# COMPARATIVE ANALYSIS OF DELAY CONTRIBUTERS IN ASKARI, BAHRIA AND DHA HOUSING SCHEMES IN PAKISTAN

By

**Ali Raza**
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**Department of Construction Engineering and Management**
**National Institute of Transportation (NIT)**
**School of Civil and Environmental Engineering (SCEE)**
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Certified that the contents and form of thesis entitled **"Comparative Analysis of Delay Contributors in Major Housing Schemes of Pakistan"** submitted by Mr. Ali Raza have been found satisfactory for the requirement of the degree.

Supervisor:_____
Assistant Professor (Dr. Muhammad Babar Khan, PhD)

**DEDICATED**

**TO**

**MY FAMILY, TEACHERS AND COLLEAGUES**

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(Ali Raza)

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# ABSTRACT

Construction delays in developing world are one of the major challenges faced by the planners and designers as well as Governments and is generally acknowledged as the most common, costly and risky problem encountered in construction projects. Mostly they are accompanied by cost and time overruns. These delays have overwhelming effects on all parties including owner, contractor and consultant in terms of adversarial relationship, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other. Thus there is a tremendous need for the application of professional construction management knowledge, skills, tools and techniques to mitigate the delay factors and minimize their effects. This research is based on the survey of major housing schemes in major cities of Pakistan and aimed at acquiring the feedback from all major stakeholders including clients, contractors and consultants regarding the significance of construction delays and their devastating effects. Hence for this study twenty (20) housing schemes including 55% completed, 25% partially completed and 20% running projects were considered. Fifty three (53) main delay factors were identified through study of literature review, pilot survey and discussion with the executives of major stakeholders. These delay factors were grouped into three major categories namely client related delays, contractor related delays and consultant related delays and all major stakeholders were asked to give their feedback regarding these delay categories separately.

Out of 120 respondents, 102 of them filled the questionnaire survey showing a response rate of 85%. The result of analysis showed that 53% of housing schemes faced up till 10% time overrun, 33 % faced up till 20% time overrun and 14% of them faced more than 20% time overrun. Based on the ranking, the five most important factors of client related delays contributors as perceived by contractors and consultants were: (a) Slow decision making on project matters, (b) Undue interference by owner and his representative, (c) Unrealistic contract duration imposed by client, (d) Frequent Change orders and (e) Lack of communication & coordination and site meetings .The five most important contractor related delay contributors as perceived by clients and consultants were: (a) Poor safety/risk management, (b) Poor contingency planning, (c) Rework due to errors during construction, (d) Poor financial capability, and (e) Hiring of unreliable and incompetent subcontractor .Similarly the five most important consultant related delay contributors as perceived by clients and contractors were:

(a) Delay in approving major changes in the scope of work, (b) Delay in approving shop drawings and sample materials, (c) Lack of qualified staff on site, (d) Poor communication and coordination with the contractor and client, and (e) Mistakes and discrepancies in design documents. There is a serious issue of delays in Private schemes like Bahria than those in public schemes like Askari and DHA.

The insights and discussions of this research are given in the analysis which is valuable to all stakeholders by reviewing their projects, identifying the delay related problems and taking remedial measures as a proactive approach for minimizing the delays and their effects.

*Chapter 1*

# INTRODUCTION

## 1.1 STUDY BACKGROUND

Construction Industry, throughout the world, is considered to be the backbone for the economic development of any country. The growth of a country and its development status is generally determined by the quality of its construction companies and their capability (Areola, 1997). Construction Industry is also considered one of the pillars for the developing countries like Pakistan, which can play a vital role in Gross Domestic Product (GDP), usually 4 to 8 % of GDP for developed countries but for Pakistan it is only 2.3%. However this potential growth is hampered by a number of issues including construction delays associated with the Cost and Time overruns being the most important issue faced by the Construction Industry of Pakistan. The main objective of any project in the construction industry is to produce a successful end product in terms of timely completion, within cost and best quality work.

Delay is generally acknowledged as the most common, costly and risky problem encountered in construction projects (Saqib et al., 2010). They are almost accompanied by cost and time overruns. These delays have devastating effects on all parties including owner, contractor and consultant in terms of adversarial relationship, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other. Monitoring and controlling the project as per customer desires, technical specifications, cash flows, financial strength, availability of resources and their judicious employment, efficient utilization of available capabilities, skills and qualifications, monitoring the project activities ,flow of materials, scheduling, quality of work and pace during execution are the key performance indicators of successful and efficient project completion (Nadir et al.,2010). Thus there is a tremendous need for the application of professional construction management knowledge, skills, tools and techniques to mitigate the delay factors and minimize their effects.

There are four basic types of construction industry including residential construction (housing schemes and high rise apartments etc), building construction(schools, colleges, universities, hospitals, commercial office towers, theaters, government buildings etc), heavy engineering construction(dams and tunnels, flood control structures, irrigation canals, bridges, railways, airports, highways, rapid transit systems, ports and harbor structures) and Industrial construction ( Petroleum refineries, petrochemical plants, nuclear power plants, steel mills, manufacturing plants etc). Among them the residential projects constitute 30 t0 35 % of the construction expenditure in a year, thus these are considered very important for economical growth of a country as well as end users.

Cost and Time are considered as two most important pillars of any project. It is also universally accepted that harnessing these two key elements during course of any project execution is considered as foundation of successful project management and achievement of project objectives. Especially “Time” becomes the most critical factor that has to be managed against the prescribed schedule, because in the absence of Successful Time Management, not only the use of any facility is denied to its particular users, but also it has an extra burden on “Cost” against the allocated budget as well (Ahmed, 2011).

In view of above brief premise, where construction delays has gradually and increasingly become one of the core issue in construction industry of Pakistan, it is therefore a dire need to carry out a comprehensive research in this field which includes delay causes and its effects, delay avoidance techniques/methods and finally mitigating some valuable strategies to counter it from recurring during construction. It is therefore intended to cover this topic comprehensively mainly focusing on housing schemes in Pakistan.

## 1.2 PROBLEM STATEMENT

Many research and studies were carried out in the past in order to find out the major and critical causes of delays and their effects in construction industries at international level by getting the perception of all major stakeholders involved in the construction activities. These studies include the research work by Kumaraswamy (1998), who surveyed the causes of construction delays in Hong Kong as per client,

contractor and consultant's perception, and examined the factors affecting productivity. Mansfield et al. (1994) studied the causes of delay and cost overrun in construction projects in Nigeria highlighting the delay causes. (Assaf et al., 1995 and 2006) studied the causes of delay in large building construction projects in Saudi Arabia. (Mezher and Tawil, 1998) conducted a survey of the causes of delays in the construction industry in Lebanon from the viewpoint of owners, contractors and architectural/engineering firms. Al-Momani (2000) conducted a quantitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan. Majority of these international researchers conducted surveys merely to identify the delay factors in different type of construction projects, but none of them had carried out a comparative study regarding the perception of major stakeholders about the delay contributors in mega residential projects like housing schemes.

A few limited studies have also been carried out in Pakistan including the research carried out by Ahmed et al. (2009), mainly focusing identification of delay factors and the allocation of responsibilities. Nida et al. (2008) analyzed the reasons for the cost overrun in the construction industry of Pakistan and reported the most significant factors responsible for the construction delays. Furthermore Farooqui et al. (2008) described the basic reasons for cost overruns. Arian and Tipu (2009) have described cost and time overruns factors in the construction projects. In the recent past Nasir, (2011) carried out research only to identify the factors of time and cost overrun in highway projects. These limited studies were merely focusing on identification of the delay causes in construction projects mainly in highway and building projects, but none of them touched the residential projects like mega housing schemes in Pakistan. In Pakistan, no single research has been done comprehensively to carry out a comparison at project level to analyze the delay contributors in relation to the perception of stakeholders.

## 1.3 RESEARCH OBJECTIVES

The main objectives of this research are mentioned as under:

1. To identify and rank the most significant delay contributors in major housing schemes through the perspective of major stakeholders.
2. To carry out comparison of delay contributors as per major stakeholder's perception in major housing schemes.
3. In view of above efforts, suggesting certain recommendations to minimize the delays in housing schemes of Pakistan.

## 1.4 RESEARCH SIGNIFICANCE

Issues of construction delays in the projects are a universal phenomenon. They are almost always accompanied by cost and time overruns and has unbearable consequences on clients, contractors and consultant in terms of adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of anxiety towards each other. Construction Industry of Pakistan contributes about 2.3 % of GDP, considered second largest industry after agricultural industry. Unless some project is successful, the desired contribution to national economy can never be achieved. But unfortunately, these desired economical contribution and project objectives are mostly not achieved due to issues like Cost-overrun, time overrun and their devastating effects on the project participants as mentioned above.

