COMPARATIVE STUDY OF PRICE ADJUSTMENT FORMULA AND ITS IMPLICATIONS IN CONSTRUCTION CONTRACTS

by

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This is to certify that the

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DEDICATED

TO

THE MEMBERS OF MY FAMILY & TEACHERS

ACKNOWLEDGEMENT

ABSTRACT

One of the wide ranging problems which construction industry is facing is the fluctuation in prices of construction inputs which is causing most of the projects to be completed at sums much higher than the original contract prices. In the recent past, we have seen significant price escalation occurring not only with the basic construction materials but also with the labor and fuel. This creates uncertainty among all the participants involved in a construction project. To overcome the effect of price fluctuations, certain methods or contract clauses are devised to deal with this uncertainty. The main purpose of the price adjustment clauses is to allow the contractors and clients to enjoy the benefit of increases or decreases in prices. In addition to this, it also encourages competitive bidding. Different methods and techniques are being used for the price adjustment in the construction contracts. The objective of this research study is to have an overview of previously used price adjustment methods and to evaluate in detail, the price adjustment formula being used currently in construction contracts, based on FIDIC. The emphasis remained on the construction contracts being executed in Pakistan. The study was undertaken via a questionnaire based survey. Data collected from 94 construction professionals from different categories of stakeholders located in different cities of Pakistan and Middle-East, was analyzed using SPSS.

Results demonstrate that the knowledge among the stakeholders, regarding the phenomenon of price escalation/de-escalation resulting from the fluctuation in prices of construction inputs, is not at all satisfactory. Very lower percentage of respondents of the survey had the experience of dealing with escalation clauses and methods of price adjustment in construction contracts. The price compensation system that is currently in place is limited to very few construction inputs. Loss in profits and project delays were found to be the major effects of the price fluctuation and inflation. As far as the introduction of FIDIC price adjustment formula by PEC is concerned, majority of the stakeholders have shown their agreement and trust over this method as this formula provides equal opportunities and fair grounds to every stakeholder in a construction contract. However, the lack of awareness, practical knowledge and experience of using the subject formula in construction contracts was found among the stakeholders of the

CI. The comparison between previously implied methods for the calculation of adjusted prices and the price adjustment formula is also the part of this study.

Based on the analysis of the results, recommendations for the stakeholders have been proposed for the betterment of the construction industry against the adverse effects of the price escalation/de-escalation. The study recommends the electricity rates should be included in the list of items on which escalation is admissible, and the requirement of establishing a comprehensive and reliable price database, with the joint efforts of all the stakeholders. The proposed database should be updated within short intervals. Finally, this study may be useful for clients, consultants, contractors and other stakeholders who desire to improve the price adjustment process in Pakistan.

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LIST OF ABBREVIATIONS

GoP	Government of Pakistan
SBP	State Bank of Pakistan
PEC	Pakistan Engineering Council
USA	United States of America
UK	United Kingdom
SPSS	Statistical Package for Social Sciences
RII	Relative Importance Index
CI	Construction Industry
FBS	Federal Bureau of Statistics
CPI	Consumer Price Index
FIDIC	Federation Internationale des Ingenieurs Conseils (French)
POL	Petroleum, Oils and Lubricants
HSD	High Speed Diesel
PMI	Project Management Institute
IPC	Interim Payment Certificate

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Chapter 1
INTRODUCTION

1.1 STUDY BACKGROUND

Construction Industry (CI) and construction activities are regarded as the backbone of economic and social growth. CI and other engineering services industry play a vital role in the economic growth through the infrastructure of the country. It can be considered as a source of generating the employment for thousands and millions of unskilled, semi-skilled and skilled persons. It also plays a very important role in generating revenues in both formal and informal sectors of the economy. It adds to the foreign exchange earnings from the export of construction materials and provision of services (Khan, 2008).

Pakistan is a developing country and it requires lots of development activities yet to be undertaken for its economic growth. One of the many important factors to attain a required level of economic progress in a developing country like Pakistan is the construction industry which is always a front line role player. In this era, the world has become a global village and keeping in view the economic competition, no country can only rely on its traditional export items. If properly encouraged the "Construction Industry" could serve as a base for the development of the country. The construction industry is one of the important economic sectors if not the most important sector of a country. However, in Pakistan the CI has shown the lowest growth rate of 0.8% in the decade in the fiscal year 2010-11(SBP, 2010-11).

Besides all its importance, unfortunately CI can be counted in one of the most ignored sectors in Pakistan. Construction is always considered as one of the high-risk business for every stakeholder in the business (Yigezu, 2008). The project owner, contractors, consultants, financers, suppliers and even the service providers, everyone has his own apprehensions of facing risks in this business. Risk management is a vital element of the decision making process in the construction (Castillo et. Al., 2009). Even though the risk analysis is important to the activities of the construction industry, very little emphasis is given to the techniques used for the risk management in the construction industry of Pakistan and the response of the CI against those techniques. There is a need to explore the construction industry's view on risk associated with construction and the extent to which the CI uses risk analysis and management methods.

One of the many major risks and challenges construction industries facing, is the fact that the costs at completion of the projects are much higher than the original contract prices. In the recent past, we have seen significant price escalation occurring not only with the basic construction materials but also with the labor and fuel. This creates uncertainty among all the parties involved in a construction project. It is, therefore, very critical for owners and contractors to find ways to quantify and manage cost escalation on their projects in order to ensure the availability of sufficient funds to achieve the final goal within allocated costs and schedules. To overcome the effect of price fluctuations, certain methods or contract clauses are devised to deal with this uncertainty. The main purpose of the price adjustment clauses is to allow the contractors and clients to get the benefit of increases or decreases in prices. In addition to this it also encourages competitive bidding. Different methods and techniques are being used for the price adjustment in the construction contracts.

In this research, the Federation Internationale des Ingenieurs Conseils (FIDIC) price adjustment formula has been studied in comparison to the previous method of calculation for price adjustments resulted from the price fluctuations in the market. Conclusions and recommendations in relation to the advantages and disadvantages of the formula have been drawn based on statistical analysis of the data.

1.2   RESEARCH SIGNIFICANCE

Price fluctuation has become a very obvious trend in the current economic scenario, all over the world. It particularly gets very important in the developing countries like Pakistan due to the dependency of the country on external factors (McCartney, 2011). As the economic and political instability and the security conditions of the country during the last decade or so remained very poor, unpredicted and abnormal price fluctuation of construction material, labour & equipment has increased the importance of dealing with this issue. This leaves the CI with a wide range of challenges and consequences (such as higher bids by the contractors by including a cover that can make the bids uncompetitive). Heavy contract losses badly impacted and delayed the projects. All the parties involved in a construction contract, should get fair compensation which will keep motivating them, at the same time no one should get undue favor. Different types of price adjustment clauses are being used to deal with the issue of price fluctuation and FIDIC price adjustment formula is being most commonly

used for the purpose. It was introduced by FIDC in 1999 and PEC adopted this formula in 2000. So, the aim was to study, evaluate, compare and to give recommendations to bring improvement in the prevailing formula being used, so that the adjusted costs should be in-accordance with the change in market prices and nobody gets undue favor or loss. The study will provide a guideline to construction industry stakeholders to develop the techniques for efficiently managing their bids.

1.3   RESEARCH OBJECTIVE

Following objectives were set forth for this research:

- To study the different methods of price adjustment being used in construction contracts.
- To explain the FIDIC formula in detail, how it is applied to get the adjusted costs.
- To make a comparison of different price adjustment techniques.
- To collect and analyze the responses of the construction project participants regarding the FIDIC formula in construction contracts and suggest improvements.

1.4   SCOPE AND LIMITATION

This study is limited to the construction industry of Pakistan mainly covering the views of major stakeholders i.e. clients, consultants and contractors/subcontractors about the price adjustment formula. Data was collected through questionnaire based survey. Keeping in view the limited time and resources, some of the experts and projects were visited personally for data collection whereas the remaining data from different locations was collected through mail/email.

The study has been conducted by collecting the data from the stakeholders of the CI of Pakistan, so the results, conclusions and recommendations mainly address and applicable to the construction industry of Pakistan.

1.5 ORGANIZATION OF THESIS

The thesis has been organized in five chapters, as shown in Figure 1.1. Details of the chapters are listed below:

- Chapter 1 gives an introduction to the research topic and the problem statement. It also covers the reasons for the research, its objectives and proposed research methodology.

- Chapter 2 covers the literature reviews. It also gives the detailed introduction to the price escalation, the reasons for escalation, escalation clauses and the background and application of price adjustment formula. Various parameters of the formula are also discussed in this chapter.

- Chapter 3 is devoted to the methodology used to carry out. The processes of survey design, development of questionnaire for data collection are the part of this chapter.

- Chapter 4 covers the results and analysis to meet the research objectives.

- Chapter 5 is the final chapter of this research thesis which presents the conclusions and future recommendations.

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│        INTRODUCTION         │
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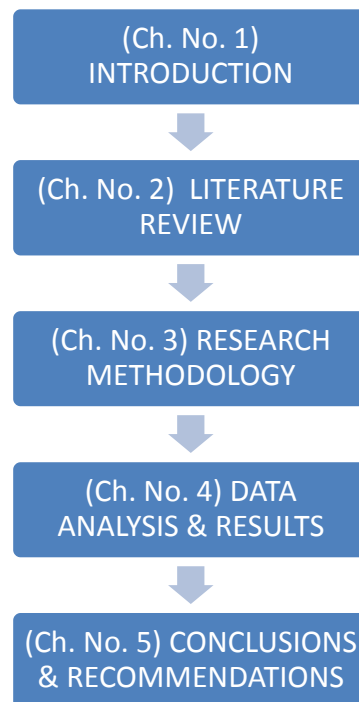
Figure 1.1 Graphical presentation of organization of thesis

1.6   SUMMARY

This chapter gives a brief introduction to the importance of dealing with the fluctuation in prices of construction materials and services. The basis of theoretical portion for this study comes from a detailed literature review (see Chapter 2). This chapter highlighted the research significance, its scope and limitations. Furthermore, this chapter provides an overview of this thesis.

Chapter 2

LITERATURE REVIEW

2.1   THE CONCEPT OF PROJECT

Project is defined as a means of achieving an organization's strategic plan (PMBOK, 2004). Projects are unique, temporary and a project may be a component of a certain program. Almost all the civil engineering construction is executed in project form having a predefined cost, completion time and specifications for quality.

2.1.1   Civil Engineering Projects

All the civil engineering projects are completed through different stages: Initiation, planning, execution, monitor and control and project closure (PMI). And every stage is accomplished through a number of activities. The project participants are Owners/Clients, financers, consultants, designers, contractors, suppliers and users of the project. With the minor variations, all the civil engineering works are accomplished through these parties. These stakeholders can have direct or indirect interactions among them, depending upon the requirement of the project, which are presented in Figure 2.1. (Dinku, 2003)
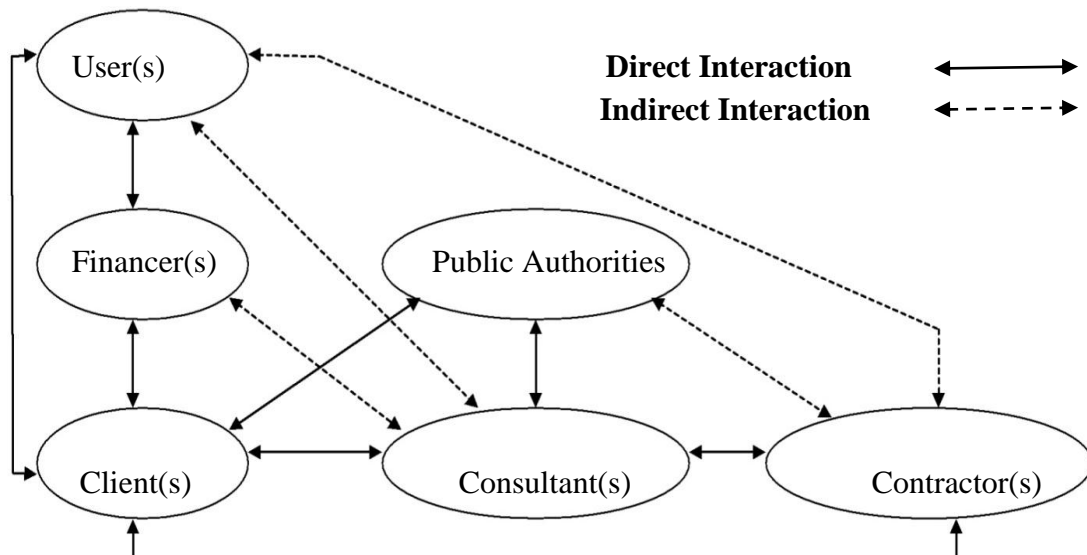
Figure 2.1 Typical interactions between parties in civil engineering projects.

2.2   CONSTRUCTION INDUSTRY

The construction industry is a business sector with a huge amount of investment and turnover. The amount of construction activities being carried out in a country directly reflects the economic condition of the country. In developing countries, construction industry is being used as a tool for poverty alleviation by generating revenue and by creating employments (Farooqui et. Al, 2008). Out of all the parties involved in civil engineering projects, contractors and consultants are purely of business organizations which are in the field to earn profits for their services and the others may or may not be of business organizations. The contractors are mainly involved in activities of diverse natures and have direct affect of the prevailing market situation.

Price fluctuations in the market affect the contractors mostly as they are the ones who are at the front line in the construction business and are responsible for the procurement and timely delivery of labor, material and equipment, depending on the type of contract, required for the completion of the works. For that, they are directly linked with suppliers, sub-contractors and the labor. However contractors need not sustain and suffer permanently from price fluctuations in the market. Such fluctuations shall be sustained by the project owners or clients as they have the ownership of the project.

2.3   PRICE FLUCTUATION

Price fluctuation is generally defined as the rise or fall of price of goods, materials and services. A survey of the CI showed that the building materials and labour component comprise 85% of construction costs (FBS, 2003).These two major components are highly sensitive against the price changes and slight changes in the prices of materials and labour effect the construction contracts considerably. Fluctuation in prices can occur in any market, i.e. in international markets, local market and/or in the labour rates which can affect a construction project severely. There can be many reasons for fluctuation in prices, the major ones in the Pakistani scenario being inflation, Increase in Petroleum, Oils and Lubricants (POL) prices, improper supply-chain-management, increase or decrease in demand of a certain item and overall economic and security conditions of the country.

2.4   INFLATION & CONSTRUCTION INDUSTRY

Inflation is a very important phenomenon especially in the context of the CI, because the purchasing power of money rarely stays constant in most world economies. Over time the amount of materials and services that can be purchased with a fixed amount of money changes. Inflation causes the currency to lose the purchasing power. That is, with the inflation in prices we can purchase less with the same amount of money. Inflation makes future currency less valuable than present value (Newnon, Lavelle and Eschenbach, 2002).

When the purchasing power of goods and services increases instead of decreasing with the passage of time, the result is deflation. Deflation is very rare in the modern world, but nonetheless, potentially exists. Deflation has the opposite effect of inflation-one can purchase more with the same amount of money in future years than can be purchased today. As such, deflation makes future currency more valuable than current value of the currency (Newnon, Lavelle and Eschenbach, 2002).

Higher inflation rate is always associated with increased price variation, which can affect the future of investment projects. It will, ultimately, lead to the reduced interest of investors and economic growth. Moreover, inflation can play its part with the tax system of the country to disturb borrowing and lending decisions. Firms may have to allocate more resources to dealing with the effects of inflation (Ayyoub, 2011). Single digit inflation rate is always preferred for the better growth. Figure 2.2 shows the comparison of inflation rates for different countries for the period of 1961 to 2012.
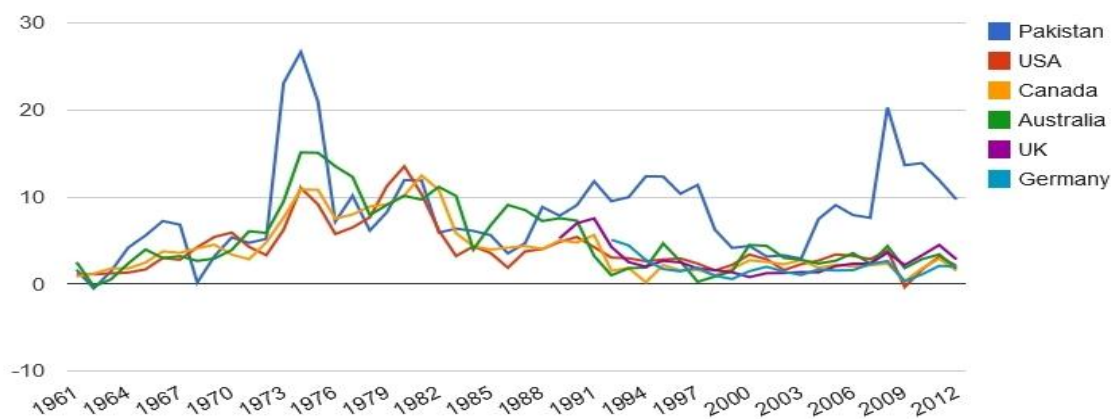
Figure 2.2 Comparison of inflation rates (1961 to 2012)
(Source: TheGlobalEconomy.com The World Bank)

2.4.1 How Does Inflation Happen?

Economists do not agree on all of the sources of inflation, but generally agree that the following factors influence the inflation, either in isolation or in combination.

Money Supply: The amount of money in our national economy is thought to have an effect on its purchasing power. If there is too much money in the system versus goods and services to purchase with that money, it tends to decrease the value of dollars. When there are fewer dollars in the system, they become more valuable. The Federal Reserve, through its influence on the money supply, seeks to increase the volume of money in the system at the same rate that the economy is growing (Newnon, Lavelle and Eschenbach, 2002).

