collapse of weito bridge, overhaul of sub base materials, possession of site, weito bride construction, and shortage of cement. During the execution period there is a price variation on diesel, bitumen, and reinforcing steel bars.</p>
	<p>The total contract time for completion of the construction works of the project is 1277 calendar days (42.5 months). However the report shows so far the contractor claims extension of time 641 calendar days (~50.2% of original contract completion time). The contractor granted extension of time and the schedule was revised six times to-date.</p>	<p>The total contract time for the completion of the construction works of the project is ETB 434,567,292.42. After revising the works contract price to date it takes ETB 436,398,33.90 excluding an amount of ETB 77,592,636.93 which is (17.8% of the original project cost) for price adjustment.</p>
	<p>The Estimated works contract price on Bill (including contingency and provisional sum) is ETB 775,524,986.83. After revising the Works contract price five times to-date it takes ETB 1,158,829,433. The overrun is ETB 383,304,446.85(nearly 49.4%) from original contract price and the amount of payment certified to date is 1,037,143,119.27(89.5%) of the revised price.</p>	<p>The main causes for cost overrun, delays and problems encountered that have been in the project are price escalation, difference in estimated quantity and actual work performed, poor communication against consultants due to contractor unrecognized site, breakdown of crushing plants, poor planning of operations and organizing the work, shortage of asphalt chipping and base course crushed aggregates, shortage of professionals and skilled man power, poor progress on the rectification of problems within taking-over requested stretches, coordination problem daily labor shortages, poor site management, fuel shortage for construction and for supervision activities and supply problems for offices as well as for camp accommodation.</p>
	<p>The main cause for cause for cost overrun and delay is that difference in estimated quantity and actual work performed (especially earth work 65.23% deviation from estimate) this is due to error in design document (slope error) and inappropriate geotechnical data and difference of the surveying work from the estimate. In addition delay in revised drawings, poor communication against consultants due to contractor unorganized site and inexperienced foremen and lack of operators were pointed out as negative side.</p>	
	<p>On the other hand continuous progress meeting, client site supervision and from their correspondence client's decision making ability and contract administration ability were mentioned as a positive sides.</p>	
	<p>Total price adjustment: For local portion (fuel & cement) up to date is 222,312,737.20 For foreign portion (foreign labor, equipment, bitumen & steel) up to date is 14,431,765.40 USD</p>	

	Project "C"	Project "D"
Project name:	Alaba - Humbo Road Rehabilitation Project	Assossa - Kurmuk Road Upgrading Project
Financier:	Federal Democratic Republic of Ethiopia	Ethiopian Gov't, Arab Bank for Economic Development in Africa (BADEA) and Saudi Fund for Development (SFD)
Road classification:	DS4	Link DS4
Type of road pavement:	Asphalt Concrete	DBST
Length:	86.703km	96.67km
Location:	Southern Nations, Nationalities and Peoples Regional State (Southern Region)	Benishangul Gumuz Regional State
Owner:	Ethiopian Roads Authority (ERA)	Ethiopian Roads Authority (ERA)
Contractor:	Keangnam Enterprises Plc.	Simhydro Corporation Limited
Consultant:	Beza Consulting Engineers Plc.	Arabian Consulting Engineering Services (ACES) in JV with Metaferia Consulting Engineers Plc (MCE)
To date work progress:	86.87% (75.32km)	94.72% (91.57km)
Original Project Cost:	ETB 460,306,935.00	ETB 502, 877,507.19
Original Completion Time:	2.5 years (913 Calender days)	3 years (1095 Calender days)

MSc. Thesis: Assessment of Price Escalation and Adjustment Problems on Federal Road Construction Projects