Empirical studies to determine the causes and effects of delays in construction projects have been carried out in developed countries. However, no such comprehensive and formal study has been carried out for the Pakistani Construction Industry, where project delays can be informally acknowledged as the most common and costly problem encountered in construction projects. Time is very important factor for both the client and the contractor, which has been a source of frequent disputes and claims leading to lawsuits in the Pakistani constriction industry. Thus there is a dire need for a comprehensive evaluation of these delay contributors and their effects in construction industry of Pakistan especially in housing schemes in order to devise some mechanism for delay mitigation and a formal project management system. Delays can be minimized only when their causes

are identified. Knowing the cause of any particular delay in a construction project would help avoiding the same.

This research study was therefore, aimed at identification and thorough evaluation of major delay contributors in construction projects especially in housing schemes in Pakistan through a survey, and quantifies the perceptions of clients, consultants and contractors regarding the causes of delays. This research will be beneficial to all concerned parties including clients, contractors and consultants and make the projects more successful and productive. This will in turn, facilitate the achievement of overall project objectives and economical benefits. Finally the recommendations suggested towards the end of this research will definitely facilitate the clients, consultants and contractors to reduce the delays and ensure timely completion of housing projects in Pakistan with enhanced efficiency.

## 1.5 SCOPE OF THE THESIS

The research was focused on major housing schemes mainly Askari, DHA and Bahria, both public and private, including recently completed and ongoing schemes in major cities of Pakistan. The major cities include Islamabad, Rawalpindi, Lahore, Peshawar, Karachi, Quetta, Multan and Gujranwala. In this research mainly key stakeholders i.e. clients, consultants and contractors were targeted in order to acquire their perception regarding subject matter. An intensive effort was invested in order to incorporate maximum number of housing projects within specified research time period.

## 1.6 ORGANIZATION OF THE THESIS

This research work is categorized into five chapters. Chapter 1 contains the background about construction delay contributors, problem statement and research significance. It also includes the objectives and scope of this research study. Chapter 2 covers a thorough literature review of construction delay contributors including definitions, types of delays, delay responsibilities, major causes of construction delays, and effects of construction delays. Chapter 3 describes the research methodology adopted for collection of the data including process of survey design, sample selection and its size, development of a questionnaire, and strategy

for statistical analysis. Chapter 4 describes the statistical analysis and results of the survey conducted. Various data analysis techniques have been utilized including test of reliability, normality, Spearman correlation, Kruskal-Wallis test and descriptive statistics using SPSS 18.0 (Statistical Package for the Social Sciences, Version: 18.0). It is then followed by the discussion based on analysis and results. Chapter 5 summarizes the main conclusion and recommendations formulated for the construction industry of Pakistan especially housing projects. Conclusions and recommendations are drawn from key research findings. Future directions are also identified

Survey questionnaires with list of housing projects can be found in the appendices. The appendices also contain results of the tests carried out in Statistical Package for the Social Sciences (SPSS Ver. 18.0) for data analysis.

*Chapter 2*

# LITERATURE REVIEW

## 2.1 INTRODUCTION

Construction delays in developing world are one of the major challenges faced by the planners and designers as well as Governments, however limited research has been carried out on the subject particularly in the context of Pakistan. Due to lack of previous studies about delay contributors, this research reviews the major causes, types and effects of delays during construction that have been explored in the literature. This chapter provides a base for understanding the complete dynamics of construction delays .Construction delay has been accepted and considered as the common trend by the entire construction industries worldwide. Construction industry continues to suffer especially in relation to delays mainly due to the inadequate and poor knowledge of project management (Hamza et al., 2008). Besides other factors, the major pillars of successful projects like quality, time, cost and safety, suffered devastative blows of construction delays. The significant role of construction industry can be assessed from the fact that it can contribute enormously in the development and growth of GDP for the economic development of any country. Thus the adverse effects of delays penetrate beyond the construction industry and influence the overall economy of a country (Arshi and Saeh, 2006). This chapter will be looking into various aspects of construction delay pertaining to construction industry significantly definitions, causes and categories, types, its devastating effects and few delay avoidance measures and mitigation strategies as highlighted in the previous studies.

## 2.2 CONSTRUCTION DELAY

According to Majid (2006), delay can be defined as," Late completion of works as compared to the planned schedule or contract schedule". He concluded in his research that, "Delay is a situation when the contractor, consultant, and client jointly or severally contributed to the non-completion of the project within the original or the stipulated or agreed contract period"

According to Kaming et al. (2010), delay is defined as," The extension of time beyond planned completion dates traceable to the contractors".

As per the research carried out by Memon et al. (2011), delay in construction industry is referred as, "The progress compared to the baseline construction schedule. Baseline construction schedule refers to the schedule prepared by contractor before the start of the project and approved by the client. Although delay to progress does not necessary end up to project delay but most of the time this progress delay leads to project delay".

Mubarak, 2005 carried out research and claimed that, "Delay is an event or a condition that results in work activity starting, or project completion, later than originally planned or an interruption or a hindrance to a planned program". As per the research carried out by Assaf and Al-Haeijji (2006), they seems to agree with Le-Hooai and Lee (2008), the concluded that, "Delay is the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project". Bassioni and El-Razek (2008) identified that, "Delay in construction project is considered one of the most common problems causing a multitude a negative effect on the project and its participating parties".

According to Arditi and Pattanakitchamrron (2006), "Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages and the parties responsible for them in order to recover time and cost. However, in general delay situations are complex in nature. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date."

Stumpf ( 2000) carried out research and defined delay as," An act or event that extends the time required to perform the tasks under a contract. It usually shows up as an additional days of work or as a delayed start of an activity". Again his view seems to agree with both Mubarak (2005) and Assaf & Al-Haeijji (2006), where his interpretation of delay largely refers to project delay.

Memon et al. (2011) has clearly concluded that mainly the definitions of delay

are coupled with extension of time to the project. Therefore he categorized the construction delay into two groups: construction delay and project delay. Further he explained that construction delays are interruption in the construction progress while project delay is related to the delay to the duration of any project. It is obvious from the fact that construction delay does not necessarily lead towards project delay, but of course construction delay is sure if there is any project delay. Undoubtedly, the source of project delay can be late start, late progress and late finish or combination of those events.

## 2.3 TYPES OF CONSTRUCTION DELAYS

As per the journal paper written by Yates and Epstein (2006), there are generally four types of delays that occur on construction projects and while they can be categorized and described, in actual practice delays are frequently difficult to sort out, separate, and accurately access. As a result, the responsibility for delays on construction projects is often disputed and can become the subject of protracted litigation. The types of delays have been labeled as: non-compensable excusable, compensable excusable, non-excusable, and concurrent and these types were also discussed by Rubin et al. (1983) and Bramble & Callahan (1987). We can find more broad categories of delay if we see those very closely with a view point of Saqib et al. (2010). They categorized these into two basic types as: excusable and non-excusable delay. These delays are described as under:

### 2.3.1 Non-Compensable Excusable Delays

Delays, which are neither the fault of client nor the contractor but are due to acts of God or unpredictable circumstances beyond the control of both parties, are called non-compensable excusable delays. Most of the time there is a clause in the contract documents usually known as force majeure clause, which enumerates various causes and factors of delays. This clause has one peculiarity that it can legally protect both the parties from being responsible for any act of delay. This clause mostly entitles the contractor with time extension or performance, but not with the additional cost, although this may depends on the contract language. Several issues have been litigated with reference to set up a non-compensable

excusable delay for unusually severe weather conditions. Unusually severe weather conditions include:

- Making clear distinctions between the levels of frequency or severity that make conditions unusually severe as opposed to merely severe
- The place where weather records are maintained which should be as close as possible to the site.
- The impact of weather on the actual work such as drying time for soils.
- The contractor should be deprived of the claims with respect to weather based non-compensable excusable delays, if he does not take reasonable precautions. As the above items illustrate, many legal issues and disputes can arise from just one aspect of one clause in a construction contract.

### 2.3.2 Compensable Excusable Delays

Those delays which are caused and that result in both a time extension and compensation to the contractor are known as compensable excusable delays. These delays result from following conditions such as:

- Owner's failure to make job site available to the contractor in a timely manner
- Changes by owner in the work
- Late issuance of notice to proceed to the contractor
- Defective supply of design by the Architect/Engineer
- Poor coordination of the work with other contractors
- Non provision of owner furnished equipment in a timely manner
- Owner providing ambiguous information
- Owner's interference with the performance of the contractor
- Late approval of contractor submitted shop drawings by owner or Architect/Engineer
- Differing site conditions

According to research carried out by Ahmed and Azhar (2008), in which they stated that besides the compensable delays that result from contract changes, there are compensable delays that can occur in other ways. They categorized such

compensable delays as excusable delays, suspensions, or interruptions to the work resulting from Owner's breach of an obligation. As per their research the contractor is entitled both time extension and additional cost provided that compensable delay has occurred.