Exchange Rates: The strength of the U.S. dollars in world markets affects the profitability of international companies in those markets. Price rates may be adjusted to compensate for the relative strength or weakness of the dollar in the world market. As corporations' profits are weakened or eliminated in some markets due to exchange rates, prices may be raised in other markets to compensate (Newnon, Lavelle and Eschenbach, 2002).

Cost-Push Inflation: It is the supply side inflation, in which producers of goods and services "push" their increasing operating costs along to the customer through higher prices. These operating costs include fabrication/manufacturing, marketing, and sales, among others (Newnon, Lavelle and Eschenbach, 2002).

Demand-Pull Inflation: This is demand side inflation, when customers spend freely on goods and services. Often "free spending" is at the expense of customer saving (Newnon, Lavelle and Eschenbach, 2002). As more and more people demand certain goods and services, the prices of those goods and services will rise (demand exceeding supply).

2.5 EFFECTS OF PRICE FLUCTUATION

The market price hike of construction materials and labor are a big hindrance towards the growth of the CI. The lack of availability and affordability, both in quantity and quality can lead the stakeholders of the construction projects into failure to complete their projects within acceptable limits of quality and time. In the absence of any

compensation strategy, the major effects of price fluctuation can be (Abdo Abatemam 2006):

- Delays or cancellation of projects
- Reduced numbers of bidders
- Poor quality
- Loss in profits
- Problems of the cash flow
- Loss of interest of stakeholders in the project

2.6   DEALING WITH PRICE ESCALATION

Much can happen to the economy and to the prices in general in the time it takes a project from start to become fruitful to its users. Under such circumstances the victorious bidder who has overlooked likely-hood of price increase will not apt to show much of the profit in his work. There will be incessant bickering, claim and perhaps even litigation before accounts are settled to say nothing of delays, shoddy work and other evidences to save last penny in contractor's costs. It is for this reason most contracts entered into for more than one year longer duration to carry escalation/price adjustment clause. An escalation clause can be defined as "*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*" (Kinlan and Roukema, 2011). A price escalation clause allows the parties to have an opportunity to plan for the uncertainty and allocate how, who and to what extent the additional costs will be absorbed. Thus future increase in prices for major cost items is thus made employer's risk whereas the owner not only to get the benefit of saving themselves from getting a "reluctant to perform contractor" under the circumstances, but also get competitive and more reliable bid. In the absence of an adjustment clause the bidders will estimate and bid possible future cost increases differently which may result in unrealistic prices. Moreover, it will make sure to estimate the future cost increases being estimated not too high, which would otherwise result in higher bids.

2.6.1   Types of Escalation Clauses

Keeping in view the consistent and unpredictable trend of fluctuation in the prices of construction materials and labour, price adjustment clauses are being the part of

the construction contracts to overcome the unpredictability of prices at the start of a project and allow a certain degree of flexibility. These clauses must be tailored with care and should be thoughtfully drafted, specifically identifying the various building materials most at risk for price variation. This procedure also should recognize the price guide to be used to measure changes in price, and it should describe how often a price adjustment clause may be used during the project.

Three types of price adjustment methods remained in use for the calculation of adjusted prices (Barthet and Wasserstein, 2010):

- *Invoice method.* In this method, the contractor provides documentation in the form of invoice, purchase bill or certification from its supplier to confirm the changes in the price of any purchased material. It must reflect the change in the material price from the time of signing the contract to the time when actual purchase was made. On the basis of this document, the contractor is paid the difference between the rates of the material on the two dates. This was not popular because of inflow of different information of increased/decreased rates from both sides.

- *Index method:* When applying the index method, the increase in the contract price is fixed to a price index guide for a particular product and documented as such. This method allows the contract to adjust the index price to regional and local fluctuations and conditions for major commodities such as steel, diesel fuel, cement and asphalt. The Index Method can often be a good choice when a supplier is not able to provide a fixed price bid until the actual purchase is made. The client has the advantage as the rates are monitored by an independent body.

- *Hybrid Method:* This is the combination of previous two methods and is based on a "certified bid cost" in which the contractor certifies its estimate of a specific material's cost based on its current supplier price or an index price listing. When the prices of those items change by a certain percentage — such as 5 percent or 10 percent, positively or negatively—the contract would be adjusted accordingly.

Properly drafted, price adjustment clauses in construction contracts minimize risk to both contractor and owner, reducing conflicts and promoting cooperation. The clauses are created with the full understanding that material, POL and labour prices are at risk of

fluctuation between the time a contract is signed and the completion of the project. Best of all, they provide a way to protect everyone's interests and preserve valuable business relationships and make sure that none of the parties get undue advantage.

2.7   PRICE ADJUSTMENT FORMULA

History: Generally construction projects, private or public, are carried out over a quite lengthy span of time that may range from several months to several years. Keeping in view the volatile nature of prices of construction materials and labour, there is always a strong possibility that the cost of labour and materials will rise and fall periodically in an unpredictable manner, to a greater or lesser extent, during the life of the project. Different parties involved in the project try to deal with this risk in terms of mitigation, incorporation or transfer depending on their attitude towards the risk and their capability to manage it. Therefore there should be provision for price fluctuation for construction contract and proper, accurate and speedy method to recover the actual fluctuation which should be acceptable to the all stakeholders of the project, and it should not give any kind of undue favor to any party.

To deal with the increase or decrease in the costs of materials, labour and services in construction contracts, the price adjustments are practiced internationally. Prices of goods and labour are highly volatile due to fluctuations in the prices resulting from various reasons. Construction experts, therefore, thought it necessary to compute the cost of contracts on present price, keeping flexibility for the provision of Price Adjustment for probable fluctuations during the currency of the project. The FIDIC 1999 has introduced a formula to calculate major part of price hike escalation risk. The purpose of bringing the formula is to propose a uniform and realistic method of dealing with the adverse effects resulting from the price fluctuations, which should be acceptable to all parties in all kind of circumstances. It is not in the best interest of the owner to ask contractors to quote firm prices without any provision of price adjustments, especially in-case of long-term contracts. The contract documents which are provided with provisions for price adjustments can render competitive offers from reputable contractors.

In Pakistan, Finance Division has given the guidelines and formula for calculating price adjustment through Office Memorandums, Pak-PWD periodically prepared graphs for escalation for typical Civil, Mechanical and Electrical projects for compensation to the contractors (PEC, 2009 "Standard Procedure and Formula for Price Adjustment").

Accordingly Government of Pakistan (GoP) in 1996 issued a detailed formula to simplify calculatuions of Price Adjustment. Internationally reputed consultants continued to use provisions of FIDIC. However, keeping in view all the methods and practices, Pakistan Engineering Council (PEC) prepared the document "Standard Guidelines and Formula for Price Adjustment", mainly on the basis of rate analysis of various elements in a contract. After lots of debates, it was felt to discuss the issue with the stakeholders of construction industry i.e. contractors, consultants, GoP officials and financial experts. A two days National Workshop was arranged in PEC HQs from March 30 to 31, 2000 to decide the basic parameters of adopting the formula method in line with FIDIC was decided. This document is, therefore, based on the recommendations of that workshop (PEC, 2009 "Standard Procedure and Formula for Price Adjustment").

2.7.1   Generalized Form of Formula

The price adjustment formula introduced by FIDIC in 1999 and adopted by PEC in 2000, is mentioned below in Equation 2.1, in its generalized form:

$$\text{Pn} = A + b\frac{\text{Ln}}{\text{Lo}} + c\frac{\text{Mn}}{\text{Mo}} + d\frac{\text{En}}{\text{Eo}} + ... \qquad (2.1)$$

Where,

"Pn"   "is the Price Adjustment factor for the work carried out in the period **n**".

"A"   "is a constant or the Non-Adjustable Portion of the Price Adjustment Factor to be specified in Appendix-C to Bid, representing the Non-Adjustable Portion of the Contract Price".

"b, c, d......."   "are Coefficients or weightages of the order of 0.xx (i.e., fractions having two significant digits) for each specified element of adjustment in the Contract. The sum of A, b, c, d, etc., shall be one".

"Lo, Mo, Eo........"   "are the Base Date Indices for the specified (adjustable) elements".

"Ln, Mn, En......."   "are the Current Date Indices of the specified (adjustable) elements for the period "**n**".

2.7.2 Parameters

The price adjustment formula involves different parameters. Following are the parameters being used in the formula:

1- Base Date

2- Effective Date

3- Coefficients or Weight-ages

4- Adjustable portion of the Contract

5- Source of Prices

These parameters are defined and explained in the Table 2.1.

Table 2.1 Parameters used in price adjustment formula

S.No	Parameter	Description
1	Base Date	The Base date for the cost of any item of work shall be the cost of the element of the item which was prevalent twenty eight (28) days prior to the date of submission of the tender.
2	Effective Date	The effective date of fixing the fluctuating rate of the items for price adjustment shall be twenty eight (28) days prior to the start of the execution month for which the contractor executed the item. The unit of time shall be a calendar month.
3	Co-efficient or Weightages	The Co-efficient for each specified item shall be calculated and given in the bidding/tender documents. The co-efficient for each specified escalable item shall be determined by the user proportionate to its ratio among all the escalable items in a contract. The sum of these co-efficient shall form the adjustable portion of the Contract.
4	Adjustable portion of the contract	The adjustable portion of the Contract shall generally be maximum up to 0.65 (65%) depending on the nature of the project and discretion of the Employer. Non-adjustable portion shall, thereby, not be generally less than 35%.
5	Sources for price adjustment	The prices of elements subject to price adjustment shall be to the extent possible as given in the Statistical Bulletins published by Statistical Division of Government of Pakistan. Where available, statutory notifications and official price from public sector organizations may be used at the option of the Employer. However, for a particular escalable item(s), the same source should be used throughout the currency of contract.

Source: PEC, 2009 "Standard Procedure and Formula for Price Adjustment"

2.7.3   Salient Features of PEC Document for Applicability of the Formula

As per PEC guidelines, the terms and conditions required for the application of Price Adjustment Formula in Pakistan are following:

1- The contracts which are being under execution at the time of introduction of the price adjustment formula, will continue as per their existing provision for price adjustment, until and unless an amendment in the contract is being signed by the parties to the contract, with mutual understanding.

2- The price adjustment will be admissible for only those contracts having original contract period of 12 months or more and having the contract value of Rs 25.00 million or more.

3- The price adjustment will be paid full for the original scheduled completion period, and the contractor should submit the construction schedule as required in the contract.

4- If the completion of the contract exceeds its original completion time, then no price adjustment will be paid to the contractor for the time beyond original contract period, if the delay is on the part of the contractor. However, if the employer is responsible for the delay then the contractor will be paid full compensation for price adjustment.

5- Following is the list of commonly use items on which price adjustment is admissible:

  - Cement
  - Steel
  - POL
  - Labour Unskilled
  - Bricks
  - Bitumen

  However, any element can be added, substituted or deleted as deemed appropriate and then the weight-ages or coefficients would be decided accordingly.

6- The contractor will not be paid price adjustment for the items supplied by the employer either free of cost or at fixed prices.

7- This document is applicable to all types of contracts including lump sum contracts, percentage over schedule contracts and items rate contracts. However fixed price contracts are excluded.

8- According to this document the price adjustment will only be paid in local currency (Pakistani Rupees). However the contracting parties may decide by mutual agreement regarding the price adjustment is some other foreign currency.

9- The cost elements, which have cost impact of 5 percent or more, can only be selected for adjustment. However, HSD and labour shall be included in the Price Adjustment formula irrespective of their percentage in a particular project, if these are applicable for that project.

10- If any item on which price adjustment is admissible as per contract and in a particular billing month that item is not used, then the current date price and base date price ratio will be considered as "one" for the price adjustment for that particular month.

11- Sometimes the cost indices are not available timely for current months. FIDIC 1999 states that till the availability of the cost index for current month the engineer may determine the provisional index for the issue of Interim Payment Certificate (IPC) or may use the index costs for the previous month. When the cost index for that particular month is available, the adjustment will be re-calculated accordingly.

2.7.4 Procedure for Application of Price Adjustment Formula

As per guidelines of FIDIC and PEC, the procedure for the price adjustment using the FIDIC price adjustment formula can be divided into following steps:

1- The Engineer's Estimate will be prepared for the complete project, and the costs of the basic elements, on which price adjustment is to be admissible, are calculated from the engineer's estimate. Each cost element determined above is then divided by the total amount of the engineer's estimate to get the co-efficient of the weight-ages.

2- Weight-age of the fixed portion (A) which is also called the non-adjustable portion of the estimated cost of the contract, will be determined as following:

a. First the weight-ages of all the elements are added (elements having values of 5% or more are considered, except POL and Labour which are taken into consideration irrespective of their percentage weight-age) to see whether the added total is 65% or less. If the total weight-age of the cost elements including POL and Labour exceeds 65%, then the elements having lower percentages other then POL and Labour will be excluded to keep the total percentage equal to or less than 65%.

b. Fixed or non-adjustable portion should never be less than 35% and accordingly the adjustable portion should not exceed 65%. A rate breakup is normally cost of material and services etc plus 25 % for profit overhead. The 25 % part, therefore, needs no escalation consideration plus 10% for smaller or less cost items other than specified items.

c. When the weight-ages a,b,c,d …….. and so on, and fixed portion "A" are added, the result should always be "1".

3- The contractor will submit his bill for each month (if the billing period is more than one month, then the billed amount will be segregated for the work done in each month separately).

4- The Base Dates and Effective Dates shall be calculated from the source of price as per procedure explained in Table 2.1.

5- The price adjustment factor "Pn" is then calculated for the billing amount submitted by the contractor for the month under consideration, by the application of the formula. This factor is multiplied by the amount of the bill to get the adjusted cost for that particular IPC.

2.8   EXAMPLES OF PRICE ESCALATION CLAUSES

The prices escalation clauses of two different projects are presented in appendix-II for having a better idea of the two types of price escalation clauses.

- The price escalation clause for the project of Chandni Chowk Fly-over, Rawalpindi was based on previously used method called "Invoice Method".

- Whereas the escalation clause for the Project of New Islamabad International Airport (Package-8A) has been presented which was based on the FIDIC Price Adjustment Formula.

2.9   CALCULATION FOR PRICE ADJUSTMENT USING PRICE ADJUSTMENT FORMULA

Following is the example of calculation of price adjustment using the price adjustment formula for an ongoing project. This example is taken from one of the many construction projects under progress for the New Islamabad International Airport, Islamabad Pakistan. The project is named as "Landside Infrastructure, Package-8A". Figure 2.3 shows the details of the price adjustment formula for the subject contract. The fixed portion for this contract is 0.60, weight-ages for labour, cement, steel, HSD and bitumen are 0.15, 0.05, 0.08, 0.05 and 0.07 respectively. Sources of prices are also mentioned in the contract document.

NEW ISLAMABAD INTERNATIONAL AIRPORT ISLAMABAD

PACKAGE 8A :- LANDSIDE INFRASTRUCTURE

PRICE ADJUSTMENT UNDER COC CLAUSE 70   **INTERIM PAYMENT APPLICATION NO. 19**

1 Adjustment Formula as per (Sub Clause 70.1 (b))

$P_n = a + b(l_n/l_o) + c(c_n/c_o) + d(s_n/s_o) + e(h_n/h_o) + f(b_n/b_o)$

2 Coefficients according to Contract Document (Appendix-C)

3 Basic Prices 28 days prior to the last date for submission of Bids according to Contract Documents Clause 70.1 (d).

Last date for submission of Bids   **May 20, 2010**

Effective date for Basic Prices 28 days prior   **April 22, 2010**

4 Current Prices 28 days prior to the last day of the period to which a particular monthly statement is related according to Clause 70.1 (d).