Detailed project description	<p>The major task of the project is rehabilitation of the existing asphalt surfaced road to a two lane flexible bituminous surfacing (asphalt concrete road, DS4 standard). this road would be a two lane- paved carriageway, 7.0m wide with 1.5m wide gravel shoulders on each side. the work involve earth works, pavement construction, rehabilitation of existing and new construction of cross drainage structures including minor maintenance of bridges, and ancillary works.</p>	<p>The Federal Democratic Republic of Ethiopia, as part of its Road Sector Development Program (RSDP), as well developed transportation infrastructure is very essential for military and political purposes and also facilities trade, the Assossa-Kurmuk road is being constructed in an idea to connecting the two friendly countries i.e. Ethiopia and Sudan.</p>
	<p>The original contract time has been completed on 16 December 2010. till July, 2011, the employer approved 335 cal. days extension of time that makes the second revised completion time November 17, 2011, the employer endorsed the consultant reconsideration request of 132 cal. days extension of time based on the contractor reconsideration request. Hence, 467 cal. days extension of time approved so far. accordingly, the third revised completion time has become March 29/2012.</p>	<p>The road is an extension of Addis Ababa-Nekemte-Meke Nejo- Mendi-Assossa- major road used by heavy vehicle traffic which links with sudanese border through Kurmuk. the work to be carried out consists of upgrading of existing gravel surfaced road to a DS4 double surface treated road with some improvements on carriage width, shoulder and walkways in in towns sections including all the necessary side and cross drainage structures.</p>
	<p>The report showed that five variation orders was given to the contractor. The first variation order costs ETB 8,814,485.63 for Humbo realignment section, the second one costs ETB 2,940,503.74 (for channelization), the third one is for additional pipe culverts its cost ETB 414,249.32, the fourth one costs 2,210,860.09 ETB for construction of additional roundabouts and the last one is to widen asphalt width which costs ETB 2,280,000. generally, the consultant is giving due attention and rendering his best efforts in such a way that the expected quantity variations would be counter-balanced thereby keeping the project cost within the allocated budget.</p>	<p>The alignment of the road consists of 47% rolling terrain and followed by rolling to mountainous section which constitutes 29% of the project alignment. the mountainous section constitutes over 20% and the remain small stretches are flat and flat to rolling terrains, which constitutes over 1% and over 3% respectively.</p>
	<p>The total price adjustment to date is 133,085,019.60 ETB</p>	<p>The financing proportions of each party is: The Ethiopian Government contributes 100% of the local currency and 66.10% of the foreign currency, the Saudi Fund for Development (SFD) shares 19.4% of the foreign currency and the Arab Bank for Economic Development in Africa (BADEA) shares 14.45% of the foreign currency part.</p>
	<p>The total price adjustment made up to now took 28.07% of the total project cost allocated for the work including VAT and contingency.</p>	<p>Total duration of the construction is 1095 cal. days including 90 cal. days of mobilization period in addition to 365 cal. Days of defects liability period. The completion time is estimated to be April 7, 2012. However, after granting the contractor an additional time of 85 cal. days in addition to the rainy season, the total time is changed to 1277 cal. Days thus the completion time is revised to be October 6, 2012.</p>
	<p>Claims</p>	<p>The original local contract price is ETB 213,326,369.69 and 20,744,217.55 EURO for original foreign contract price. The percent payable in foreign currency is 58% and 42% payable in local currency. Total price adjustment to date is ETB 87,456,957.76 (excluding VAT and contingency) which is 17.4 % of the original project cost.</p>
	<p>The contractor requested three claims regarding:</p> <ul style="list-style-type: none"> due to additionally instructed pipe culverts by the engineer due to an increase in quantity from the bid quantity the contractors indirect cost for the approved time extension adverse weather condition 	<p>The following problems were encountered during the project execution period: shortage of water, delay of removal of utilities from the road corridor, dust due to construction activities, rain, delay of repayment of contractor's interim payment, price adjustment.</p>
		<p>In the contract the price adjustment is limited to 20% of the basic contract amount. while processing the monthly payment it was found that the price adjustment local component was growing very high due to increment of some local purchased items (fuel and cement), while the foreign component is not growing fast as the local.</p>
		<p>Therefore, the contractor was worried that he is about the foreign currency component in this regard. Notwithstanding the 20% ratio the issue is under discussion to be finalized.</p>
		<p>The limit of price escalation is 20% of the basic price contract amount i.e ETB 100,575,501.60 including VAT and ETB 87,456,957.88 without VAT as total amount of price escalation to be paid for the change in current fuel, labor, cement,</p>