They also concluded that in Owner-issued contracts which specifically address some potential compensable delays and provide equitable adjustments that apply to delay are:

- Changes
- Differing Site Conditions
- Suspension of work

The changes clause in Owner-issued contracts provides that equitable adjustments may be considered as follows:

- **Changes**

Ahmed and Azhar (2008) concluded that owner can make any changes in the Work within the general scope of the Contract with the help of proper written change order, including but not limited to changes:

- In the drawings, designs or specifications
- In the method, manner or sequence of Contractor's work
- In Customer or Owner furnished facilities, equipments, materials, services or sites
- Directing acceleration or deceleration in the performance of the work
- Modifying the Contract Schedule or the Contract milestones

As per the contractor's believe, if these changes are not included in the written change order then he shall submit a written change notice request , within 10 calendar days, explaining the basis for the request. Owner then either issue the written change order or refute the request. A reasonable cost adjustment and contract modification shall be done if this clause directly or indirectly adds to or reduces the cost or time required for performing the work.

- **Differing Site Conditions**

According to Ahmed and Azhar (2008), the contract clause for differing site conditions has the provision that if these conditions vary in material and have direct

or indirect effects in terms of increase or decrease cost or time, then a reasonable adjustment can be made pursuant to the General Condition titled “Changes”. Under this clause without the written notice of contractor, he is not allowed to put any claim, because the purpose of this clause is not to damage or enrich the contractor due to consequential delay.

Ahmed and Azhar (2008), also stated that there is a difference between different site conditions and site condition clause commonly known as “Exculpatory” clause, whose purpose is to reject contractor’s delay related claims associated with site conditions. The exceptions are limited to those conditions defined in the Differing Site Conditions clause.

### 2.3.3 Non-Excusable Delays

As per the research of Yates and Epstein (2006), delays caused by actions or inactions of contractor are known as non-excusable delays. Non-excusable delays are events that are within the contractor’s control or that are foreseeable. If this type of delay occurs then the contractor is not provided with any time extension and further this may also trigger delay damages against the contractor. Few of the examples of such delays are as under:

- Contractor’s failure to mobilize the manpower resources and start the work in a timely manner
- Late submittal of shop drawings for owner’s approval
- Lack of construction equipment
- Poor quality and workmanship
- Lack of planning in resource allocation on the project
- Lack of coordination of tradesmen and subcontractors

### 2.3.4 Concurrent Delay

James (1990) concluded that,” When more than one cause/factor results in a delay to a project during the same time period, the project is said to have incurred concurrent delays”. According to Yates and Epstein (2006), all those delays which do not come under one of the previous categories are the concurrent delays. They further stated that there are available different methods which can be adopted to assess the responsibility for occurring of concurrent delays. If still there is no

solution between owner and contractor for who is responsible for concurrent delay, then the issue can be resolved through legal proceedings.

As per the research carried out by Majid (2006) in which he stated that, “Concurrent delays refer to delay situations when two or more delays occur at the same time or overlap to some degree either of which, had the delays occurred alone, would have affected the ultimate completion date. Normally concurrent delays which involve any two or more excusable delays result in a time extension. When excusable with compensation and non-excusable delays are concurrent, a time extension can be issued or the delay can be apportioned between the owner and the Contractor”. Further he elaborated some guidelines for classifying these concurrent delays as under:

- Contractor is only allowed time extension in case of concurrent occurrences of excusable and non-excusable delays
- Contractor is entitled time extension with no delay damages if excusable delays with compensation /without compensation occur concurrently.
- Contractor is entitled to both time extension and damages in case two excusable with compensation delays occur concurrently.

## 2.4 FURTHER CATEGORIZATION OF DELAYS

Theodore (2009) mentioned that there are four basic ways to categorize type of delays:

- Critical or noncritical
- Excusable or non-excusable
- Compensable or non-compensable
- Concurrent or non-concurrent (already discussed in detail in serial 2.3.4)

In the process of determining the effect of a delay on the project, the analyst must determine whether the delay is critical or noncritical. The analyst must also assess if delay are concurrent. All delays that are identified in the analysis will be either excusable or non-excusable. Delay can be further categorized into compensable or non-compensable delays.

### 2.4.1 Critical Versus Non-Critical Delays

Delays that affect the project completion, or in some cases a milestone date, are considered as critical delays, and delays that do not affect the project completion, or a milestone date, are noncritical delays. If these activities are delayed, the project completion date or a milestone dater will be delayed. The determining which activities truly control the project completion date depends on the following:

- The project itself
- The contractor's plan and schedule (particularly the critical path)
- The requirement of the contract for sequence and phasing
- The physical constraint of the project, i.e. how to build the job from a practical perspective

### 2.4.2 Excusable versus Non-Excusable Delays

All delays are either excusable or non-excusable. An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. Normally, based on common general provisions in public agency specifications, delays resulting from the following events would be considered excusable:

- General labor strikes
- Fires
- Floods
- Acts of God
- Owner-directed changes
- Errors and omissions in the plans and specifications
- Differing site conditions or concealed conditions
- Unusually severe weather
- Intervention by outside agencies
- Lack of action by government bodies, such as building inspection

### 2.4.3 Compensable Delays versus Non-Compensable Delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-

excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension. Whether or not a delay is compensable depends primarily on the terms of the contract. In the most cases, a contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension.

## 2.5 DELAY RESPONSIBILITIES

According to research carried out by Ahmed et al. (2003), he inferred that the subject of delay responsibility is associated with the compensation in terms of additional cost and time to the contractor for completion of any project. He categorized the responsibilities into following groups:

- Owner responsible – In this case the contractor is entitled compensation in terms of additional cost and time.
- Contractor responsible – In this case no compensation is granted to the contractor.
- Neither party responsible – For such case where delays occur due to acts of God, the contractor is only entitled time extension with no additional cost and also no damages/penalties will be assessed.
- Both parties responsible – In this case the contractor will also be granted time extension with no additional cost and no damages/penalties will be assessed.

## 2.6 CAUSES OF CONSTRUCTION DELAY

There are many factors that contributed to causes of delays in construction projects. These range from factors inherent in the technology and its management, to those resulting from the physical, social, and financial environment. Assaf, et al. (1995) carried out research about the causes of delays in large building construction projects in Saudi Arabia. He identified the most important causes of delay such as: late approval of shop drawings; late payments to contractors; changes in design;

conflicts in work schedules of subcontractors; slow decision making in owner's organizations; inadequate design; lack of manpower resources.

Ogunlana et al. (1996) carried out research work on the delays in building project in Thailand and concluded that there are three types of problems in construction projects of developing countries such as problems related to shortages in industry infrastructure, problems related to owners and consultants and thirdly problems related to contractors.

Mezher and Tawil (1998) conducted a survey about the causes of delays in the construction industry in Lebanon. They found that financial matters are the source of concern for the owners ,contractual relationship have more significance for contractors and project management issues are considered most significant causes of construction delays.

Chan and Kumaraswamy (1998) carried out research work on the causes of construction delays in Hong Kong. They concluded that there are some common factors leading to delay which includes: lack of proper supervision and management on sites, and the five principal and common causes of delays are: poor site management and supervision; differing site conditions, slow decision making and changes by client.

According to the research work of Majid and McCaffer (1998) about the factors of non-excusable delays that influence contractors' performance, in which they categorized and identified the main causes of non-excusable delays. They concluded that there is a much more control over the compensable delays by the clients as compared to contractors. On the contrary the non-excusable delays are expected to be effectively controlled by the contractors and they assumed that contractors can do more to prevent these delays than client for smooth execution of projects. Further they categorized the causes of such delays into 12 groups as: material-related delays, labor-related delays, equipment-related delays, financial-related delays, improper planning, lack of control; subcontractor-related delays, poor coordination, inadequate supervision, improper construction methods, technical personnel shortages, and poor communication.

As per the research work of Al-Momani (2000) in which he conducted a quantitative analysis of construction delays by examining the records of 130 public

building projects constructed in Jordan during period of 1990-1997. A regression model about the relationship between actual and planned project duration was presented by him in which he considered the different causes of delays .He concluded that there are some main causes of construction delays such as: delays in association with designers, changes by owner, adverse weather condition, differing site conditions, late delivery of materials and financial issues related to owner and contractor. Odeh and Battaineh (2002) carried out survey on causes of construction delay in Jordan In which they concluded that top ten major causes of delay are: unnecessary interference by owner, inexperience contractors, late payments to the contractors, low labor productivity, owner's slow decision making, lack of planning, and improper work by sub-contractors. They further categorized these causes into eight (8) groups as under:

- Client related delay factors
- Contractor related delay factors
- Consultant related delay factor
- Material related delay factor
- Labor and equipment related delay factor
- Contract related delay factor
- External related delay factor
- Unforeseen ground conditions

Frimpong et al. (2003) carried out research work on the main causes of delays in construction of groundwater projects in Ghana such as: late payments by client, lack of project management by contractor, late procurement of material and material's price escalation. Long et al. (2004), carried out research work on the problems in large construction projects in developing countries, a case study from Vietnam and categorized the causes of delay into 5 factors such as: incapable/experienced contractors and consultants/designers, poor estimation, social and technological issues, work site related problems and improper construction methods.