Sr. No	Cost Element		Weightages	Basic Prices (Rs.)	Source of Price	Remarks
a	Fixed		0.60	-		
b	Labour Unskilled	Day	0.15	325.00	M.S.B.*	
c	Cement	Bags	0.05	270.00	M.S.B.	
d	Reinforcement Steel	Ton	0.08	64,000.00	M.S.B.	
e	High Speed Diesel (HSD)	Ltr	0.05	73.39	OGRA	
f	Bitumen	Ton	0.07	59,428.00	Attock Refinery	
	Total		**1.00**			

∗ M.S.B = Monthly Statistical Bulletin

Figure 2.3 Price Adjustment formula as per Escalation clause for New Islamabad International Airport (Package-8A)

S.No	IPC No.	Billing Month	Effective Date for Current Prices	Current Prices					Pn Values as per COC	VOW for the Billing Month	Amount against Price Adjustment UP DATED	Amount against Price Adjustment PREVIOUS	Amount against Price Adjustment THIS BILL	% Age
				Labor unskilled (Day) (lo) Rs.	Cement (Bag) (co) Rs.	Reinforcement (Ton) (so) Rs.	HSD (Ltr) (ho) Rs.	Bitumen (Ton) (bo) Rs.		Rs.	Rs.	Rs.	Rs.	
									Calculation of Amount against Price Adjustment		**INTERIM PAYMENT APPLICATION NO. 19**			
1	IPC No. 02	Oct-10	3-Oct-10	350.00	332.50	60,000.00	73.82	55,377.00	1.0136	72,136,898	981,062	981,062	-	1.36%
2	IPC No. 03	Nov-10	2-Nov-10	350.00	350.00	60,000.00	78.33	59,131.00	1.0244	42,404,402	1,034,667	1,034,667	-	2.44%
3	IPC No. 03 Rev.	Dec-10	3-Dec-10	375.00	350.00	60,000.00	78.33	59,131.00	1.0360	7,094,111	255,388	255,388	-	3.60%
4	IPC No. 03 Rev.A	Jan-11	3-Jan-11	375.00	335.00	61,000.00	82.58	62,540.00	1.0414	165,119,793	6,835,959	6,835,959	-	4.14%
5	IPC No. 04	Feb-11	31-Jan-11	375.00	335.00	61,000.00	78.33	62,540.00	1.0385	49,229,759	1,895,346	1,895,346	-	3.85%
6	IPC No. 04 Rev.	Mar-11	3-Mar-11	375.00	352.50	62,250.00	86.09	71,890.00	1.0596	76,172,061	4,539,855	4,539,855	-	5.96%
7	IPC No. 05	Apr-11	2-Apr-11	375.00	390.00	66,000.00	92.89	75,400.00	1.0799	67,919,007	5,426,729	5,426,729	-	7.99%
8	IPC No. 05 Rev	May-11	3-May-11	375.00	410.00	67,500.00	97.31	77,343.00	1.0908	132,863,354	12,063,993	12,063,993	-	9.08%
9	IPC No. 06	Jun-11	2-Jun-11	375.00	410.00	68,500.00	94.11	77,343.00	1.0898	89,093,969	8,000,638	8,000,638	-	8.98%
10	IPC No. 06 A	Jul-11	3-Jul-11	400.00	395.00	70,500.00	92.10	79,582.00	1.1022	29,328,684	2,997,392	2,997,392	-	10.22%
11	IPC No. 06 B	Aug-11	3-Aug-11	400.00	390.00	70,000.00	92.10	76,978.00	1.0977	18,245,468	1,782,582	1,782,582	-	9.77%
12	IPC No. 06 C	Sep-11	3-Sep-11	400.00	397.00	69,500.00	92.64	76,821.00	1.0986	47,689,910	4,702,225	4,702,225	-	9.86%
13	IPC No. 06 D	Oct-11	3-Oct-11	400.00	410.00	70,500.00	94.15	76,183.00	1.1024	61,531,385	6,300,814	6,300,814	-	10.24%
14	IPC No. 07	Nov-11	3-Nov-11	400.00	416.43	70,500.00	94.15	76,763.00	1.1043	30,004,597	3,129,479	3,129,479	-	10.43%
15	IPC No. 07 Rev.A	Dec-11	3-Dec-11	400.00	420.00	70,500.00	98.82	76,763.00	1.1082	39,252,225	4,247,091	4,247,091	-	10.82%
16	IPC No. 07 Rev.B	Jan-12	3-Jan-12	400.00	420.00	71,500.00	98.82	76,763.00	1.1095	94,506,782	10,348,493	10,348,493	-	10.95%
17	IPC No. 08	Feb-12	3-Feb-12	400.00	420.00	71,500.00	103.46	76,763.00	1.1127	122,506,282	13,806,458	13,806,458	-	11.27%
18	IPC No. 09	Mar-12	3-Mar-12	400.00	425.00	72,500.00	103.46	78,930.83	1.1174	112,804,187	13,243,212	13,243,212	-	11.74%
19	IPC No.10	Apr-12	3-Apr-12	400.00	440.00	75,500.00	108.16	80,300.00	1.1288	77,561,850	9,989,966	9,989,966	-	12.88%
20	IPC No.10 Rev. A	May-12	3-May-12	400.00	450.00	75,500.00	107.00	80,300.00	1.1298	223,876,826	29,059,212	29,059,212	-	12.98%
21	IPC No.11	Jun-12	3-Jun-12	400.00	437.50	76,500.00	105.77	80,300.00	1.1279	157,528,612	20,147,909	20,147,909	-	12.79%
22	IPC No.12	Jul-12	3-Jul-12	400.00	442.50	77,000.00	97.21	80,300.00	1.1236	221,980,705	27,436,815	27,436,815	-	12.36%
23	IPC No.13	Aug-12	3-Aug-12	400.00	442.50	77,000.00	101.79	84,272.00	1.1314	247,446,565	32,514,479	32,514,479	-	13.14%
24	IPC No.14	Sep-12	3-Sep-12	450.00	442.50	76,000.00	112.13	84,272.00	1.1603	230,253,542	36,909,643	36,909,643	-	16.03%
25	IPC No.15	Oct-12	3-Oct-12	450.00	442.50	76,000.00	112.13	84,272.00	1.1603	375,661,013	60,218,460	60,218,460	-	16.03%
26	IPC No.16	Nov-12	3-Nov-12	450.00	442.50	76,000.00	109.77	84,272.00	1.1587	418,375,020	66,396,116	66,396,116	-	15.87%
27	IPC No.17	Dec-12	3-Dec-12	450.00	442.50	73,500.00	109.77	81,952.00	1.1528	313,052,902	47,834,483	49,681,496	(1,847,013)	15.28%
28	IPC No.18	Jan-13	3-Jan-13	450.00	442.50	73,500.00	110.13	81,952.00	1.1530	251,631,623	38,499,638	39,984,265	(1,484,627)	15.30%
29	IPC No.19	Feb-13	1-Feb-13	450.00	442.50	73,500.00	109.21	81,952.00	1.1524	118,164,415	18,008,257		18,008,257	15.24%
	Total Amount Against Price Adjustment									3,893,435,947	488,606,361	473,929,744	14,676,617	12.55%

Figure 2.4 Calculation Sheet for price adjustment for New Islamabad International Airport (Package-8A)

Figure 2.4 presents the complete sheet for the calculation of adjusted price through price adjustment formula for the subject project. Price adjustment factor (Pn) is calculated for work-done for each month by putting the relative data in the formula and that factor is multiplied with the value of work-done (VOW) for each month, thus obtaining the adjusted price payable to the contractor.

2.10 SUMMARY

In this chapter, Price Escalation was discussed in detail. The detailed literature review covered the effects of price fluctuation, its causes and the methods & techniques used to minimize the adverse effects of price escalation. The commonly used method to cover the escalation in prices is the inclusion of Price Escalation Clause in the contract. The discussion on different types of price escalation clauses is also the part of this chapter. Then the background of price adjustment formula, its generalized form and factors, application of the formula to calculate the adjusted costs are discussed in detail, which was one of the objectives of this study. All this extensive literature review helped in the preparation of questionnaire which was the research tool for this thesis. In the next chapter the research methodology developed for this research study is discussed.

CHAPTER 3

RESEARCH METHODOLOGY

3.1   INTRODUCTION

In this chapter, the research methodology adopted for this thesis is discussed. Research strategy shows how the researchers are going to carry out their study to achieve the research objectives (Saunders *et al.,* 2007). Generally the common methods used for the collection and generation of the research data are the questionnaire survey and interviews. This research is conducted as an exploratory and comparative study of the FIDIC price adjustment formula and its implications in construction contracts and suggested measures to improve the formula. Graphical presentation of the research methodology adopted in this research is shown in Figure 3.1. After the preliminary study, detailed literature review was carried out and a number of previously prepared questionnaires were examined.

After carrying out the pilot study, the questionnaire was reviewed further and necessary adjustments were made keeping in view the practices and requirement of the CI of Pakistan to make it suitable for the local environment. A five-point likert scale, with 5 being very high and 1 being very low, is utilized to judge the opinion of the concerned stakeholders. The construction professionals, contractors and people from academia related to civil engineering are the sample population for this research. Total 107 questionnaires are received out of which 94 were valid, remaining were excluded being incomplete/invalid. Respondents to this survey include 24 from owners/client category, 12 were working as consultants, 5 from academia and 53 respondents are from contractor/subcontractor side.

The collected data was analyzed using MS excel and PASW-Statistics-18. The Cronbach's Coefficient Alpha method test was applied to measure the internal consistency (reliability). To check whether data was parametric or non parametric (normally distributed or otherwise), the Shapiro-Wilk Normality Test was performed. Kruskal-Wallis test was conducted to have a view about the differences or similarities in the opinion of all stakeholders about escalation and price adjustment formula.

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        │   IDENTIFICATION OF     │
        │       RESEARCH          │
        │       OBJECTIVES        │
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        │   LITERATURE REVIEW     │
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        │ QUESTIONNAIRE DESIGN AND LAYOUT │
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        │         DATA            │
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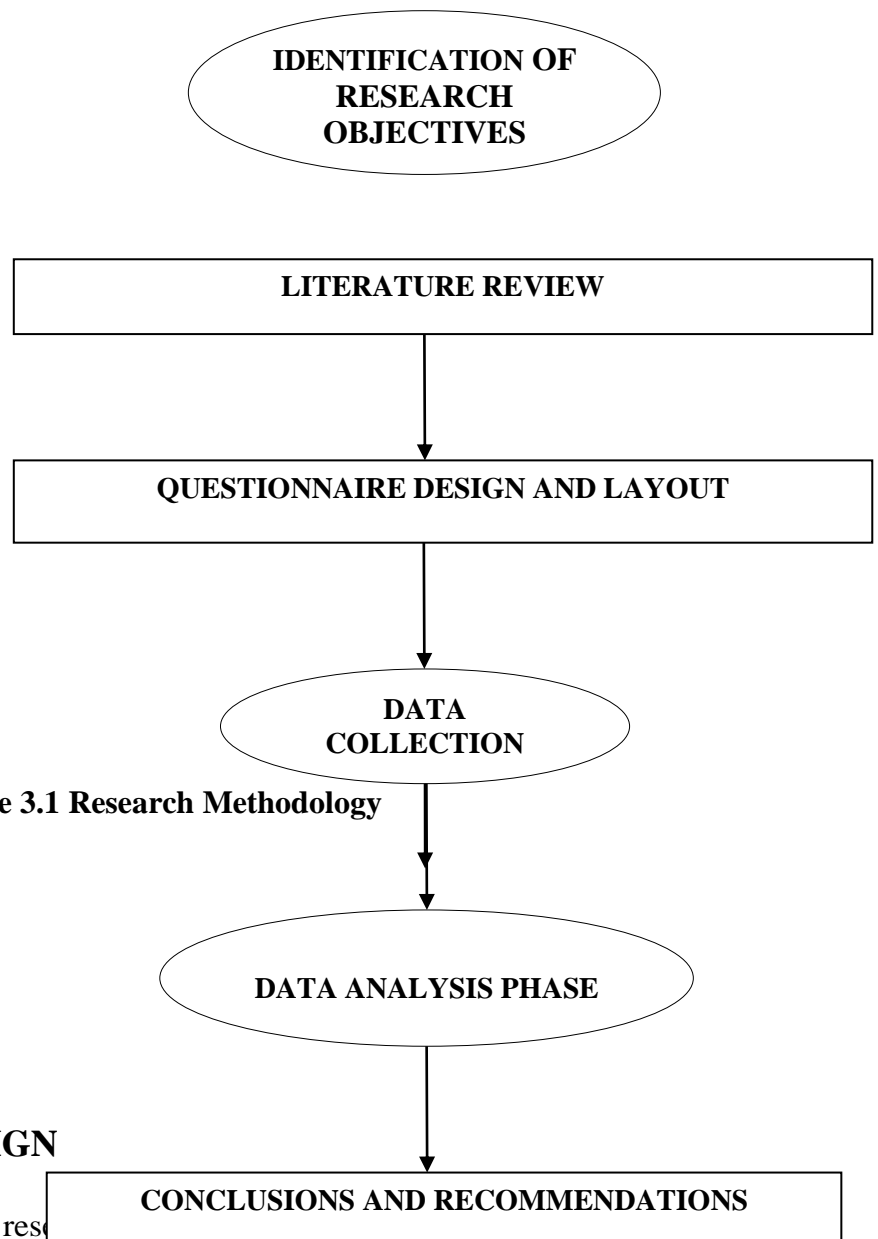
Figure 3.1 Research Methodology

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        ┌─────────────────────────┐
        │   DATA ANALYSIS PHASE   │
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        ┌───────────────────────────────────────┐
        │  CONCLUSIONS AND RECOMMENDATIONS      │
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3.2   RESEARCH DESIGN

The objectives of the research this chapter, the methods for achieving these goals are discussed in.

In this study, the survey was carried out through questionnaire method as it is the most appropriate method for this kind of study (Naoum, 2007). Instead of using "Yes/No" answers, for most of the questions, a five point likert scale was used, to give respondent the extra range of possibilities between "Yes" and "No". "The principal consideration for using likert scale is to determine the extent to which respondents agree or disagree with a particular statement or view" (Cormack, 2000).

Analysis of data has been carried out using MS excel and PASW-18, to have

frequency analysis, reliability analysis and SPI analysis. To check the differences in the opinions of all stakeholders, Kruskal-Wallis test was performed. The selection of these statistical methods will be introduced in relevant chapters. In the last, efforts were made to draw conclusions and give recommendations on the basis of analysis and results obtained.

3.3   DATA COLLECTION

In order to understand the opinion of the stakeholders, a questionnaire survey was conducted. the questionnaire was distributed through e-mails, face to face meetings with the professionals and by visiting the construction sites and projects.

Determination of the characteristics of the population through sampling is the main purpose of statistics. Sampling should be done to reflect the true representation of population. Several methods of sampling are there depending upon the characteristics and attributes of the population.The sample to carry out the research for the thesis is selected from a population of construction enterprises and professionals in Pakistan. The questionnaire was, therefore, distributed to approximately 150 randomly selected potential respondents, through e-mails, mail and by personally visiting the various projects.

The objective of statistics is to have summary measure about some of the characteristics of the complete population through sampling. Sampling should be a true representative of the population for getting good results. The population of civil engineering professionals is believed to be greater than 50000 based on PEC statistics. Table 3.1 containing acceptable sample sizes with different sampling errors, was used to obtain the desired sample size. 50000 was used as the population size. Confidence level was selected as 95%.

Table 3.1: True Sample Size *(Dillman, 2000)*

Completed sample sizes needed for various population sizes and characteristics at three levels of precision.						
	Sample size for the 95% confidence level					
	±10% Sampling Error		±5% Sampling Error		±3% Sampling Error	
Population Size	50/50 split	80/20 split	50/50 split	80/20 split	50/50 split	80/20 split
100	49	38	80	71	92	87
200	65	47	132	111	169	155
400	78	53	196	153	291	253
600	83	56	234	175	384	320
800	86	57	260	188	458	369
1,000	88	58	278	198	517	406
2,000	92	60	322	219	696	509
4,000	94	61	351	232	843	584
6,000	95	61	361	236	906	613
8,000	95	61	367	239	942	629
10,000	95	61	370	240	965	640
20,000	96	61	377	243	1,013	661
40,000	96	61	381	244	1,040	672
100,000	96	61	383	245	1,056	679
1,000,000	96	61	384	246	1,066	683
1,000,000,000	96	61	384	246	1,067	683

3.4   THE QUESTIONNAIRE

The questionnaire developed for the research study consisted of two major parts. Part I was designed to gather the general information of the respondent like Name, Contact Details, Experience, Employer's Details etc. Part II is the main body of the questionnaire in which there are 30 questions in total. Out of 30 questions, 22 questions are based on the five point Likert Scale, with 1 being very low and 5 being very high, to judge the opinion of the respondents. In the last section of the Part II, there are 8 questions in which the respondent has to choose the answer of his choice from the given

options.

The questionnaire was distributed for online filling and submission, as well as in hard form by visiting the potential respondents. Collection of data through online submission is always a speedy method which takes lesser time to record the opinion. Detail of the feedback of the respondents has been presented in Figure 3.2.
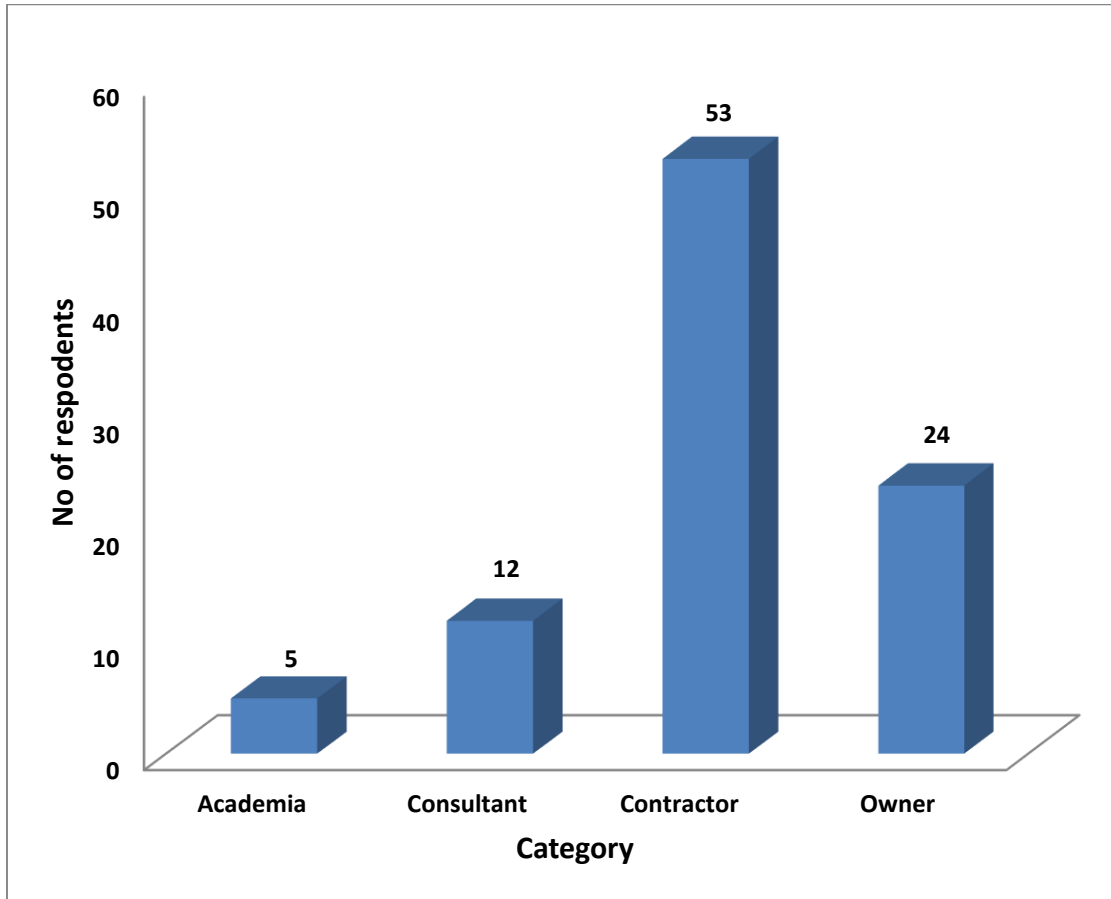
Figure 3.2 Detail of respondents' feedback

3.5   SUMMARY

This Chapter covers the detail of research methodology adopted for the thesis and the formulation of survey questionnaire form. Chapter also discusses the detail of data collection procedures for data analysis.. In the next chapter, the detailed analysis of the data using MS Excel and PASW-18 software is discussed.

Chapter 4

DATA ANALYSIS AND RESULTS

4.1   INTRODUCTION

Recently, the price fluctuation of construction materials and services in Pakistan has become severe and very much unpredictable. Most of the contractors in CI,

especially local contractors, are facing strong challenges during bid process due to the high uncertainty of predicting what would happen during the course of the execution of the project. The challenge gets even more severe not only as a result of the ever escalating market prices but also as a result of the non-availability or weaker compensation practice in the event of price variation. Based on the above explained fact, the research problem has been addressed in this research by collecting data with the help of the questionnaires, distributed to local construction contractors, consultants, clients and stakeholders from academia.

MS Excel and PASW-18 are the softwares used to analyze the data collected through questionnaire based survey. Results of this survey are discussed in the subsequent paragraphs.

4.2   CHARACTERISTICS OF RESPONDENTS

4.2.1   Grouping of the Respondents

Out of the 130 potential respondents, 107 responses were received. However, on scrutiny, 13 responses were found in-valid or in-complete which were rejected. Therefore, the response rate for accepted responses was 72.30%. Response by the owners/clients was 25.5 %, consultants 12.8%, academia/students 5.3% and contractors 56.4 %. Grouping and frequencies (percentages) of respondents are shown in Table 4.1 and Figure 4.1:

Table 4.1 Grouping of the respondents

Respondents	No of Questionnaires Returned	Percentage	Cumulative Percentage
Academia	05	05.32	5.32
Clients/Owner	24	25.53	30.85
Consultants	12	12.77	43.62
Contractors/Subcontractors	53	56.38	100
Total	94	100	-
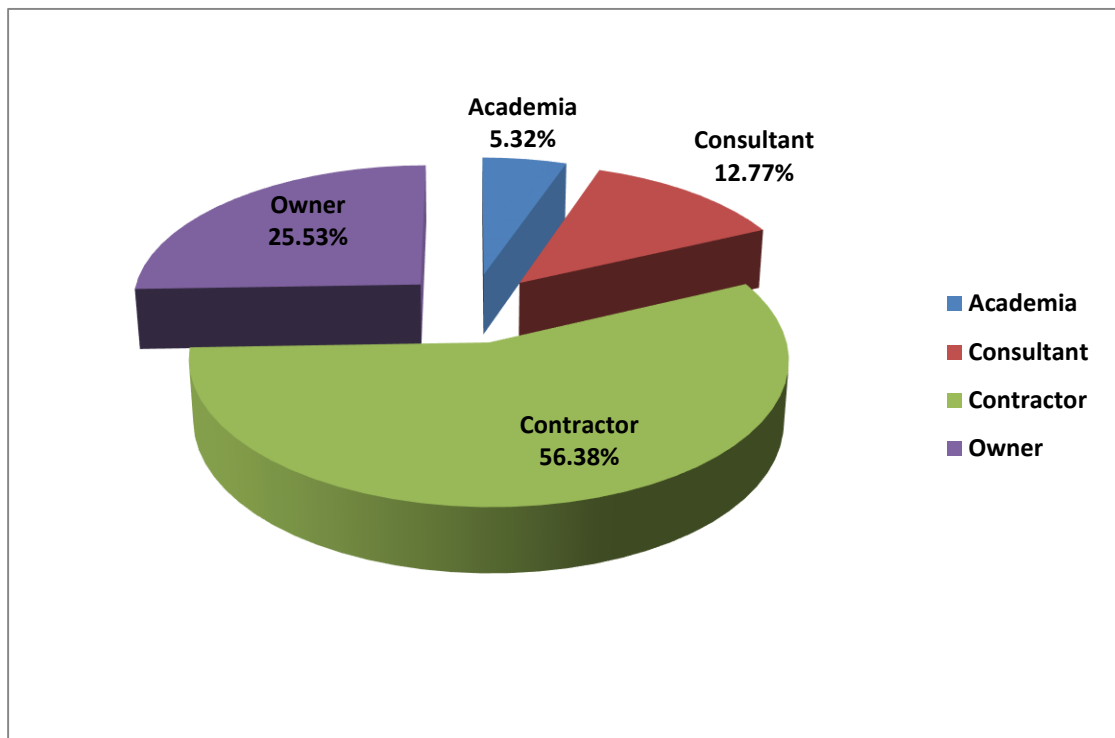
Figure 4.1 Grouping of the respondents

4.2.2 Experience of the Stakeholders in the Construction Industry

Persons with different number of years of working with CI, responded to the questionnaire as shown in Table 4.2 and Figure 4.2. Approximately 9.57% of the

respondents had accumulated over 15 years of construction experience, 15.96% had experience between 11 to 15 years, and 56.38% possessed 6 to 10 years of experience, whereas only 18.09% had less than 5 years of construction industry experience..

Table 4.2 Experience of respondents in construction industry

Experience of Respondents	Frequency of Respondents	Percentage of Respondents	Cumulative Percentage
0-5 years	17	18.09	18.09
6-10 years	53	56.38	74.47
11-15 years	15	15.96	90.43
16-20 years	05	5.32	95.75
20+ years	04	4.25	100.0
Total	94	100.0	-
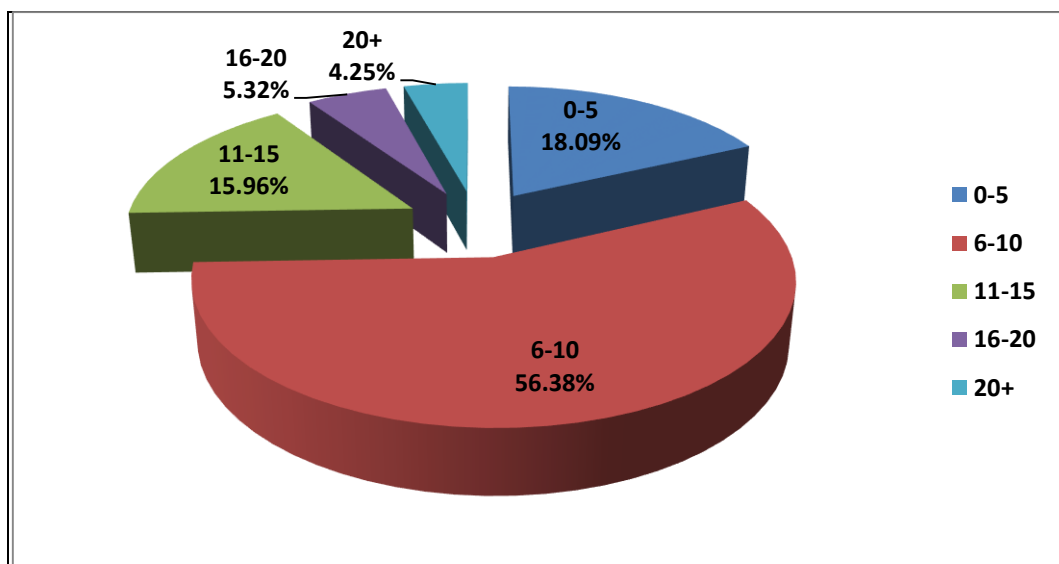
Figure 4.2 Percentage of respondents based on industry experience

4.2.3 Positions of the Respondents in the Construction Industry

Respondents to this research survey belonged to different positions in the CI. Table 4.3 and Figure 4.3 show the positions holders who responded to this survey. Approximately 8% of the respondents were either Director or GM in their organizations, 21% were Managers at different levels, 53% were field engineers, 5% supervisors and 12 % were the owners of their companies/organizations.

Table 4.3 Positions of the respondents in construction industry

Positions of the Respondents	Frequency of Respondents	Percentage of Respondents	Cumulative Percentage
Director/GM	7	8	8
Managers	20	21	29
Field Engineers	50	53	82
Supervisors	5	5	87
Owners	12	13	100.0
Total	**94**	**100**	**-**
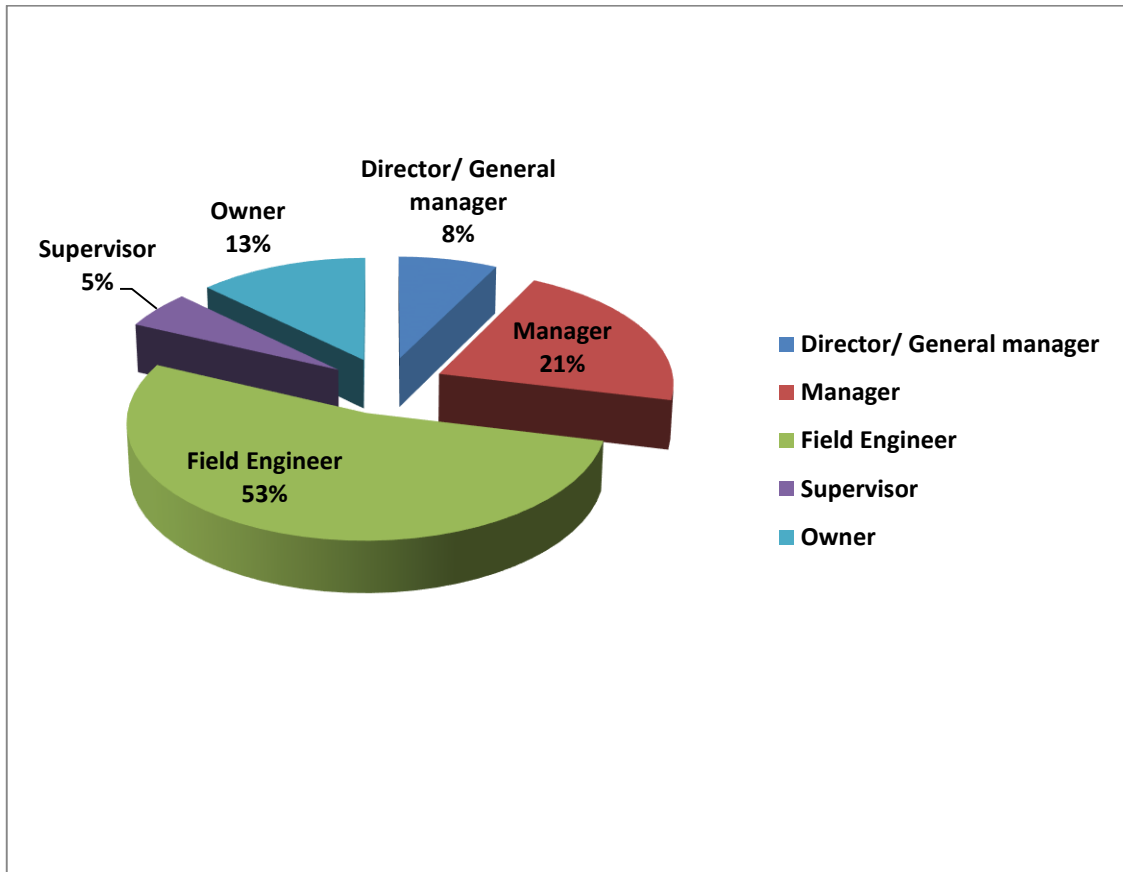
Figure 4.3 Percentage of the respondents based on their position

4.3   STATISTICAL ANALSIS

4.3.1   Reliability of the Sample

4.3.1.1 Cronbach's Coefficient Alpha Method

To check the reliability of data, when questions are asked on likert scale, Cronbach's Coefficient Alpha method is the most commonly used test. If Cronbach's Coefficient Alpha value is higher than 0.7, this means that the data is acceptable for analysis whereas if its value is higher than 0.9, this means that the data is excellent for further analysis (Li, 2007). For the collected data, its value was calculated as 0.968 using SPSS, as given in Table 4.10. Its higher value indicated that the data was consistent and reliable for further analysis.

Table 4.4 Reliability Statistics

Case Processing Summary				Cronbach's Alpha	0.968
		N	%		
Cases	Valid	94	100.0		
	Excluded[a]	0	.0	Number of Items	22
	Total	94	100.0		
a. Listwise deletion based on all variables in the procedure.					

4.3.2 Measurement of Normality of Data

To check the normality of the data, "Shapiro-Wilk normality test" was conducted as the sample size was less than 2000. This test was performed to evaluate whether the collected data was normally distributed or not, i.e. the data was parametric or non-parametric. Significance values being less than 0.05 (the data will be sufficiently normal if significance value exceeds 0.05), therefore, data was not normally distributed and to further analyze, non-parametric tests were required. Table 4.5 shows the result of the Shapiro-Wilk test.

Table 4.5 Shapiro Wilk test for Normality

S. No.	Parameter	Statistic	Df	Sig.
1	Familiarity with escalation/de-escalation and price adjustment process	0.798	94	.000
2	Engineers are given enough knowledge about dealing with escalation/de-escalation process.	0.668	94	.000
3	Efforts to anticipate the effect of price fluctuations.	0.776	94	.000
4	Following the price fluctuation trends of different materials.	0.835	94	.000
5	Price adjustment clause should always be a part of a construction contract.	0.769	94	.000
6	Inclusion of price adjustment clause in construction contracts helps in reducing the related conflicts between contractor and client.	0.797	94	.000
7	Bids can go higher in the absence of price adjustment clause.	0.771	94	.000
8	Escalation clause is an effective method of dealing with risk associated with price fluctuation.	0.803	94	.000
9	Effective planning can be helpful in minimizing the adverse effects of price fluctuations.	0.757	94	.000

10	Frequent use of FIDIC price adjustment formula.	0.779	94	.000
11	Escalation is a major cause of cost over-run of the construction projects.	0.815	94	.000
12	Price adjustments through the Formula truly represent the cost variations.	0.669	94	.000
13	Invoice Method of price adjustment was more effective than the Price Adjustment Formula method.	0.759	94	.000
14	Contractor can get unfair advantage by manipulating with the purchase dates, when using the "Invoice Method".	0.674	94	.000
15	"Invoice Method" cannot be effectively applied in Pakistani environment because of less government control on proper invoicing.	0.746	94	.000
16	Difficulty to check & verify the invoices submitted by the contractors, when claiming the escalation by using "Invoice Method".	0.792	94	.000
17	Price Adjustment Formula provides fair environment to all the parties.	0.737	94	.000
18	Formula requires any other parameter to be included.	0.815	94	.000
19	Limitations of the formula.	0.739	94	.000
20	Flexibility in the formula to cope with the changes in the scope of work.	0.794	94	.000
21	Contractors have more advantage by the application of price adjustment formula.	0.826	94	.000
22	Client/owner have more advantage through the price adjustment formula.	0.774	94	.000

4.3.3   Kruskal Wallis Test for Non-Parametric Data

Since the data collected for this research was non-parametric, Kruskal Wallis test was performed to check whether all stakeholders including academia, owners/clients, consultants and contractors had similar perception regarding the price escalation/de-escalation and price adjustment formula.

Table 4.6   Kruskal Wallis test for Academia, Consultants, Contractors & Owners/Clients

S. No.	Parameter	Significance
1	Familiarity with escalation/de-escalation and price	**0..000**

	adjustment process	
2	Engineers are given enough knowledge about dealing with escalation/de-escalation process.	**0.000**
3	Efforts to anticipate the effect of price fluctuations.	**0.000**
4	Following the price fluctuation trends of different materials.	**0.000**
5	Price adjustment clause should always be a part of a construction contract.	0.651
6	Inclusion of price adjustment clause in construction contracts helps in reducing the related conflicts between contractor and client.	0.707
7	Bids can go higher in the absence of price adjustment clause.	0.030
8	Escalation clause is an effective method of dealing with risk associated with price fluctuation.	0.208
9	Effective planning can be helpful in minimizing the adverse effects of price fluctuations.	**0.001**
10	Frequent use of FIDIC price adjustment formula.	0.014
11	Escalation is a major cause of cost over-run of the construction projects.	0.019
12	Price adjustments through the Formula truly represent the cost variations.	0.065
13	Invoice Method of price adjustment was more effective than the Price Adjustment Formula method.	0.177
14	Contractor can get unfair advantage by manipulating with the purchase dates, when using the "Invoice Method".	**0.000**
15	"Invoice Method" cannot be effectively applied in Pakistani environment because of less government control on proper invoicing.	0.124
16	Difficulty to check & verify the invoices submitted by the contractors, when claiming the escalation by using "Invoice Method".	0.022
17	Price Adjustment Formula provides fair environment to all the parties.	**0.000**
18	Formula requires any other parameter to be included.	**0.003**
19	Limitations of the formula.	**0.001**
20	Flexibility in the formula to cope with the changes in the scope of work.	0.388
21	Contractors have more advantage by the	0.092

	application of price adjustment formula.	
22	Client/owner has more advantage through the price adjustment formula.	0.712

From the results of Kruskal Wallis test mentioned in Table 4.6, it is clear that the stake holders have similar perception for the following parameters:

a. Price adjustment clause should always be a part of a construction contract.

b. Inclusion of price adjustment clause in construction contracts helps in reducing conflicts between contractor and client.

c. Bids can go higher in the absence of price adjustment clause.

d. Escalation clause is an effective method of dealing with risk associated with price fluctuation.

e. Frequent use of FIDIC price adjustment formula.

f. Escalation is a major cause of cost over-run of the construction projects.

g. Price adjustments through the formula truly represent the cost variations.

h. Invoice Method of price adjustment was more effective than the Price Adjustment Formula method.

i. "Invoice Method" cannot be effectively applied in Pakistani environment because of less government control on proper invoicing.

j. Difficulty to check & verify the invoices submitted by the contractors, when claiming the escalation by using "Invoice Method".

k. Flexibility in the formula to cope with the changes in the scope of work.

l. Contractors have more advantage by the application of price adjustment formula.

m. Client/owner has more advantage through the price adjustment formula.