According to the research work of Koushki et al. (2005) in which they identified the main causes of delays in the construction of private residential projects in Kuwait such as: frequent changes by the owner, financial issues related to owner,

contractor and material related issues. Wiguna and Scott (2005) carried out survey on the risks affecting construction delay and cost overruns in building projects in Indonesia in which they identified few factors resulting in cost overrun such as: material's price escalation, changes by owner, defective project design, and severe weather condition, late payments by owner and poor quality work by the contractor.

Majid (2006) surveyed the causes of delay in Aceh, Indonesia, construction industry and identified 57 causes of delay and categorized those causes into eight groups as under:

- Material related delay
- Labor related delay
- Equipment related delay
- Finance related delay
- Contractor related delay
- Client related delay
- Consultant related delay
- External Factor related delay

Ahmed and Azhar (2008) studied the delay causes and they identified 56 causes of delay and further identified 24 key factors contributing towards delay through survey questionnaire. They categorized those causes into six groups as under:

- Design related delay
- Financial/Economical related delay
- Construction related delay
- Management and Administration related delay
- Code related delay
- Acts of God related delay

Theodore, (2009), surveyed the causes of delay in and identified fifty two (52) causes of delay and categorized those causes into seven groups as under:

- Client related delay
- Contractor related delay
- Material related delay
- Labor related delay

- Equipment related delay
- Consultant related delay
- External Factor related delay

Saqib et al. (2010) carried out research about delay management in Pakistani construction industry and they identified fifty eight (58) causes of delay and classified them into ten categories as:

- Finance/Economic related delay
- Design related delay
- Contract related delay
- Equipment related delay
- Labor related delay
- Material related delay
- Sub-Contractor related delay
- Third Party related delay
- Management related delay
- Administrative related delay

➢ **Summary of Major Causes of Delays Identified in Previous Studies**

Table 2.1refers to the category wise major causes of delays as identified by the many researchers as discussed in section 2.6 above:

**Table 2.1: Factors of delays identified by all researchers**

| Group/Category | Delay Factors | |
|---|---|---|
| Client Related delay Factors | 1 | Frequent Change orders and delay in its issuance |
| | 2 | Slow decision making |
| | 3 | Financial issues |
| | 4 | Lengthy and cumbersome payment process |
| | 5 | Delay in progress payments |
| | 6 | Undue interference by owner and his representative |
| | 7 | Owner's lack of experience in the construction business |
| | 8 | Lack of qualified staff and trained human resource |
| | 9 | Lack of communication and coordination |
| | 10 | Delay to furnish and deliver the site |
| | 11 | Unrealistic contract duration imposed by owner |

| | | |
|---|---|---|
| | 12 | Poor management of contractual issues |
| Contractor Related delay Factors | 1 | Inadequate contractor experience |
| | 2 | Improper construction methods |
| | 3 | Inaccurate time and cost estimate |
| | 4 | Poor site management and supervision |
| | 5 | Poor project planning and scheduling |
| | 6 | Incompetent project team |
| | 7 | Hiring unreliable and incompetent subcontractor |
| | 8 | Poor communication and coordination |
| | 9 | Rework due to errors during construction |
| | 10 | Poor financial capability |
| | 11 | Delays in site mobilization |
| | 12 | Poor qualification of the contractor's technical staff |
| | 13 | Poor management of contractual issues |
| | 14 | Getting contract by unfair means |
| | 15 | Lack of site safety plan |
| Consultant Related delay Factors | 1 | Delay in approving major changes in the scope of work |
| | 2 | Poor communication and coordination |
| | 3 | Inadequate experience of consultant |
| | 4 | Mistakes and discrepancies in design documents |
| | 5 | Un-use of advanced engineering design software |
| | 6 | Inaccurate site investigation |
| | 7 | Shortage of qualified staff |
| | 8 | Lack of responsibility |
| | 9 | Non flexible attitudes |
| | 10 | Monetary gains and kick backs in revised Work |
| | 11 | Delay in preparation and approving the drawings |
| | 12 | Delay in review and approving the Contractor’s submission plan and shop drawings |
| | 13 | Poor supervision and quality assurance of work at site |
| | 14 | Delay in verification and submission of contractor’s interim payment certificates |
| Material Related delay Factors | 1 | Shortage of construction materials in market |
| | 2 | Changes in material types and specifications during construction |
| | 3 | Delay in material delivery |
| | 4 | Late procurement of materials |
| | 5 | Poor quality of construction materials |

| | | |
|---|---|---|
| | 6 | Escalation of material prices |
| | 7 | Unreliable suppliers |
| | 8 | Delay in Testing of materials |
| Equipment Related delay Factors | 1 | Frequent equipment failure |
| | 2 | Shortage of equipment and its parts |
| | 3 | Low productivity and efficiency of equipment |
| | 4 | Lack of modern equipment |
| | 5 | Slow mobilization of equipment |
| | 6 | Late delivery of equipment |
| | 7 | Poor monitoring and control |
| Labor Related delay Factors | 1 | Shortage of labors(skilled and unskilled) |
| | 2 | Low productivity level of labors |
| | 3 | Slow mobilization of labor |
| | 4 | Strike |
| | 5 | Low motivation and morale of labors |
| Miscellaneous Factors Related delays | 1 | Effects of subsurface conditions (e.g. soil, high water table, etc.) |
| | 2 | Hot weather effect on construction activities |
| | 3 | Poor safety management |
| | 4 | Lack of site meetings |
| | 5 | Delay in providing utilities services (such as water, electricity) |
| | 6 | Environmental concerns and restrictions |
| | 7 | Law & order and security situation |
| | 8 | Natural disasters like flood, earthquake etc |

## 2.7 EFFECTS OF CONSTRUCTION DELAYS

Projects are classically defined by the need to complete a task on time, to budget, and with appropriate technical performance/quality. In recent decades, projects have tended to become more time constrained, and the ability to deliver a project quickly is becoming an increasingly important element in winning a bid.

A project consists of collections of activities. An activity's completion may be delayed due to a delayed start or extended activity duration. While an activity's start

may be delayed due to certain reasons, its duration may be extended due to some other reasons. Activity's delayed completion may cause delays in the succeeding activities, which in turn can cause a delay in the project completion.

Shi et al. (2001) concluded that delays can occur in any and all activities, and can concurrently or simultaneously cause delays in the project completion. In other words, a Project delay is the accumulated effect of the delays in individual activities.

Delays can give rise to disruption of work and loss of productivity, late completion of project, increased time related costs and third party claims and abandonment or termination of contract.

### 2.7.1 Previous Studies on Effects of Delay

Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. The six effects of delay identified were: time overruns cost overrun, dispute, arbitration, total abandonment, and litigation. By a questionnaire survey they evaluated the effects of construction delays, and their findings showed that time and cost overruns were the frequent effects of delay. Delay had significant effects on completion cost and time of sixty one building projects studied.

Construction cost overrun is a common problem in the construction industry. It is believed that construction projects experience an increase in cost of about 33% on average (Hartley and Okamoto, 1997). Over the past few years state transportation agencies have experienced an increasing trend of construction cost overruns. To illustrate the problem, in a survey of 102 recently completed projects with initial budget USD 302.7 million conducted by the Florida Department of Transportation, the construction cost overruns were found to be USD 28.6 million (9.5%). Over half of this amount (USD 15.6 million or 5.2% of the budget) was classified as avoidable costs, and the remaining amount was considered to be unavoidable. About USD 4.2 million (1.4% of the budget) in avoidable cost overruns did not add value for citizens and represent wasted money. In general, steps need to be taken to minimize cost overruns.

Sun and Meng (2008) carried out research on frequent project changes and their effects in construction projects and they stated that one of the harmful effects of the project change is rework or revision of work. The cost of rework in construction

projects can be as high as 10-15% of the contract value. In addition to rework, other negative effects of project change include extra work, time loss, design revisions, increase costs etc. Project changes may also result in some indirect effects, which will ultimately have a damaging impact on project cost and/or schedule. Indirect effects include disputes and claims, loss of productivity, loss of rhythm, unbalanced gangs and resource allocations, changes in cash flow, increased risks of co-ordination failures and errors, lower morale of the work force, loss of float, and so on.

Cahil ,Baker and McKenzie, discussed the consequential effects of delay on the project including :

- Further delay suffered due to weather, industrial etc which would not have been experienced if the project had not suffered the early delays
- Increased costs of any material and labor cost escalation
- The missing of seasonal(e.g. Christmas) trading in the case of a shopping centre, cinema etc
- The missing of a “window of opportunity”, for example, being first on the market and thus ahead of the competition for a particular type of development
- Losing business(e.g. sales of apartments) through late completion

The consequences of time overruns are almost serious and hard to resolve. Failure to meet deadlines represents financial losses to users and, more often than not, has a negative impact on the project profitability for promoters. However, understanding the causes may help to curb the problem and contribute for improving productivity (Pedroand, 2007).