However the Academia, Consultants, Contractors and Owners/Clients have different perceptions for the following parameters:

a. Familiarity with escalation/de-escalation and price adjustment process.

b. Engineers are given enough knowledge about dealing with escalation/de-escalation process.

c. Efforts to anticipate the effect of price fluctuations.

d. Following the price fluctuation trends of different materials.

e. Effective planning can be helpful in minimizing the adverse effects of price fluctuations.

f. Contractor can get unfair advantage by manipulating with the purchase dates, when using the "Invoice Method".

g. Price Adjustment Formula provides fair environment to all the parties.

h. Formula requires any other parameter to be included.

i. Limitations of the formula.

To see the differences among all the four groups of stakeholders, Relative Importance Index (RII) values were calculated. The results are presented in the Table 4.7:

Table 4.7   RII Values for parameters having difference in perception

Sr. #	Parameters	Stakeholders			
		Academia	Consultant	Contractor	Client
		RII	RII	RII	RII
1	Familiarity with escalation/de-escalation and price adjustment process.	0.640	0.783	0.618	0.775
2	Engineers are given enough knowledge about dealing with escalation/de-escalation process.	0.560	0.600	0.418	0.583
3	Efforts to anticipate the effect of price fluctuations.	0.360	0.583	0.441	0.658
4	Following the price fluctuation trends of different materials.	0.520	0.516	0.464	0.700
9	Effective planning can be helpful in minimizing the adverse effects of price fluctuations.	0.760	0.766	0.637	0.725
14	Contractor can get unfair advantage by manipulating with the purchase dates, when using the "Invoice Method".	0.640	0.566	0.769	0.741
17	Price Adjustment Formula provides fair environment to all the parties.	0.600	0.650	0.773	0.775
18	Formula requires any other parameter to be included.	0.640	0.500	0.452	0.600
19	Limitations of the formula.	0.640	0.616	0.433	0.575

4.3.4   Relative Importance Index (RII)

The data collected through the questionnaire was analyzed and ranked using the "relative importance index" as used by Kometa et.al, (1994). RII was calculated for each

factor available in the questionnaire by transforming the scale and giving weightage to the scale. This was then used to determine the ranks of each factor. Equation 4.1 shows how RII was calculated:

$$\textit{Relative Importance Index } (RII) = \sum w/(A*N) \ldots\ldots\ldots\ldots (4.1)$$

Where:

w = Weight-age given to each factor by the respondents and ranges from 1 to 5 where '1' is 'Never' and '5' is 'Always'

A = Highest weight (i.e. 5 in this case)

N = Total number of respondents (i.e. 94 in this case)

On the basis of the analysis, the results of the findings are presented and discussed in the following section.

4.4   FINDINGS

After detailed statistical analysis of the data and applying different tests, the understanding of the stakeholders towards the price fluctuation and price adjustment formula was evaluated. The same is discussed as follow.

4.4.1 Familiarity with Price Escalation Process

First question was designed to know that how much familiar the different categories of stakeholders are with price escalation and price adjustment process. The results are shown in the Table 4.6 and Figure 4.4. The results show only 31% of the respondents is often/always familiar with the escalation/de-escalation and the remaining 69% do not have frequent exposure to the escalation/de-escalation process.

Table 4.8 Familiarity with price escalation and price adjustment process

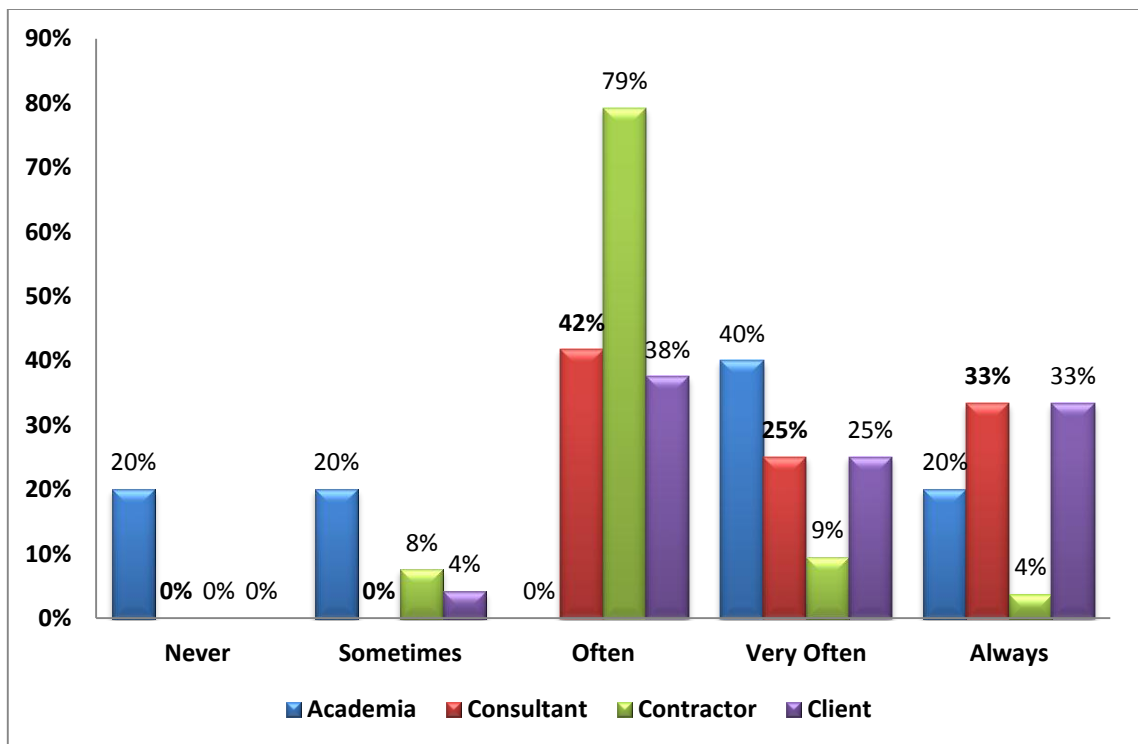| Familiarity with price escalation and price adjustment process			
Likert Scale	*Frequency*	*Percentage*	*Cumulative %*
1	1	1.06	1.06
2	6	6.38	7.45
3	56	59.57	67.02
4	16	17.02	84.04
5	15	15.96	100.00

Figure 4.4 Familiarity with price Escalation & Price Adjustment Formula

4.4.2 Knowledge of Dealing with Escalation/De-escalation Process

The respondents were asked about the knowledge, they are provided during studies, regarding dealing with Escalation/De-escalation process. The results of different categories of stakeholders are shown in Figure 4.5, on the basis of Relative

Importance Index (RII). It is very clear that most of the stakeholders think that the knowledge and awareness given to them is not sufficient, specially the contractors.
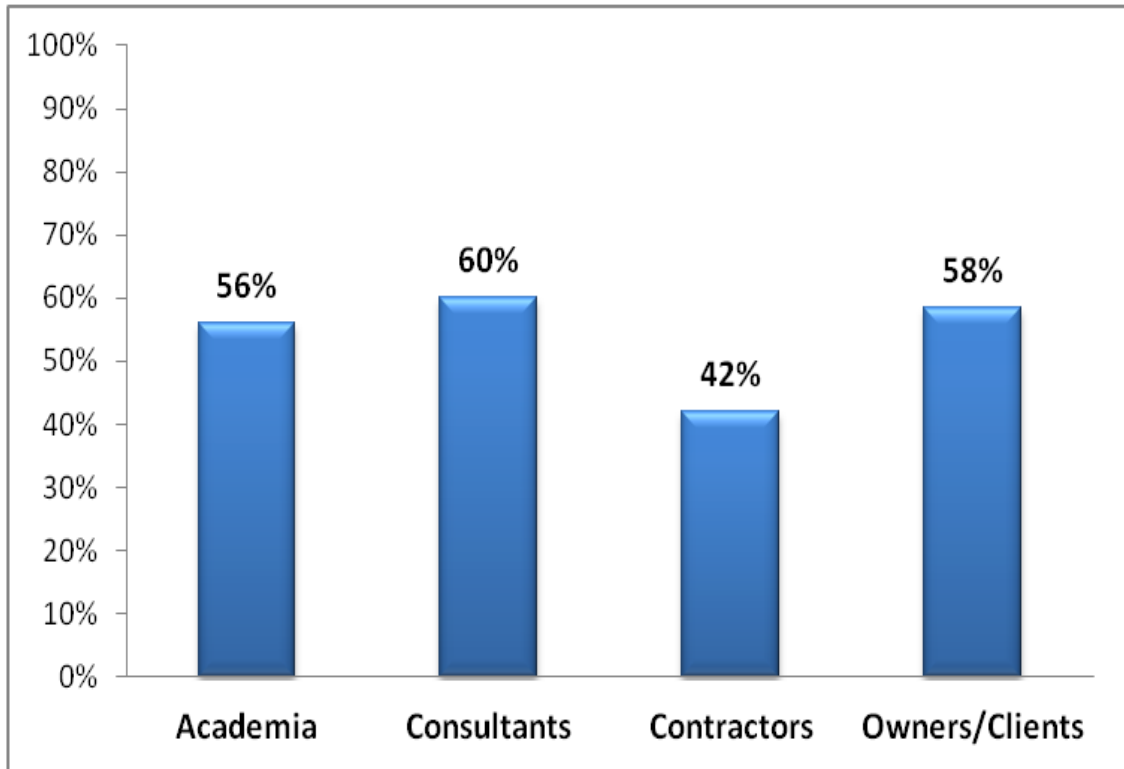

Figure 4.5 Knowledge regarding escalation/de-escalation process

4.4.3   Causes for cost escalation in construction projects

In order to know that what can be the major factors which can cause the price escalation in construction projects in Pakistan, the respondents were asked to choose the major cause out of the four options. The result is presented in Figure 4.6 which reflects that 61.7% of the respondents think that Inflation is the major factor for the price escalation in construction projects in Pakistan. Economic instability is the second largest reason for the contract price escalations.
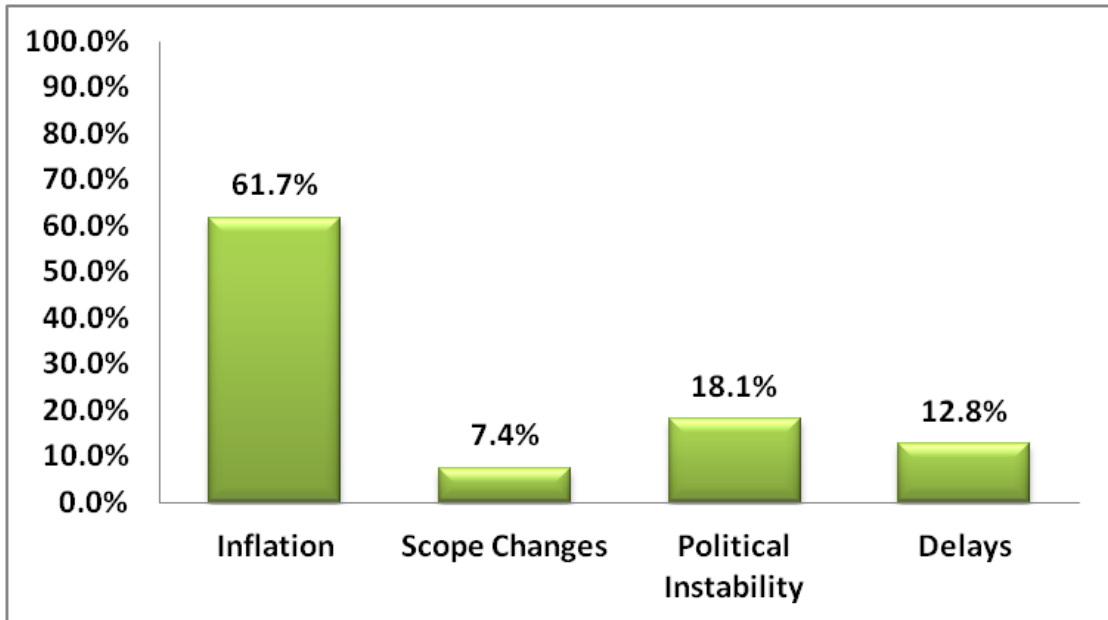
Figure 4.6 Major causes for price escalation in construction projects in Pakistan

4.4.4 Impact of price fluctuation on a construction project

To see the impact of fluctuation in prices on a construction project, the respondents were asked to choose their answer from the given options. Figure 4.7 summarizes the opinion of the stakeholders. A very big majority of the respondents (74%) feels that the price escalation in the prices of construction materials can cause the problems of cash flow, besides causing the delays, loss in profit and poor quality.
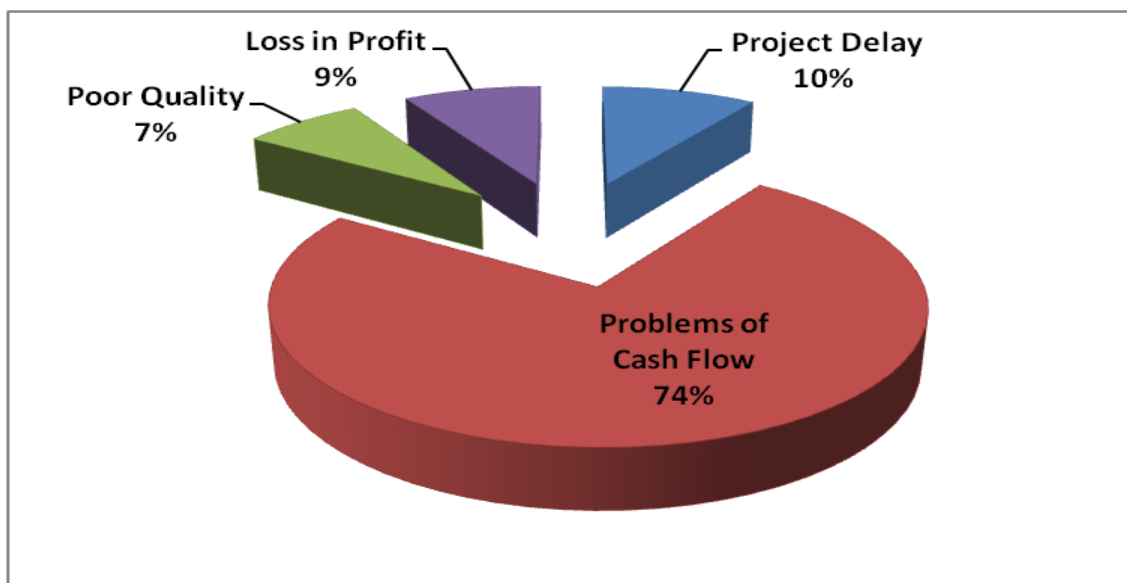

Figure 4.7 Impact of price fluctuation on a construction project

4.4.5   Vulnerable material to price escalation

Respondents were asked to give their opinion to judge which material is more vulnerable to price fluctuation, out of those components on which usually price escalation is admissible in construction contracts in Pakistan. The results are shown in Figure 4.8. It can be seen that 64.9% of the total respondents rate that in Pakistan fuel prices are the most sensitive to the price fluctuation and hence can have their impact on the construction project. Prices of steel are on the second in this list.
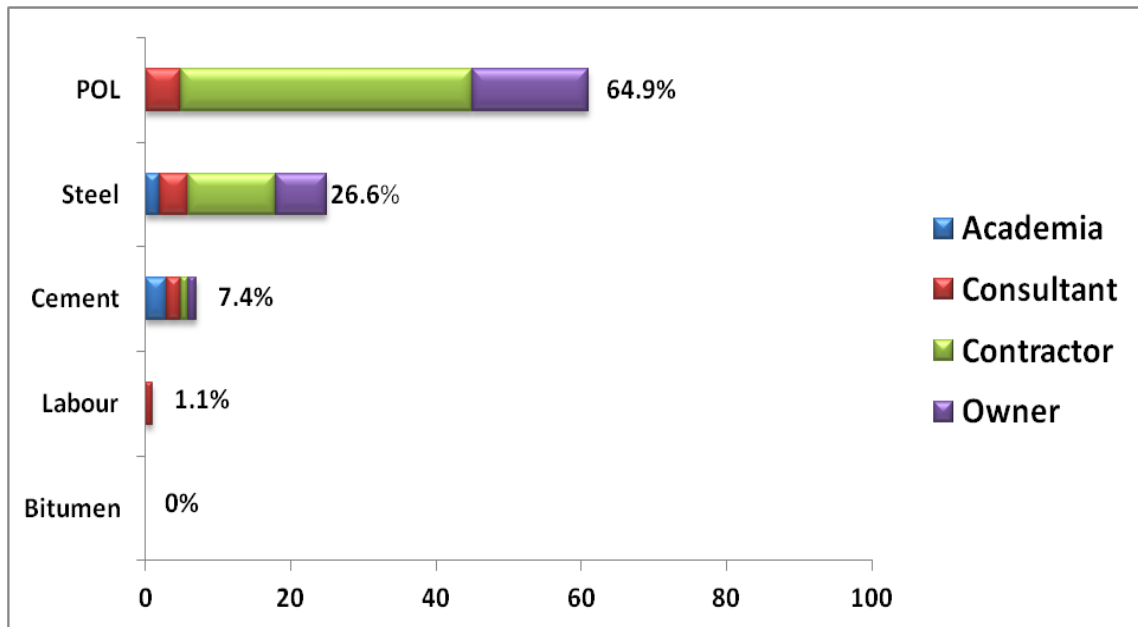

Figure 4.8 Vulnerable material to price escalation

4.4.6   Price Adjustment Clause should be Part of Contract

The respondents were asked whether the price adjustment clause should always be a part of the contract or not? In the response, the combined answers of the various categories of the stakeholders are presented in the Figure 4.9 whereas Figure 4.10 presents the response of academia, consultants, contractors and owners/clients separately. It is very obvious in Figure 4.9 that 28% and 57% of the respondents think that the escalation clause should always and very often be the part of the contract respectively, which shows that majority of the stakeholders, wants the escalation clause to be the part of the contract in all kind of circumstances.

Figure 4.10 shows the RII values given by the different stake holders regarding the escalation clause being the part of the contract. It is very clear that all the

respondents have given it very high percentage in favor of escalation clause should be the part of the construction contract.
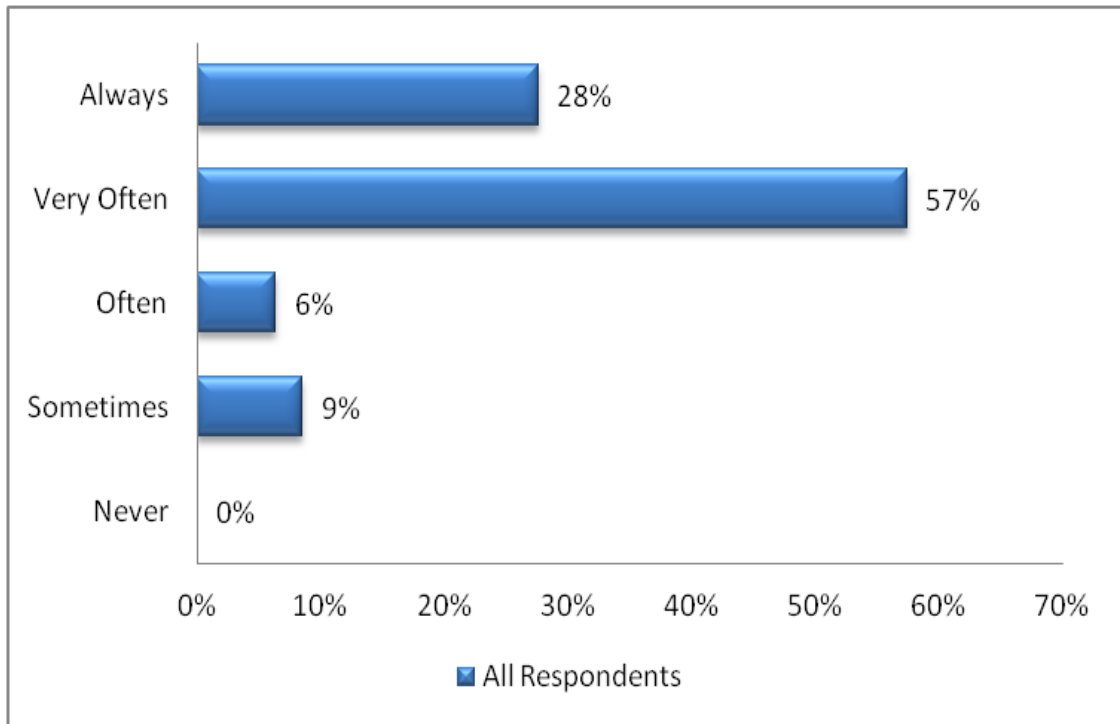

Figure 4.9 Overall response regarding escalation clause being part of contract

4.4.7 Price Adjustment Clause & Contract-Client Conflicts

Respondents were asked about the role of price adjustment clause in reducing the contractor-client conflicts-disputes. The responses of the stakeholders are summarized in Figure 4.11 based on the RII values. The results clearly depict that majority of the stakeholders are of the opinion that the inclusion of price escalation clause is a very helpful tool in reducing the conflicts which arise due the price fluctuations.
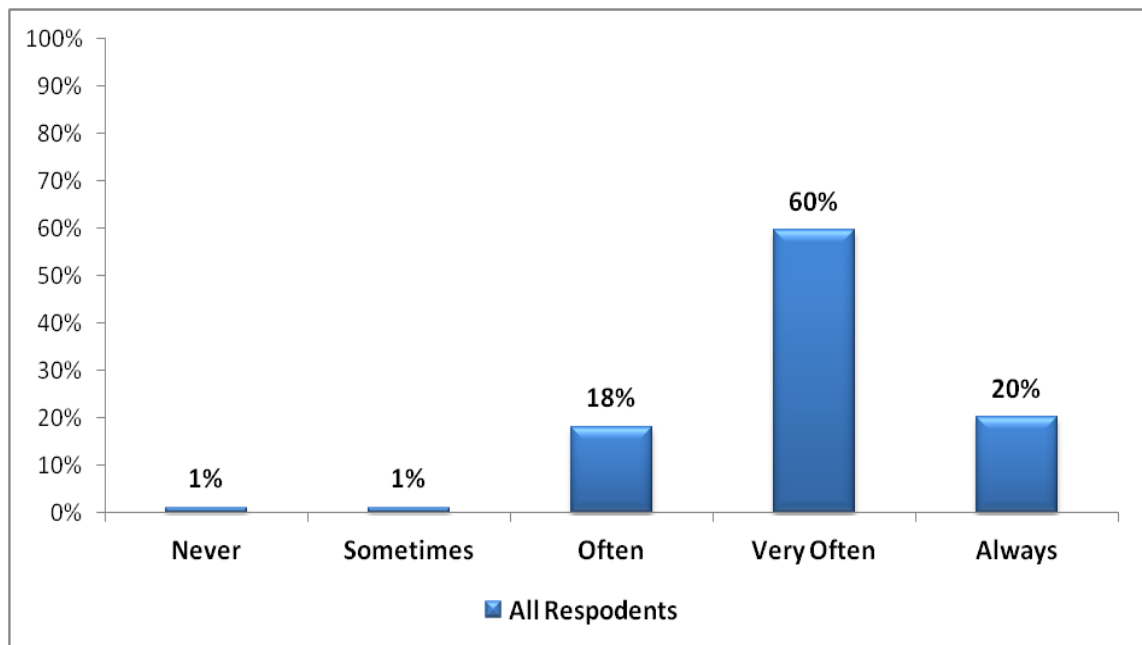
Figure 4.11 Role of escalation clause in reducing contractor-client conflicts

4.4.8 Higher Bids in the Absence of Price Adjustment Clause

Stakeholders were asked about their opinion regarding the chances of bids going higher if the price adjustment clause is not the part of the contract. The results for different stakeholder categories are shown in Figure 4.12. These results are based on the RII values. It is very clear that all the respondents have rated very high about the bid

amounts being at higher side of the contract which does not have the price adjustment clause.

All the stakeholders are of almost similar understanding for the higher bid values resulting from the absence of the price adjustment clause, as the RII values ranges from 72% to 82%.
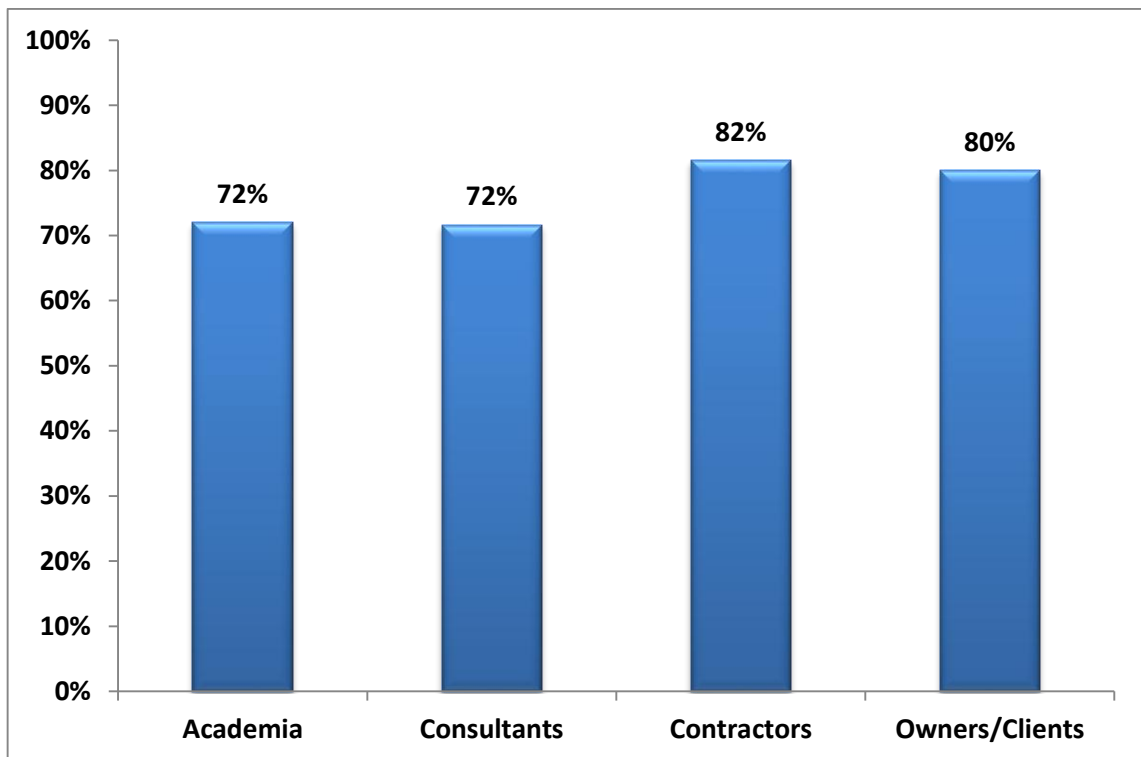
Figure 4.12 Perception of stakeholders about the higher bid values in the absence of escalation clause

4.4.9 Exposure of stakeholders towards FIDIC price adjustment formula

The stakeholders were asked to give their opinion about the frequency of their exposure towards the FIDIC price adjustment formula. The result very clearly shows that the respondents have not frequently worked with this formula. 13.8% of the respondents had never worked with this formula and 59.6% of the respondents were occasionally familiar with this method of price adjustment. 9.6% of the respondents had often got the chance of working with price adjustment formula. The respondents who had very often and always used this formula for the price adjustment were only 10.6% and 6.4% respectively. This shows the lack of exposure of the stakeholders towards the FIDIC price adjustment formula.
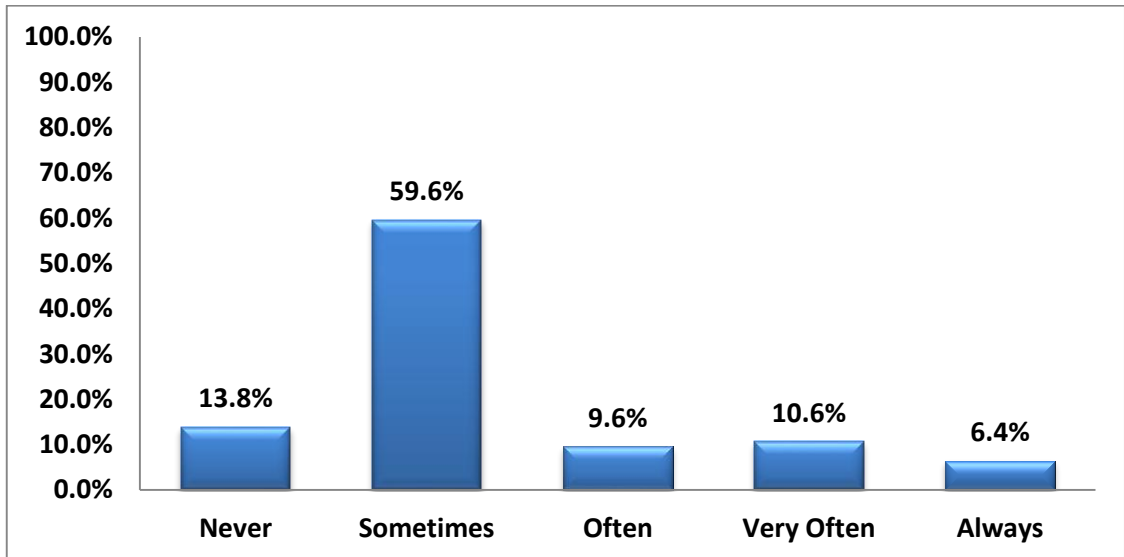
Figure 4.13 Exposure of stakeholders towards price adjustment formula

4.4.10 Effectiveness of "Invoice Method" compared to "Price Adjustment Formula"

An important question was framed to get the perception of the respondents regarding the effectiveness of previously used Invoice Method compared to the currently used price adjustment formula. The result has been shown in Figure 4.14. It is very obvious that majority of the stakeholders are of the opinion that Invoice Method was not as effective as the price adjustment formula.
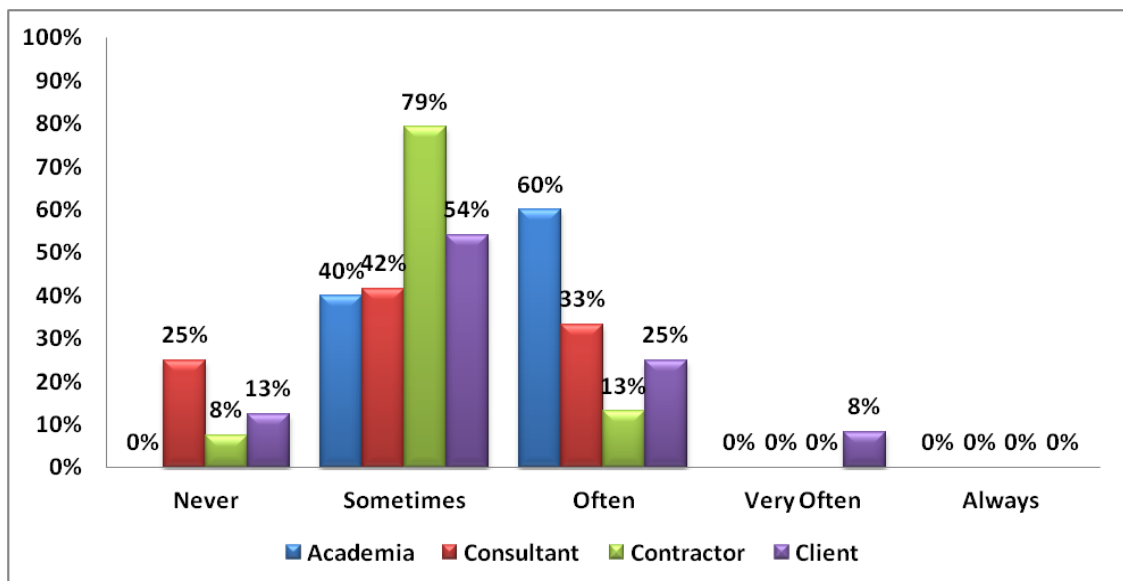

Figure 4.14 Effectiveness of invoice method compared to price adjustment formula

4.4.11 Facts about the Invoice Method

Three questions were asked to obtain the perception of the respondents of the survey, regarding their experience with previously implied Invoice Method for price adjustment. The results are tabulated in Table 4.9.

Table 4.9 Experience of respondents with "Invoice Method"

Likert Scale	While Using Invoice Method:					
	Contractors can get unfair advantage.		Not effective due to less control on proper invoicing.		Difficult for clients/consultants to verify the invoices.	
	Responses	Percentage	Responses	Percentage	Responses	Percentage
1 (Never)	1	1%	0	0%	1	1%
2 (Sometime)	10	11%	6	6%	6	6%
3 (Often)	13	14%	13	14%	59	63%
4 (Very Often)	67	71%	64	68%	23	25%
5 (Always)	3	3%	11	12%	5	5%

Look at the results, it is very clear that majority of the respondents showed the lack of satisfaction over the previously implied "Invoice Method" for price adjustment. They were of the view that contractors may use this method for their benefit by manipulating with purchase dates of the materials, and the main reason for that manipulating is the lack of control over proper invoicing system in Pakistan.