Aibinu (2002), M. Sambasivan (2007) and Memon et al. (2011), studied and evaluated the effects of construction delays on project delivery and found that the six effects of construction delay were:

- Time overrun
- Cost overrun
- Dispute
- Arbitration
- Litigation

- Total abandonment

They further stated that time overrun and cost overruns are the two most significant effects of delay in construction projects.

### 2.7.2 Brief Description of Some Common Effects of Construction Delay

Sambasivan and Soon (2007) highlighted some description of effects of construction delays as under:

- **Time overrun**

Client-related and contractor-related factors have impact on the time overrun. Out of the most important causes of delay are client-related and contractor-related factors such as inadequate planning by the contractors, improper site management by the contractors, inadequate project handling experience of contractors, and delay in the payments for the work completed directly affect the completion of the project and cause time overrun.

- **Cost overrun**

Contract-related factors such as change orders (changes in the deliverables and requirements) and mistakes and discrepancies in the contract document result in cost overrun. Mistakes and discrepancies in the contract document can be in scope, deliverables, resources available and allocated, payment terms, achievement of various milestones, and the project duration. In most of the instances, time overrun leads to cost overrun. Correlation analysis between cost and time overruns indicated a strong linkage (correlation coefficient = 0.487, significant at 0.01 level of significance)

- **Disputes**

Client-related, contract-related, contract relationship-related and external factors have impact on the disputes that arise during the course of the project. Factors such as delay in the payments for completed work, frequent owner interference, changing requirements, lack of communication between the various parties, problems with neighbors, and unforeseen site conditions give rise to disputes between the various parties. The disputes, if not resolved amicably, can lead to arbitration or litigation.

- **Arbitration**

Client-related and contract relationship-related factors escalate disputes to be settled by arbitration process. A competent third-party can settle the disputes amicably without going to the court.

- **Litigation**

Client-related, labor-related, contract-related, contract relationship-related and external factors escalate disputes to be settled by the litigation process. The parties involved in the projects use litigation as a last resort to settle disputes.

- **Total Abandonment**

Client-related, consultant-related, labor-related, contract- related, and external factors contribute to the total abandonment of the projects. In Malaysia, many projects were temporarily abandoned during the financial crisis between 1997 and 2000. Promoters of various projects backed out because of poor cash flow and economic conditions.

## 2.8 DELAYS AND HOUSING SCHEMES OF PAKISTAN

- **Brief history of Housing schemes of Pakistan**

Housing co-operatives were introduced by co-operative credit societies Act of 1904. The Act was changed with co-operative societies Act in 1912.Under Government of India Act of 1919, co-operatives were transferred to provinces giving them power to make administrator and then develop the co-operative. When Pakistan was created in 1947, housing was a major problem for millions of people due to large influx of immigration into newly State (Pakistan). Refugees and rural migration contributed to the growing number of issues with respect to provision of shelters in the shape of houses.

In Sindh province, there were 46 housing co-operatives located in Karachi (22), Hyderabad (23) and Sukkar (1).In 1949; Karachi Co-operative Housing Society Union was founded. The newly state had leased out 1400 acres of land to the union for township development. Other housing co-operatives such as Pakistan Employees C-operative Housing Society Limited also received land from the state. In Punjab Province, housing was responsibility of Government through urban and housing development until 1970 at which time, commercial and co-operative developers started to do business. Co-operatives were also

introduced in Baluchistan Province in 1950.Similarly these were also developed in NWFP (Now KPK Province) and in capital territory of Islamabad.

- **Context of Housing Schemes in Pakistan**

Pakistan is the seventh ($7^{th}$) most populous countries in the world and fifth ($5^{th}$) in Asia. According to a survey, the urban population in Asia is growing at the annual rate of 3%.Housing conditions in Pakistan are overcrowded with inadequate sewerage conditions, full of pollution, poor building construction. In 2008, the yearly estimated housing demand was 570,000 where as actual supply of housing units was recorded as 300,000 with a shortfall of 270,000 units every year.

Various efforts have been invested by the Government as well as private sectors to reduce this shortfall. Many housing schemes are introduced by both the public and private sectors for providing housing societies to low income as well as upper class citizens of the country. As per the survey report of 2009, there are about 2608 housing co-operatives thus have provided about 13 million housing units to their members.

- **Major Housing Schemes of Pakistan**

There are many housing schemes in Pakistan, busy in developing and constructing the housing units for their members, but major ones are Bahria Town, DHA (Defence Housing Authority) and Askari housing Schemes. Some of salient features of these housing schemes are discussed in Table 2.2 below:

**Table 2.2: Salient's of Bahria Town DHA and Askari housing schemes**

| Salient Features | Bahria Town | DHA | Askari | Remarks |
|---|---|---|---|---|
| Type of Organization | Private | Public | Public | |
| Project's Location | Lahore & Islamabad* | Islamabad, Karachi & Lahore | Rawalpindi, Lahore, Karachi, Quetta, Peshawar, Gujranwala, Multan & Sialko | *Planning to develop in Murree & Karachi also |
| Established in | 1996 | *1975(1999),#1980 and @1990 | Early 1980s | *LCCHS(DHA Lhr)<br>#DHA Kci<br>@ DHA Isd |
| Chairman/Executive | Malik Riaz Hussain | *Corps Commander | AG@ | *Governing body headed by |

| | | | | |
|---|---|---|---|---|
| | | | | Secretary Ministry of Defence @ Executive body headed by DG Housing |
| Total Area of Projects | 65576 Acres | 77273Acres | 34430 Acres | |
| Completed Projects | Phase-1 to 7 (Islamabad), Executive Lodges and Canal View Residency(Lahore) | Phase-1 & 2 Islamabad, Phase-1 to 5 Lahore and Phase-1 to 5 Karachi. | Askari-1 to 10 (Lhr), Askari-1 to 5 (Kci), Askari-1 to 13 (Rwp),Askari-1 to5 (Psr),Askari-1(Qta ,Gwa& Mtn) | |
| Under construction Projects | Phase-8 &9, Overseas Enclave, Bahria Orchard. | Underground Electrification and Defence Villas Islamabad,Phase 6 to 8 Karachi and Phase-6&7 Lahore | Askari-14 (Rwp) Askari-11 (Lhr), Askari-5 Extn (Kci), Askari-1Extn (Qta), Askari-6Extn (Psr), Askari-2 (Mtn & Gwa) | |
| Future Projects | Bahria Golf City, Sheraton Hotel (Islamabad), Garden City, Paradise & Nasheman (Lahore) | Community Centre, Development of Lake Islamabad and Phase-8 & 9 Lahore | Askari-12 (Lhr), Askari-14 Extn (Rwp) , Askari-6 (Kci),Askari (Skt), Askari-2 (Mtn &Gwa) | |

- **Delay Issues in Major Housing schemes**

  Like other categories of construction industry in Pakistan, besides other issues related with the projects, the issue of construction delays is one of the most glaring problems in housing schemes also. This issue is very much solvable and requires deep considerations from all major stakeholders. Due to this issue the end user ultimately suffer a lot.. The major housing schemes like Bahria Town, DHA and Askari housing schemes also suffered a lot from these delays. The effects of these delays are directly affecting all stakeholders including the end users.

*Chapter 3*

# RESEARCH METHODOLOGY

## 3.1 INTRODUCTION

In this chapter the basic aim is to discuss the research methodology which has been used for this study in order to achieve research aim and objectives that were described in Chapter 1. This chapter includes the main methods for collecting and generating the research data through questionnaire survey and the interview. It also contains the information about pilot study which was also conducted in order to check the validity of the questionnaire. The development of the questionnaire, collection of data through field survey and data analysis strategy is also presented in this chapter.

## 3.2 RESEARCH DESIGN

The objectives of the research have been described in chapter1 and the methods for achieving these objectives are addressed by designing the research in an appropriate manner.

The research methods used in social sciences are, experiments, surveys, archival analysis, case studies, and histories .Moreover method adopted for a particular research depends on the degree of research, type of the research operation (what, how, why) etc, the research focus, and control over variables (Yin, 2006 ).While selecting an appropriate method for research, it is mandatory to consider the links between data collection and its analysis, as well as the main questions to be addressed, and the results. Therefore, when proceeding on a research, the research questions, the data analysis approach and the kind of data, should be considered.

Research strategy is selected on the basis of research aim/objectives and it defines the layout/design showing how the researchers are going to carry out their study to achieve and answering research questions (Saunders et al., 2003). This strategy contains the sampling and questionnaire development, data collection sources and considering research constraints. Different methods have been extensively used by the researchers during their research work and the most suitable

methods were identified as quantitative, qualitative and their combination. Quantitative research methods use deductive approach and associated with collection of data and statistical analysis. On the other hand, using inductive approach, qualitative methods draw the results from interviews or observations rather than using statistical procedures (Amjad, 2004 and Amjad, 2005).

Loose more et.al. 1996,concluded that mostly researchers in the field of Construction Engineering & Management, used the quantitative method of collecting data and quite a few percent of them used the other two methods, i.e. qualitative method and combination of quantitative and qualitative methods. Wing et al. (1998) concluded that quantitative method can produce more factual and practical solutions in the field of Construction Engineering & Management research. Many other researchers, such as Seymour and Rooke (1995) and Seymour et al. (1997) believed that quantitative approach produces better results than the other two methods.

Other methods, such as interview are likewise chosen to complement and validate the survey questionnaire. Quantitative method is used for this research and survey method is selected for data collection Furthermore, the methods used for relevant data analysis in this study are MS Excel and SPSS version 18 (Statistical Program for Social Sciences) package to have mean score, frequency analyses, descriptive analysis, normality test, reliability test, and Kruskal-Wallis test .The selection of these statistical methods are introduced in relevant chapters.

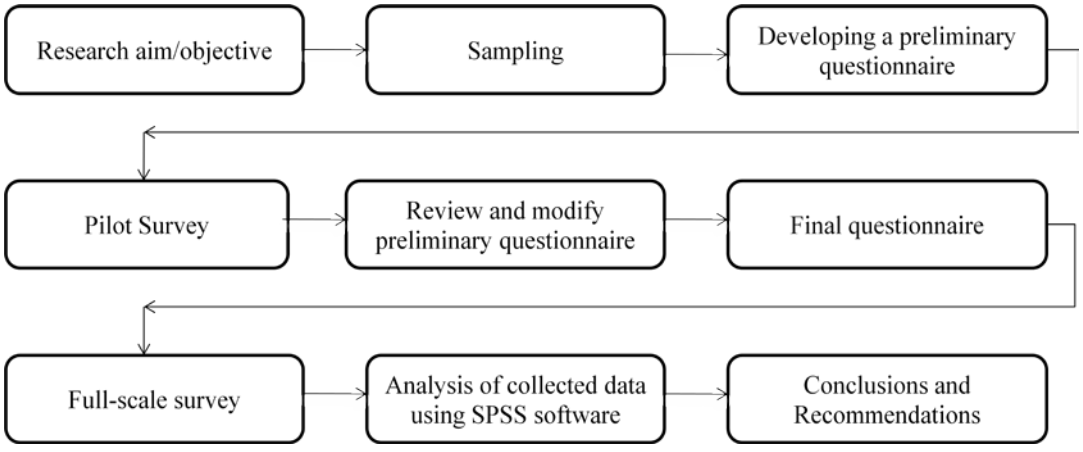


**Figure 3.1: Flow chart showing research methodology/process**

The research has been done as per the methodology adopted by Jehanzeb (2011), shown in Figure 3.1 above. To carry out the study, a questionnaire survey was developed. Pilot study was carried out for validation, refinement and improvement of the questionnaire. Having done a feasibility survey, a full fledged (open interview based) survey was conducted by visiting different major housing schemes in major cities of Pakistan to get the stakeholder's feedback. Finally, statistical analysis has been done from the collected data to explore the actual facts.

## 3.3 THE SURVEY DESIGN PROCESS

Marsh (1982), concluded in his research about the definition of survey as, " Data collected from number of cases/projects through systematic measurement and then analyzed to yield the results ". Later on Trochim (1997) and Bryman (2004) argued about this finding and concluded that while doing research in the field of social sciences, in applied social research, surveys are mostly through questionnaire and interview. Trochim (1997) further suggests that several issues should be kept in mind when a survey is chosen as a research strategy: a) population, b) sampling and c) question issues

### 3.3.1 Survey Sampling

- **Sample Selection**

The purpose of statistics is to have summary measure about some characteristics of the population through sampling and for good results sampling should be a good representative of population (Francis and Hoban 2002). Fellows and Liu (2003) defined the purpose of sampling as "collection of data and carry out of the research components provided that the sample selected is a good representation of the study population.

In this study a good sample of respondents including clients, contractors and consultants were randomly selected from a targeted population of 120 respondents from all major cities of Pakistan including Lahore, Karachi, Quetta, Peshawar, Rawalpindi, Islamabad, Multan and Gujranwala, where the detailed survey was conducted on the major housing schemes. Twenty (20) major and medium sized

housing projects from all major cities of Pakistan were taken into account including 11(55%) completed, 5(25%) partially completed and 4(20%) in progress projects. The sample of respondents was taken from these twenty (20) housing projects from all major cities of Pakistan. The questionnaire was therefore dispatched to 120 randomly selected potential above mentioned respondents. All these respondents were registered with Pakistan engineering Council (PEC) and the contractors are also members of All Pakistan Contractors Association (APCA).The executive appointments of the enterprises were addressed as the research informants, since they are supposed to possess the maximum knowledge regarding the firms construction delays being faced by them and their serious effects on their firm and projects. The names and particulars of these executives were obtained from PEC .The list of respondents is shown in Appendix 1.

### 3.3.2 Design of a Research Instrument

After setting out the objectives of this research work, a questionnaire was developed for full scale survey basing on literature reviews of the related research papers, researcher experience on the housing projects and after conducting a pilot survey. Important considerations such as selection of a measurement scale, attitude measurement and ranges of response category were also taken into account regarding questionnaire design.

- **Selection of measurement scale**

Reaves(1992) and Trochim (1997) concluded in their research work that the measurement scale has got basically four levels such as nominal, ordinal, interval and ratio. In this research, perception of all stakeholders about delay contributors in housing schemes was to be measured, so the researcher has selected the ordinal scale (also called ranking scale) for its measurement because it is more suitable scale for measurement.

- **Attitude measurement**

Bell (2005) argued that attitude measurement is suitable for measuring individuals' perception or feelings, called an attitude scale. DeVaus (2002) and Saunders et al. (2003) have named attitude scale as numeric rating scale and semantic differential rating scale. There are four commonly used methods of attitude scaling in social research: the Bogardus, Thurstone, Likert and Guttmann (cumulative) scales (Oppenheim 1992; Trochim 1997 and De Vaus 2002). Among them, Likert scale is widely used as it provides better reliability and is less laborious (Oppenheim, 1992 and De Vaus, 2002). In this research the Likert scale was selected in order to measure perception of all stakeholders regarding the delay contributors in housing projects.

- **Ranges of response category**

As per the research of Alwin (1997), there are different categories of ranges of response for a questionnaire design including 2-category response, 3-category response, 4-5-category response, 6-7-category response, 9-category response and even 10-11-category response. The widely used response categories are 2, 5, 7 and 10 (De Vaus, 2002). Kelly (1999) argued that points in excess of seven fails to provide sufficient information. Several researchers have recommended 7-point scale (Alwin, 1997 and De Vaus, 2002); however, the fine distinctions can confuse and requires precision with greater accuracy (Shuwei, 2009). Therefore, based on the above, five point scale was adopted for the survey questionnaire to get perception of stakeholders regarding delay contributors in housing projects and defined scales as 1 for Very Low, 2-Low, 3-Medium, 4-High and 5-Very High degree of contributions of delays factors and also 1 for Never, 2-Seldom, 3- Sometimes, 4-Mostly and 5-Always degree of occurrences of effects of these delay factors.

### 3.3.3 Sample Size

Various researchers and economists 2003 concluded that 30 is the minimum sample size for statistical analysis. Also Saunders et al. (2009), argued that it will be difficult to obtain a significant statistic test if the sample size is smaller than 30. The reason why all the above researchers view 30 as the smallest sample size is because

according to them, a sample size of 30 usually could result in a sampling distribution for the mean that is very close to a normal distribution. Therefore considering the above arguments, at least 30 respondents are to be considered to be the minimum number for this research. The choice of sample size depends on:

- The confidence required to have the data, i.e., the level of certainty that the characteristics of the data collected will represent the characteristics of the total population;
- The margin of error that can be tolerated, i.e., the accuracy required for the estimates made from the sample.

In this research the following empirical formula is used for calculation the sample size as adopted by Wilson (2010):

$$n = [N / \{1 + N (e^2)\}] \quad \text{.....Equation.1}$$

Where,

$n$ = Sample Size

$N$ = Population Size = 120

$e$ = Precision = 5 percent = 0.05

Putting values in Equation.1;

$n = 120 / [1+ (120 \text{ X } (0.05^2))] = 92$

A total of 120 respondents including 50 PEC registered contractors having the category C-A to C-4, 40 clients and 30 consultants were selected as the targeted population for this research from all major cities of Pakistan. Out of 120 respondents, 102 of them filled the questionnaire survey which was considered valid for the analysis. Table 3.1 showing a response rate of 85% .All these respondents were amply qualified and experienced in the Pakistan construction industry. Around 45% of the respondents had accumulated over 15 years of relevant experience, about 31% having 10-15 years experience, about 18% having 5-10 years experience and 6% having less than 5 years experience in the construction industry. Therefore the information provided by these professionals was considered to be authentic and reliable. The area wise distribution of questionnaire is: 36(Karachi), 40 (Lahore) and 24 (Rawalpindi / Islamabad), 4(Peshawar), 10(Quetta), 3(Gujranwala), 3(Multan). The category wise distribution is: 30 (Consultant), 40 (Client) and 50 (Contractors).