4.4.12 Price Adjustment Formula provides fair environment to all parties

Another important question was framed to know the perception of the stakeholders about that fair ground provided to all the parties in a construction contract while using the FIDIC price adjustment formula. The results of the responses are

compiled in Figure 4.15 on the basis of RII values. Majority of the respondents have given a very high RII value (contractors 77% and clients 78%) which shows the understanding of the respondents that the price adjustment formula is quite fair for all the parties, and gives equal grounds for every stakeholder in the contract.
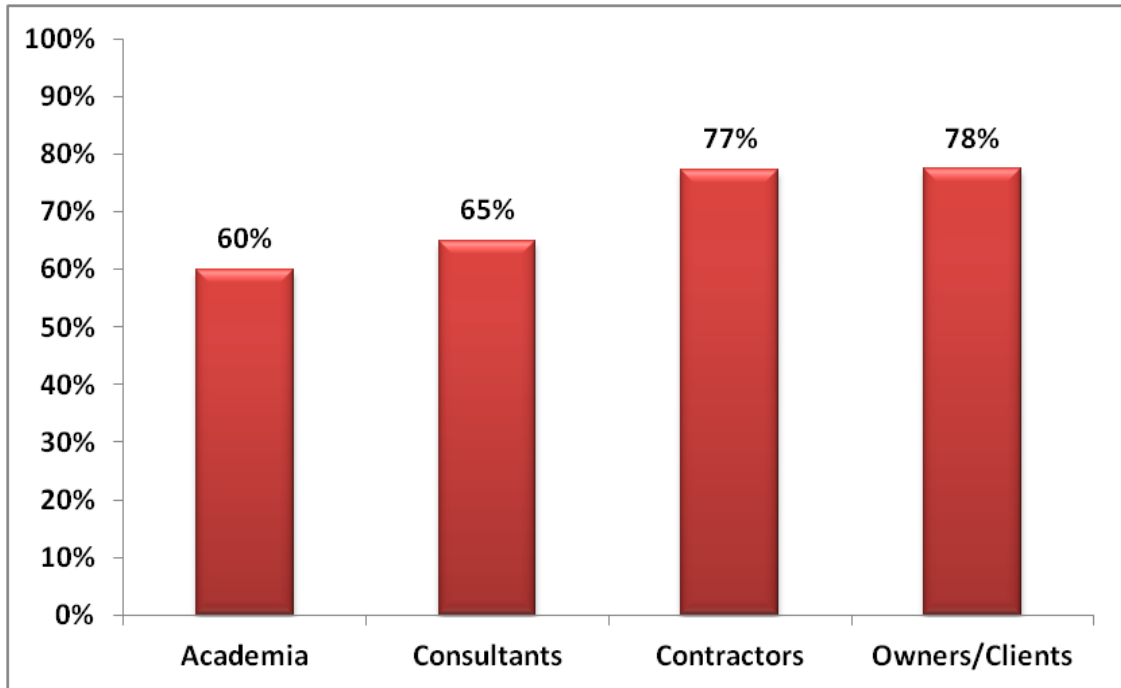
Figure 4.15 Price adjustment formula provides fair environment to all parties

4.4.13 Limitations of Price Adjustment Formula

The respondents of the survey were asked about the limitations of the price adjustment formula. Figure 4.16 shows the reflection of the perception of the stakeholders. 3.2% of the respondents think that the formula does not have any limitations, 61.7% of the respondents feel that formula sometimes has limitations, 20.2% of the stakeholders have the opinion that often the formula has limitations. Similarly 8.5% and 6.4% of the respondents put their opinion in the category of very often and always when they were asked about the limitations of the price adjustment formula.

It is very evident from the results that lesser percentage of the respondents feels that the formula has some limitations. However a reasonable percentage of the respondents feel that sometimes the subject formula do have some limitations.
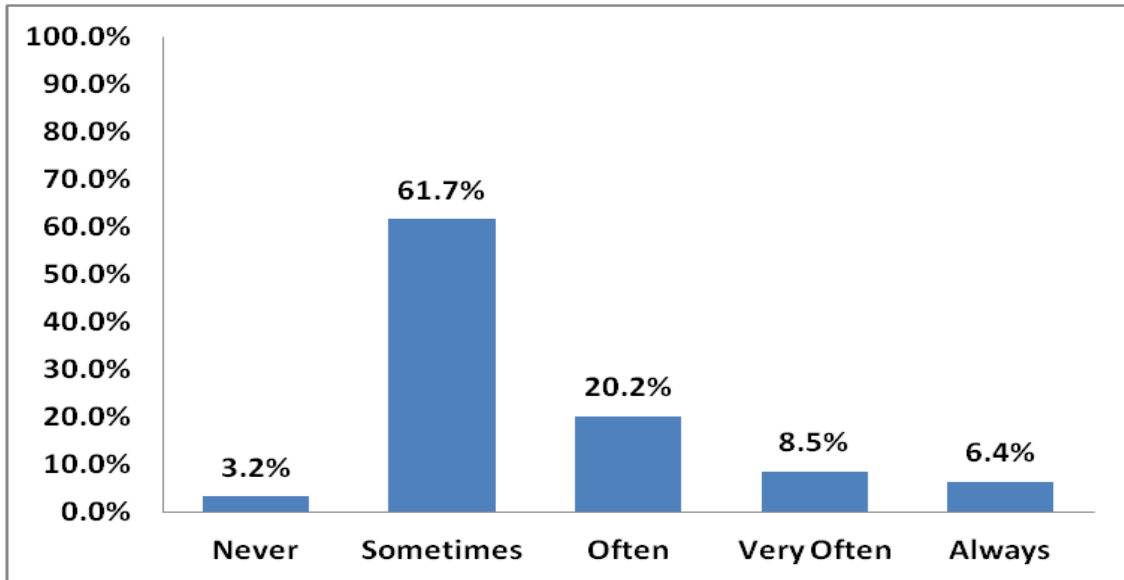
Figure 4.16 Respondents perception regarding limitations of the formula

4.4.14 Application of price adjustment formula is complicated

One question was framed to judge the opinion of the respondents about the applicability of the formula. The main purpose of this question was to judge the respondent's view that is the application of the formula is simple or complicated. The result of the responses from stakeholders is compiled in Figure 4.17. It is very clear that a big majority (88.3%) found the price adjustment formula effective, whereas only 2.1% had the opinion that the formula is not-effective. 9.6% of the respondents said that the application of the subject formula is complicated.
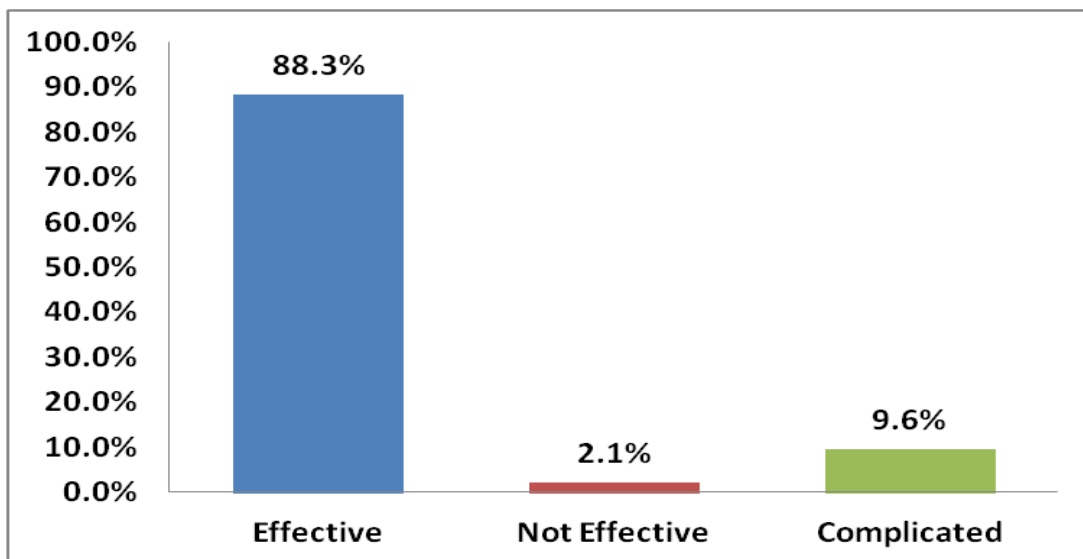
Figure 4.17 Application of price adjustment formula

4.4.15 Inclusion of any other parameter in formula

In a question, the respondents were inquired about the need of inclusion of any other parameter in the price adjustment formula. The responses of the stakeholders are summarized in Figure 4.14 which is based on the RII values given by each category of the stakeholders. Academia and Clients are the stakeholders which have given higher RII value in support of inclusion of additional parameters in the formula. Consultants' opinion is divided and contractors' has 45.3% understanding towards the requirement of additional parameter in the formula.
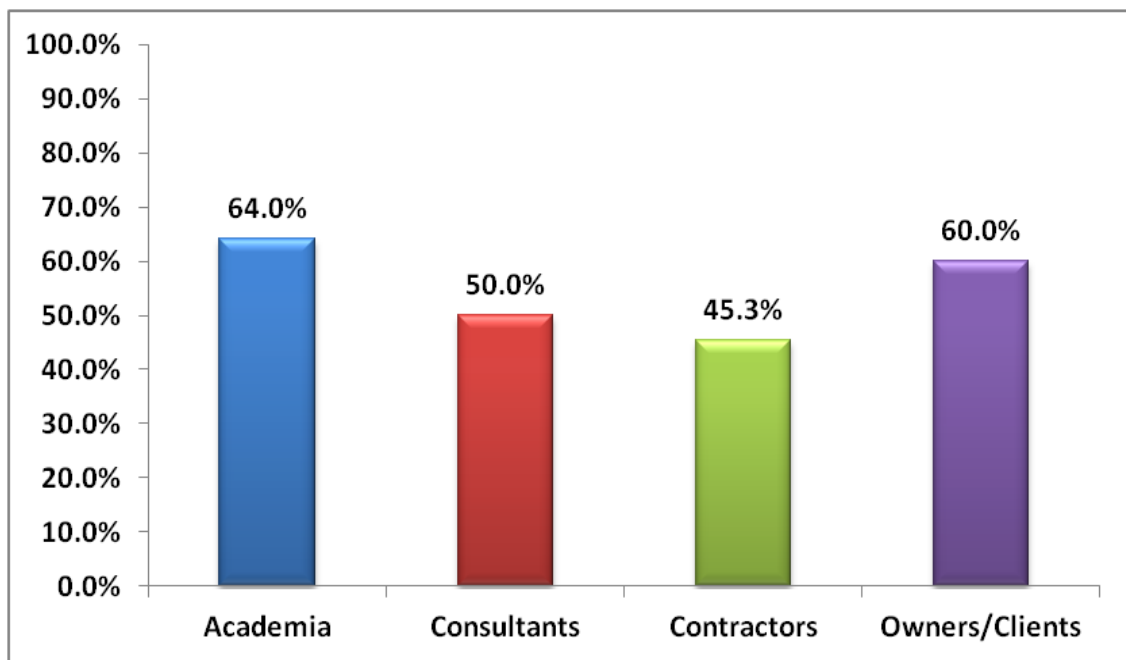
Figure 4.18 Inclusion of any additional parameter

In the next question, the respondents were further inquired about which additional parameter or component should be the part of the price adjustment formula and process, especially in the Pakistani scenario. The respondents were given the four options to choose their answer. The result of the inquiry is summarized in Figure 4.19. The respondents were clearly favored the inclusion of Electricity as the additional price component in the formula. The major reason for this choice is the current energy crisis in Pakistan and the ever and rapidly increasing electricity rates.
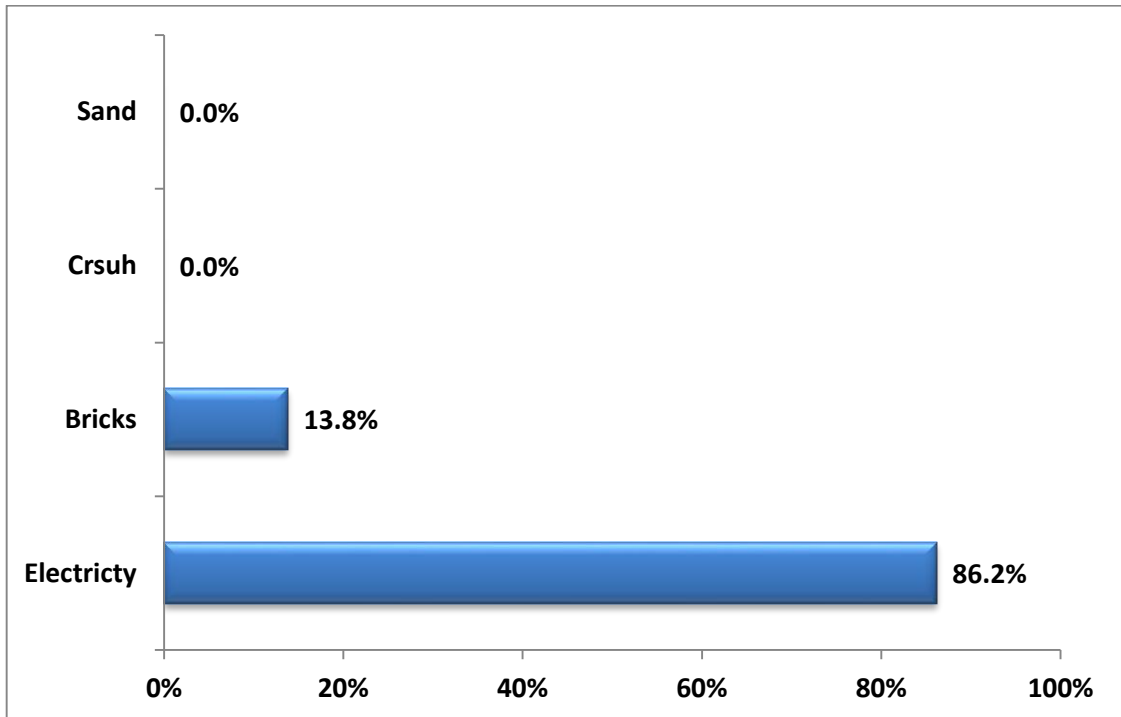
Figure 4.19: Additional component for price adjustment

4.5   SUMMARY

Detailed analysis of the collected data and results obtained, have been discussed in this chapter. Various statistical tests have been used to get the output from the collected data using MS Excel and SPSS-18, so as to assess the data for the detailed study of price adjustment procedure and price adjustment formula.

All the responses obtained from the four categories of stakeholders, were analyzed in detail to get the in-depth perception of the stakeholders about the price adjustment process and methods. On the basis of this analysis, the conclusions and recommendations are made in the next chapter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1   REVIEW OF RESEARCH OBJECTIVES

The objectives of this study as the result of research are:

- To study the different methods of price adjustment in construction contracts in Pakistan.
- To explain the FIDIC formula in detail, how it is applied to get the adjusted costs.
- To make a comparison of different price adjustment techniques.
- To study the implications of the formula in construction contracts and suggest improvements on the basis of the research survey.

The first objective of this research study was to study the different methods of price adjustment in construction contracts in Pakistan. This was achieved through extensive literature review and previously published research papers. To achieve the second objective, the price adjustment formula is explained in detail in the light of the guidelines provided by the PEC documents, and further its working is explained through the data of an on-going project where the escalation was paid to the contractor using the price adjustment formula. Third and fourth objectives were achieved by getting the perception of the stakeholders of the construction industry in Pakistan and then analysing their opinions and inferring the results which have come into light after the statistical analysis of the data.

5.2   CONCLUSIONS

After carrying out the detailed statistical analysis, the major findings of the research are:

1- The research has shown that the stakeholders of CI do not have the detailed and frequent exposure towards the price adjustment process. Only 16% of

the respondents confirmed that they always have the exposure to this process. The main reason for this lack of awareness is:

a) Non availability of the data regarding the impact of the price fluctuations on the projects, due to which the importance of the price adjustment is not very clear to ever professional or even civil engineering students.

b) Narrow compensation system and denial for compensations.

2- In Pakistan, the major cause for the escalation is inflation, as 61.7% of the respondents gave their opinion in favor of inflation.

3- The major problem faced by the stakeholders due to the price escalation is the problem of cash flow, which creates hindrance towards the successful completion of the projects. 74% of the respondents voted in support of this statement.

4- As per opinion of the professionals of the CI, the most sensitive material with respect to the price fluctuation is the POL prices, whereas the steel prices come second in this list.

5- Each of the categories of the stakeholders has the realization of the importance of the escalation clause; therefore the respondents have rated very highly that the escalation clause should be the part of the contracts.

6- The escalation clause is helpful in:

a) Reducing the conflicts which may arise due to price fluctuation.

b) Bid amounts may get higher in the absence of the escalation clause as the contractors have to include the future fluctuations of prices at the time of quoting their bids.

7- When talking about the price adjustment formula, it was revealed that 14% of the respondents never used this formula whereas almost 60% have used it sometimes. So the research shows that the exposure of the stakeholders is much lesser towards the price adjustment formula.

8- The price adjustment formula was studied in comparison to the previously implied "invoice method". The research has revealed following:

a) Contractors can get unfair advantage in the previously implied 'invoice method" by playing with the purchase dates in their favor (71% of the respondents think it happens very often).

b) In Pakistan, the registration of manufacturers and suppliers with sales tax & income tax departments is very weak, which increases the chances of manipulating with the purchase invoices or documents. Verification of such documents becomes very difficult in this scenario.

c) All the parties in a contract are on the same grounds and have equal opportunities to get the benefit of the increase/decrease in the prices of commodities and services, when the FIDIC price adjustment formula is the part of the contract under the escalation clause. The basic prices are monitored through an impartial body which provides the fair environment to all parties.

9- Keeping in view the current energy crises and ever increasing rates of electricity in Pakistan, 86.2% of the respondents have chosen the "electricity" as the another component which should be added to the list of the items on which escalation is admissible through price adjustment formula.

10- The weight-ages or coefficients of the items on which escalation is admissible, are provided in the contract documents. These weight-ages are based on the Engineer's estimate. The formula is silent whether these weight-ages should be re-calculated at the completion of the project, on the basis of actual consumptions or not.

11- The PEC document says that the weight-ages should not be changed until there is any substantial change in the scope of work; however the limit of substantial change is not defined.