**Table 3.1: Category wise responses to the questionnaire**

| Respondent | No. of Questionnaires Distributed | No. of Questionnaires Returned | Response Rate |
|---|---|---|---|
| Clients | 40 | 37 | 92.5% |
| Contractors | 50 | 45 | 90% |
| Consultants | 30 | 20 | 66.67% |
| Total(Overall) | 120 | 102 | 85% |

**Table 3.2: Area wise responses to the questionnaire**

| City | No. of Questionnaires Distributed | No. of Questionnaires Returned | Response Rate |
|---|---|---|---|
| Karachi | 36 | 33 | 91.66% |
| Lahore | 40 | 37 | 92.50% |
| Rawalpindi/Islamabad | 24 | 21 | 87.50% |
| Peshawar | 4 | 2 | 50% |
| Quetta | 10 | 7 | 70% |
| Multan | 3 | 1 | 33.33% |
| Gujranwala | 3 | 1 | 33.33% |
| Total(Overall) | 120 | 102 | 85% |

There are 102 valid replies out of 120 showing a response rate of 85%. According to Owen and Jones (1994), an average of 20% of questionnaires returned is considered satisfactory. And in the construction enterprises, a good response rate is around 30% (Black et al., 2000). Therefore, the response rate in this research is highly acceptable.

### 3.3.4 Development of Questionnaire

There are many views regarding questionnaire design and many researchers have suggested that the survey questionnaire should be clear, precise and attractive for the respondents to fill in and return it(Shuwei, 2009).Further in this regard the significance of questionnaire design for an impelling survey has been highlighted by Giritli et al. (1990), Kim (2010) and Lingard et al. (2010). Accordingly, a well designed questionnaire contains questions that respondents can tackle and answer without putting in much of the effort, which maintain their interest, and at the same time does not consume much of their time . The questionnaire for this

research was designed in such a way that it can be easily understandable and also it contains the items well fitted for the Pakistani construction environment. The questionnaire used in this thesis is attached with a covering letter (Appendix III), which describes the main purpose of the study and ensuring the respondents that the information provided by them will be kept confidential and used for academic purposes only.

From the literature reviews, a survey instrument in the form of a questionnaire was developed as the principle survey method. Fifty three (53) key delay contributors were selected from literature reviews and researchers knowledge. Questionnaire was given to the researchers as well as colleagues for review and critique. Also a pilot survey was conducted to check the applicability of questionnaire in local environment and also to check its reliability, consistency and validity. Fifteen (15) questionnaires were distributed to respondents representing different organizations: five (5) to the clients, five (5) to the contractors and five (5) to the consultants followed by small open interviews with each participant. Respondents had an experience of more than 15 years in their respective fields. This exercise was conducted with face to face meeting thus ensuring 100 percent response. From their feedback, the questionnaire was amended and redistributed to same individuals, and a final questionnaire was developed from the feedback of these experts and other colleagues to suit local environments. Final questionnaire survey (Appendix III) has four sections. Section -1 contains the general information about the respondents including their name, qualification, appointment, experience in construction industry, experience in housing projects, group(Client, Consultant and Contractor), contact address and telephone/mobile numbers. Section-2 of the questionnaire was developed in a manner that contractors and consultants can give their perception separately about clients. Section-3 of the questionnaire was developed in a manner that clients and consultants can give their perception separately about contractors. Section-4 of the questionnaire was developed in a manner that clients and contractors can give their perception separately about consultants. The questions were measured on a five point likert scale, allowing different statistical techniques for analysis. Based on past literature reviews as mentioned earlier, fifty three (53) delay contributors were identified and these were

divided into three basic categories namely: client related delay contributors (16), contractor related delay contributors (24) and consultant related delay contributors (13) as shown in Appendix-II.

**Table 3.3: Categories of delay contributors**

| S.No. | Basic Category |
|---|---|
| 1 | Client Related Delays |
| 2 | Contractor Related Delays |
| 3 | Consultant Related Delays |

### 3.3.5 Pilot study

The basic aim of pilot survey, as perceived by Thomson 2010, is to test a questionnaire for its reliability, consistency and validity .Other researchers like De Vaus (2002) emphasized that questionnaire should be checked for any problem in its items,time required to fill it and respondent's interest level in order to fill it. For the same purpose in this research, a pilot survey was carried out to test the questionnaire items as well as the whole questionnaire. Few housing projects at Rawalpindi and Islamabad were selected from which fifteen (15) respondents including clients, contractors and consultants were approached. The questionnaires were delivered to them by hand and with face to face meeting in order to ensure maximum response. The questionnaires were filled in, and detailed discussions were made with the professionals as well as scholars. The responses provided by these respondents were helpful in refining and improving the questionnaire for conducting full scale survey. This small sample for pilot study was from the same population, which is under consideration for the purpose of this survey. Also the results of the pilot surveys were also incorporated in the data analysis as well which was helpful in the exclusion of certain unrelated delay factors. As suggested by Saunders et al. (2003), the questionnaire was also thoroughly discussed with research advisor, colleagues and friends to pick any error and obtain a valid questionnaire. After that, the questionnaire was refined and ready for carrying out a full scale survey.

### 3.3.6 Data collection for Full Scale Survey

Since the scope of this study was restricted to the housing schemes in major cities of Pakistan, so it was decided that the questionnaires to be delivered personally

to all the respondents located in closer cities like Rawalpindi, Islamabad, Lahore, Peshawar, Gujranwala and Multan. This method of questionnaire delivery has main advantages like purpose of research can be well understood by the respondents, questionnaires can be filled through face to face communication, any difficulty in the questionnaires can be sort out easily and high response rate can be obtained (Bell,2005). It was further decided that the remaining questionnaires will be delivered by mail to the respondents located in farther cities like Quetta and Karachi. Therefore, major housing schemes in Lahore, Rawalpindi, Islamabad, Peshawar, Gujranwala and Multan were visited personally by the researcher and out of 120 questionnaires, 75 were delivered to the respondents by hand and the researcher received 63 valid responses from them. These valid filled questionnaires were collected from the respondents through face to face meeting. Also remaining 45 questionnaires were delivered to the respondents in Quetta and Karachi through mail and 39 questionnaires were filled by them and received by the researcher through return mail. Overall 18 respondents refused to provide the feedback and did not show any serious intention to fill the questionnaires. It is important to note that the researcher has received a total of 102 valid responses which are more than the sample size as calculated above by using Equation 1.

*Chapter 4*

# DATA ANALYSIS, RESULTS AND DISCUSSIONS

## 4.1 INTRODUCTION

This chapter includes the detailed analysis of the data collected from the different categories of respondents. In order to analyze the data, the researcher has used the most comprehensible statistical software commonly known as SPSS Ver.18.0 (Statistical Package for the Social Sciences) in order to make an error free analysis from a large set of data( Gaur ,2009). Different categories of statistical tests such as reliability and normality tests, descriptive statistics (mean, frequency etc.), Spearman Correlation test and Kruskal-Wallis test were applied on the collected data using SPSS Ver.18.0.

## 4.2 DEFINING VARIABLES

In this research work SPSS version.18 is used as a primary statistical tool along with MS Excel and significance of client related delay contributors, contractor related delay contributors, consultant related delay contributors and effects of construction delays were abbreviated for easy understanding , comprehension of data and for saving the time which is as shown in Table4.1.

**Table 4.1: Categories of delay contributors with codes**

| S.No. | Category | Abbreviation/Code |
|---|---|---|
| 1 | Client Related Delay Contributors | CLR |
| 2 | Contractor Related Delay Contributors | COR |
| 3 | Consultant Related Delay Contributors | CSR |

The details of these categories are listed in Appendix II.

Before carrying out the descriptive statistics, normality analysis etc, it is strongly recommended to assess the reliability of the collected data first which is discussed in the next section.

## 4.3 RELIABILITY ANALYSIS

Oppenheim (1992), concluded that "*Reliability* refers to the consistency of a measure and to the probability of obtaining similar results if the measure is to be duplicated". Hinton et al. (2004) have also defined reliability as," a questionnaire tested to study any topic at different times and across different populations, if produces same results, the questionnaire is a 'reliable one". Reliability can be assessed in various ways, including the split-half, test-retest reliability, the parallel-form methods, and the internal consistency. Most commonly used method in researches is internal consistency.

In SPSS, widely used methods for assessing reliability include Cohen's Kappa Coefficient for categorical data and Cronbach's Alpha for continuous data (Likert-scale type items). Among them, Cronbach's Alpha is most popular method (Hinton et al., 2004 and Leech et al., 2005). Hinton et al. (2004) explained that Cronbach's Alpha value range from 0 (un-reliable) to 1 (reliable) with 0.75 being considered the most sensible value. They have also provided a guide line to assess the reliability of any data as shown in the Table 4.2.