5.2.1 Merits and de-merits of price adjustment formula

In the light of the research carried, following are the merits and de-merits of using the price adjustment formula as the tool for the calculation of the price adjustments in construction contracts:

Merits:

- Basic prices are linked with an impartial third party which eliminates the chances of any malpractice by any party
- Formula does not favor any particular party in a construction contract.

- All the stakeholders in a construction contract are at equal grounds.
- Clients or contractors need not to maintain the record of purchases of the material on which escalation is admissible.
- Stakeholders' satisfaction level is quite high.

Difficulties:

- Client has to provide the weight-ages for the components on which escalation is admissible, for which the client has to do calculation before the tender with appropriate rate analysis.
- Monthly record of the measurements of the work done is to be maintained to apply the corresponding monthly rates of the items on which escalation is to be paid.
- Often the statistical bulletins (used for the basic rates of the items) are not published timely, due to which the provisional price adjustment for that month is to be calculated on the basis of last available bulletin. Adjustment is to be made later on when the rates are made available for that particular month.

5.3   RECOMMENDATIONS

The goal of this research study was to study and implication of the price adjustment formula in comparison of previous methods and to propose the ideas and recommendations which can be beneficial for the construction industry in Pakistan. On the basis of the research findings and conclusions, some recommendations are enlisted below:

1- The professionals and stakeholders of the CI should be provided with more knowledge and expertise about the price fluctuations, escalation clauses and price adjustments. PEC and educational institutes may hold seminars, conferences and training workshops to highlight the important and debatable aspects of the issue.

2- Pakistan's economy is very un-predictable due to the country's dependency on many external factors, which makes it even more important that the construction contracts, specially the long term contracts, should be provided with escalation clause.

3- The introduction of price adjustment formula by PEC is very much supported by the stakeholders of the construction industry. However, the majority of the professionals of the industry does not have much expertise or practical experience of using the formula and knowledge about the merits & de-merits of the formula.

4- The stakeholders of the CI and regulatory bodies should work together to improve the compensation system in Pakistan and a wider range of inputs should be allowed for compensation. Keeping in view the current energy crisis and increasing rates, electricity is the far most important input which should be included in the list of the components on which escalation should be admissible.

5- As the price adjustments through formula require the basic prices of the items on which escalation is admissible, therefore, a comprehensive and reliable price database should be established by the joint effort of all the stakeholders. This database should not only be acceptable to all stakeholders for the price adjustments, but also be used by the clients or consultants at the time of the preparing the estimates. The important aspect of this database should be the updating at short intervals to achieve the realistic current prices.

6- PEC should define the limits for the revision of weight-ages of the components on which escalation is admissible, in case of change in the scope of work.

5.4   KNOWLEDGE CONTRIBUTION

This research study is one of the pioneer efforts to highlight the importance of compensation system and price adjustments resulting from the fluctuation of prices in Pakistan. It will help the stakeholders of CI of Pakistan to find the weaknesses in price adjustment practices and improve them to such a level that every stakeholder should have trust and satisfaction.

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APPENDIX-I

Questionnaire

National University of Sciences and Technology, Islamabad

QUESTIONNAIRE
(Part I)

Subject: **Comparative study of price adjustment formula and its implications in construction contracts.**

General Information about the Respondent	
Personal Details:	*(All the details will be kept confidential)*
Name:	
Name of Company: (Optional)	
Telephone: (Optional)	
Email: (Optional)	

Please encircle appropriate category for each question below.

Age (years)	1. 18-30 2. 30-40 3. 40-55 4. 55+
You belong to which stakeholder organization?	1. Owner 2. Contractor 3. Academia 4. Consultant 5. Subcontractor
Position/Appointment	1. GM/Manager 2. Field Engineer 3. Inspector 4. Worker 5. Supervisor 6. Owner
Experience in Construction Industry (years)	1. 0-5 2. 6-10 3. 11-15 4. 16-20 5. 20+
How long have you worked in this company/ organization	1. Less than 1 year 2. 1-5 years 3. 6-10 years 4. 11-15 years 5. More than 15 years
Education	1. Primary 2. Secondary 3. Certificate/Diploma 4. College or Higher

QUESTIONNAIRE
(Part II)

Subject: <u>Comparative study of price adjustment formula and its implications in construction contracts.</u>

	Please encircle one box to indicate the practice in your company/organization	Never	Some times	Often	Very often	Always
01	Are you familiar with escalation/de-escalation and price adjustment process?	1	2	3	4	5
02	Do you think that engineers are given enough knowledge about dealing with escalation/de-escalation process?	1	2	3	4	5
03	Have you ever made efforts to anticipate the effect of price fluctuations of any kind?	1	2	3	4	5
04	Have you ever tried to follow the price fluctuation trends of different materials?	1	2	3	4	5
05	Should a price adjustment clause always be a part of a construction contract?	1	2	3	4	5
06	The inclusion of price adjustment clause in construction contracts helps in reducing the related conflicts between contractor and client?	1	2	3	4	5
07	Do you think that the bids can go higher in the absence of price adjustment clause?	1	2	3	4	5

Please encircle one box to indicate the practice in your company/organization		Never	Some times	Often	Very often	Always
08	Do you think that escalation clause is an effective method of dealing with risk associated with price fluctuation?	1	2	3	4	5
09	Do you think that better and effective planning can be helpful in minimizing the adverse effects of price fluctuations?	1	2	3	4	5
10	How frequently have you worked with FIDIC price adjustment formula?	1	2	3	4	5
11	Is escalation in prices of construction material, labor & equipment, a major cause of cost over-run of the construction projects?	1	2	3	4	5
12	Do you think that the price adjustments through the Formula truly represent the cost variations in any kind of circumstances?	1	2	3	4	5
13	The previously used "Invoice Method" (in which the contractor submits the actual purchase invoices of the material on which he was paid the cost difference of the basic rate of current date and the rate at the time of tender) was more effective than the Price Adjustment Formula method?	1	2	3	4	5
14	Is it true that the contractor could get unfair advantage by manipulating with the purchase dates, when using the "Invoice Method"?	1	2	3	4	5
15	Will you agree that the "Invoice Method" cannot be effectively applied in	1	2	3	4	5

Please encircle one box to indicate the practice in your company/organization	Never	Some times	Often	Very often	Always
Pakistani environment because of less government control on proper invoices?					
16 Was it always difficult for clients/consultants to check & verify the invoices submitted by the contractors, when claiming the escalation by using "Invoice Method"?	1	2	3	4	5
17 Does the price Adjustment Formula provides fair environment to all the parties?	1	2	3	4	5
18 Does the formula require any other parameter to be included?	1	2	3	4	5
19 Does the subject formula have some limitations?	1	2	3	4	5
20 Do you think that price adjustment formula has the flexibility to cope with the change in the scope of work?	1	2	3	4	5
21 Is it right that the contractors have more advantage by the application of price adjustment formula?	1	2	3	4	5
22 Do you think that client/owner have more advantage through the price adjustment formula?	1	2	3	4	5

Subject: <u>Comparative study of price adjustment formula and its implications in construction contracts.</u>

(Please tick the most appropriate option)

23.   What is the major cause for cost escalation in a construction project?

    a.   Inflation.

    b.   Scope changes.

    c.   Political instability.

    d.   Delays.

24.   The impact of price fluctuation on the project:-

    a.   Delay.

    b.   Problems of cash flow.

    c.   Poor quality.

    d.   Loss in profit.

25.   Which material is more vulnerable to price fluctuation?

    a.   Steel.

    b.   Cement.

    c.   Bitumen.

    d.   Labour.

    e.   POL.

26.   What is your opinion on the application of the FIDIC price adjustment formula in construction contracts?

    a.   Effective.

    b.   Not effective.

    c.   Complicated.

27. In your opinion, "should the price adjustment formula be applied to all contracts irrespective of the amount or duration of the project?"

    a.   YES   b.   NO   c.   Not Always

28. Have you actually used price adjustment formula on any project for the calculation of escalation/de-escalation?

    a.   YES   b.   NO

29. Which parameter should be included in the price adjustment formula?

    a.   Electricity
    b.   Bricks
    c.   Crush
    d.   Sand

30. When preparing estimates as client/consultant or when pricing for a bid as a contractor, do you always price the items keeping in view the price fluctuation in near future?

    a.   YES   b.   NO   c.   Not Always

31. Any additional comments/suggestions:

_____

_____

_____

_____

_____

_____

Thanks for your co-operation

APPENDIX-II

Examples of price escalation clauses

Escalation clause for Chandni Chowk Fly-Over project, Rawalpindi

(43)

VARIATION IN PRICES OF SPECIFIED MATERIALS

CLAUSE - 55

Price variation

1. Where any variation (increase or decrease), to the extent of 5% or more, in the price of any of the item mentioned in sub-clause (2) below takes place after the acceptance of tender and before the completion of contract, he amount payable under the contract shall be adjustable to the extent of the actual variation in the cost of the item concerned.

2. No price variation under the clause shall be admissible except in respect of the following items:-

    i. Cement

    ii. Steel

        a) M.S Bars (Plain and deformed)

        b) M.S. sections.

        c) High Tensile steel wire.

        d) M.S. and G.I. Pipes.

    iii. Asbestos Cement Pipes.

    iv. P.V.C. Pipes.

    v. R.C.C/P.C.C. Pipes.

    vi. Bitumen.

    vii. High Speed Diesel.

    viii. Bricks

        a) Bricks

        b) Tiles

        c) Gutka

    ix. Stone aggregate

        a) Stone metal for sub base.

        b) Stone metal for base course.

        c) Crushed bujri.

    x. Labour

3. The base price for the purposes of calculation of the price variation shall be the price prevalent in the month during which the last day of the submission of tender falls.

4. The price variation under this clause shall be worked out on the basis of the price of the particular item prevalent in a particular District on first day of each month as per price list of such manufacturers or suppliers at such places as are notified by the Finance Department from time to time. The prices of the manufacturer or supplier at the place(s) so notified shall be applicable to the particular District or the entire Punjab (where district wise list of manufacturers or suppliers has not been notified).

5. If no notification in respect of any of the item mentioned in sub-clause (2) is issued under sub-clause (4) no price variation shall be admissible in respect of that item during that month.

Contractor

Executive Engineer /
District Officer

(44)

6. The amount payable or deductible in respect of **items No.(i) to (x)** of sub-clause (2) shall be calculated on the basis of the quantity of the item actually consumed on the work during the month.

7. The amount payable or deductible in respect of item No.(v) of sub clause (2) shall be calculated on the basis of the actual quantity of cement and steel bars used in the manufacture of the pipes during the month.

8. No escalation shall be allowed to the contractor in respect of the period extended for the completion of the work due to his own fault.

9. If, under the existing codal rules, secured advance is paid on all or any of the imperishable items mentioned at (ii) to (vi) & (viii) to (ix) in sub-clause (2) above, no price variation shall be admissible on such item(s) in respect of the quantity or quantities for which secured advance has been paid to the contractor.

10. The increase or decrease in the contract price subsequent to any increase or decrease in the cost of high speed diesel shall be calculated from the increase or decrease in the basic price of high speed diesel using the following formula:

Increase or decrease= α x VOW x (CPD-BPD)/ BPD in contract price.

Where:

VOW= the value of the work for which payment has been certified by the Engineer-in-charge, executed subsequent to such increase or decrease in the Basic Price as shall be obtained by applying the approved unit rates and prices entered in the measurement book.

CPD= Current price of high speed diesel, and

BPD= Basic price of high speed diesel.

Factor α =0.15 for Highway / Road works &

α =0.07 for Buildings and R.C.C structures

11. The increase or decrease in the contract price subsequent to any increase or decrease in the cost of labour shall be calculated from the increase or decrease in the basic price of labour using the following formula:

Increase or decrease= β x VOW x (CLR-BLR) / BLR in contract price.

Where:

VOW= the value of the work for which payment has been certified by the Engineer-in-charge, executed subsequent to such increase or decrease in the Basic Price as shall be obtained by applying the approved unit rates and prices entered in the measurement book.

CLR= Current labour rates for unskilled worker (as published by Bureau of Statistics).

BLR= Basic labour rates of unskilled worker on the date of receipt of tenders (as published by Bureau of Statistics)

Factor β = 0.15 both for building & road works.

Contractor

Executive Engineer /
District Officer

Escalation clause for New Islamabad International Airport

67.7   Venue of Arbitration

The venue of arbitration proceedings shall be Karachi, Pakistan.

68.1   Notice to Contractor

The following paragraph is added:

For the purposes of this Sub-Clause, the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Employer and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract.

68.2   Notice to Employer and Engineer

For the purposes of this Sub-Clause, the respective addresses are:

a)   The Employer: HQ, Civil Aviation Authority, Pakistan,
Head Quarter, B-6, K.D.A Scheme-1, Shahrah-e-Faisal,
Karachi, Pakistan

b)   The Engineer: The Louis Berger Group Inc. in association with
Engineering Consultants International (Pvt) Limited.
B-6, KDA Scheme No.1, Shahrah-e-Faisal,
Karachi, Pakistan

70.1   Increase or Decrease of Cost

Sub-Clause 70.1 is deleted in its entirety, and substituted with the following:

The amounts payable to the Contractor, pursuant to Sub-Clause 60.1, shall be adjusted in respect of the rise or fall in the cost of labor, materials to the Works by applying to such amount the formula prescribed in this Sub-Clause.

(a) Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

The Contractor shall not, otherwise than as provided in this Sub-Clause, be entitled to any other compensation whatsoever of additional cost of security, insurances, Contractor's personnel, labour, material and Subcontractors that might arise out of or as a consequence of actualization of the risks listed under Sub-Clause 20.4 paras (a) (i) to (v).
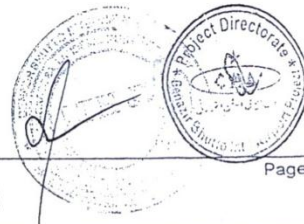
(b) Adjustment Formula

The adjustment to the monthly statements in respect of changes in cost shall be determined from the following formula:

$$Pn = A + b\,\frac{Ln}{Lo} + c\,\frac{Mn}{Mo} + d\,\frac{En}{Eo} + \dots\dots\dots\dots$$

Where:

Pn is a price adjustment factor to be applied to the amount for the payment of the work carried out in the subject month, determined in accordance with Paragraph 60.1 (a), and with Paragraphs 60.1 (b) and (e), where any variations and daywork are not otherwise subject to adjustment;

A is a constant, specified in Appendix-C to Bid, representing the nonadjustable portion in contractual payments;

b, c, d, etc., are weightages or coefficients representing the estimated proportion of each cost element (labour, cement, reinforcing steel etc.) in the Works or Sections thereof, net of Provisional Sums and Prime Cost; the sum of A, b, c, d, etc., shall be one;

Ln, Mn, En, etc., are the current cost indices or reference prices of the cost elements for month "n", determined pursuant to Sub-Clause 70.1(d), applicable to each cost element; and

Lo, Mo, Eo, etc., are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 70.1(d).

(c) Sources of Indices and Weightages

The sources of indices shall be those listed in Appendix-C to Bid, as approved by the Engineer. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightages and Source of Indices if different than those given in Appendix-C to Bid, which shall be subject to approval by the Engineer.

(d) Base, Current, and Provisional Indices

The base cost indices or prices shall be those prevailing on the day 28 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 28 days prior to the last day of the period to which a particular monthly statement is related. If at any time the current indices are not available provisional indices as determined by the Engineer will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

Any fluctuation in the indices or Prices of material other than those given above shall not be subject to adjustment of the contract price.

0044

Package 6A: Landside Roads, Bridge, Drainage And Utilities
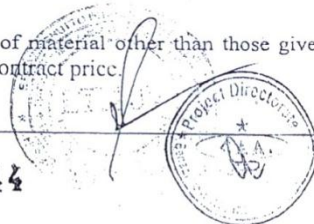
(e) Adjustment after Completion

If the Contractor fails to complete the Works within the Time for Completion prescribed under Clause 43, adjustment of prices thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Employer, provided that if an extension of time is granted pursuant to Clause 44, the above provision shall apply only to adjustments made after the expiry of such extension of time.

(f) Weightages

The weightages for each of the factors of cost given in Appendix-C to Bid shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced, or inapplicable as a result of varied or additional work executed or instructed under Clause 51. Such adjustment(s) shall have to be agreed in the variation order.

72.2   Currency Proportions

At the end of the last paragraph add:

The Tender shall be expressed in Pakistani Rupees. However, the Bidder's may specify that a proportion of the ~~all events~~ ~~a~~~~~~~~~~~~amount less than 25% (twenty ~~five~~ percent ~~of the total~~ shall be paid in a foreign currency. Where payment of any portion ~~of~~ the Tender is required to be paid in a foreign currency requisite justification of the same shall be provided by the Bidders.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1 and 78.1 are added:

73.1(a) Payment of Income Tax

The Contractor, Subcontractors and their employees shall be responsible for payment of all their income tax, super tax and other taxes applicable under the laws of Pakistan, as amended from time to time, on income, or any loss of income, arising out of the Contract and the rates and prices stated in the Contract shall be deemed to cover all such taxes.

The Employer shall apply source deduction of Taxes (with holding) at the applicable rate during currency of the Contract for all the amounts payable in terms of the Contract as per Income Tax Laws of Pakistan under the above clause.

73.1(b) Payment of Local Tax

The prices bid by the Contractor shall include all customs duties, import duties, sales tax, octroi and other taxes that may be levied in accordance with the laws and regulations in force on the date 28 days prior to the latest date for submission of bids in Pakistan on the Contractor's equipment, plant, materials, and supplies (permanent