**Table 4.2: Guideline for assessing reliability results**

| | | | | | |
|---|---|---|---|---|---|
| **a.** | 0.9 & above | Excellent reliability | **b.** | 0.7 to 0.9 | High reliability |
| **c.** | 0.5 to 0.7 | Moderate reliability | **d.** | 0.5 and below | Low reliability |

In reliability analysis, un-dimensionality i.e. correlation of each item with the total scale can be checked as well. De Vaus (2002) and Hinton et al. (2004) argued that if the item-to scale coefficient is below 0.3, the item should be removed. Since the data gathered was based on Likert-scale; therefore Cronbach's Alpha method was used to check the reliability in this research. The summary of the reliability analysis conducted on SPSS is presented here and full results can be seen in the Appendix IV.

### 4.3.1 Client's Perception about Categories of Delay Contributors

- **Contractor related delays (COR)**

  This category comprises of twenty four (24) items and after testing, an alpha coefficient of 0.957 was achieved showed excellent reliability (Please see Table 4.3).

- **Consultant related delays (CSR)**

  The second category is composed of thirteen (13) items. The items were tested produces an alpha coefficient of 0.911 showed excellent reliability (Please see Table 4.3).

**Table 4.3: Number of items of contractor related and consultant related delays**

| Category | No of Items | Alpha coefficient value |
|---|---|---|
| COR | 24 | 0.957 |
| CSR | 13 | 0.911 |

### 4.3.2 Contractor's Perception about Categories of Delay Contributors

- **Client related delays (CLR)**

  This category comprises of sixteen (16) items and after testing, an alpha coefficient of 0.797 was achieved showed high reliability (Please see Table 4.4).

- **Consultant related delays (CSR)**

  This category comprises of thirteen (13) items and after testing, an alpha coefficient of 0.891 was achieved showed high reliability (Please see Table 4.4).

**Table 4.4: Number of items of client related and consultant related delays**

| Category | No of Items | Alpha coefficient value |
|---|---|---|
| CLR | **16** | 0.797 |
| CSR | 13 | 0.891 |

### 4.3.3 Consultant's Perception about Categories of Delay Contributors

- **Client related delays (CLR)**

This category comprises of sixteen (16) items and after testing, an alpha coefficient of 0.901 was achieved showed excellent reliability (Please see Table 4.5).

- **Contractor related delays (COR)**

This category comprises of twenty four (24) items and after testing, an alpha coefficient of 0.942 was achieved showed excellent reliability (Please see Table 4.5).

**Table 4.5: Number of items of client related and contractor related delays**

| Category | No of Items | Alpha coefficient value |
|---|---|---|
| CLR | 16 | 0.901 |
| COR | 24 | 0.942 |

## 4.4 DESCRIPTIVE ANALYSIS

### 4.4.1 Sample Characteristics

In this study there is a sample of 95 valid responses out of 120 targeted populations showing a response rate of 79.17% as described in Table 4.6 below:

**Table4.6: Grouping of respondents**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Client | 37 | 36.28 | 36.28 | 36.28 |
| | Contractor | 45 | 44.12 | 44.12 | 80.40 |
| | Consultant | 20 | 19.60 | 19.60 | 100.0 |
| | Total | 102 | 100.0 | 100.0 | |

From figure 4.1it is clear that there are almost 37% clients, 44% contractors and 19.60% consultants who responded to the questionnaire survey. This shows that respondents were evenly chosen and distributed.

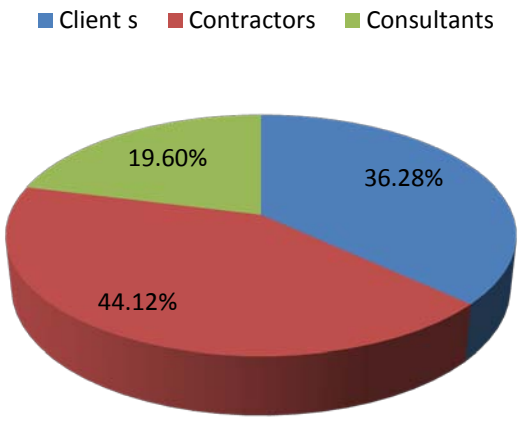


**Figure 4.1: Grouping of respondents**

### 4.4.2 Area wise Response Rate

Table 4.7 shows an area wise distribution of respondents. The respondents are representing all four provinces namely Sind, Punjab, KPK and Baluchistan. Table 4.1 shows that there are about 32.35% representation of respondents from Sindh (Karachi), about 58.82% representation from Punjab and capital city (Lahore, Rawalpindi, Multan, Gujranwala and Islamabad), 1.96% from KPK (Peshawar) and 6.86% from Baluchistan (Quetta).Hence majority of the respondents are from Punjab province.

**Table 4.7: Area wise response rate by the respondents**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Karachi | 33 | 32.35 | 32.35 | 32.35 |
| | Lahore | 37 | 36.27 | 36.27 | 68.62 |
| | Rawalpindi/Islamabad | 21 | 20.59 | 20.59 | 89.21 |
| | Peshawar | 2 | 1.96 | 1.96 | 91.17 |
| | Quetta | 7 | 6.86 | 6.86 | 98.03 |

| | | | | | |
|---|---|---|---|---|---|
| | Multan | 1 | 0.98 | 0.98 | 99.02 |
| | Gujranwala | 1 | 0.98 | 0.98 | 100 |
| | Total | 102 | 100.0 | 100.0 | |

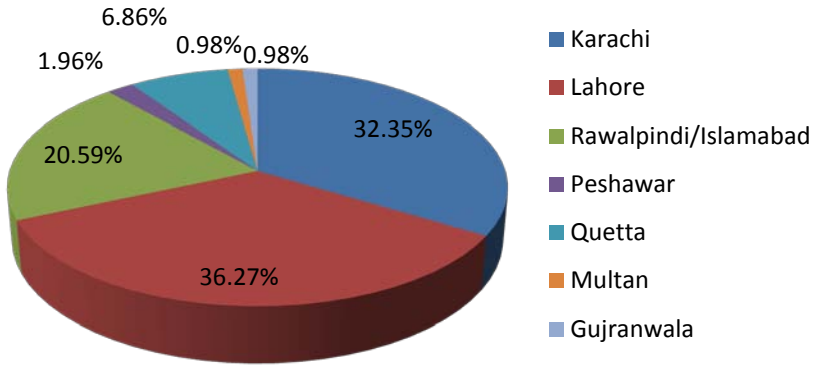


**Figure 4.2: Area wise response rate by respondents**

### 4.4.3 Respondent's Information

- **Respondent's Qualification**

Table 4.8 shows that majority (about 57%) of the respondents are qualified civil engineers having qualification of BSc and MSc degrees in engineering. Some of them are architects (about 6%), some are having masters (about 2%) and bachelor (6.86%) degrees in arts, few of them are having diploma in civil engineering (about 6%) and remaining of them (25%) are FSC/FA and metric qualified. Hence it can be justified in saying that the feedback from the respondents is a reliable one because majority of them are related with the civil engineering related construction projects.

**Table4.8: Qualification of respondents**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | MSc (Engg) | 18 | 17.65 | 17.65 | 17.65 |
| | MA | 2 | 1.96 | 1.96 | 19.61 |
| | BSc (Engg) | 40 | 39.22 | 39.22 | 58.83 |
| | BA | 7 | 6.86 | 6.86 | 65.69 |
| | Architect | 6 | 5.88 | 5.88 | 71.57 |

| | | | | | |
|---|---|---|---|---|---|
| | FSc/FA | 10 | 9.80 | 9.80 | 81.37 |
| | DAE | 6 | 5.88 | 5.88 | 87.25 |
| | Metric | 13 | 12.75 | 12.75 | 100 |
| | Total | 102 | 100.0 | 100.0 | |

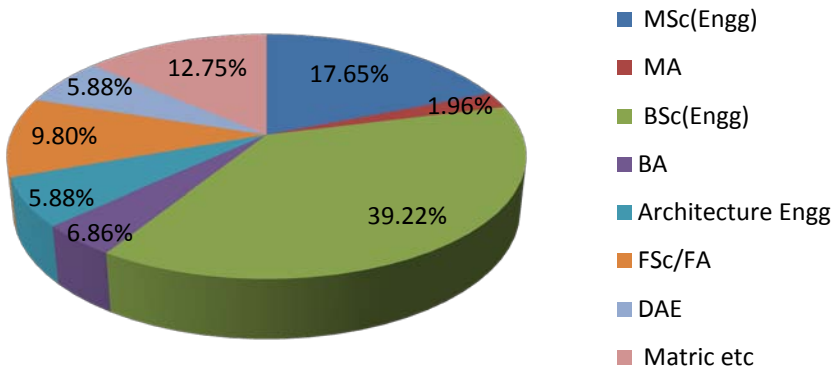


**Figure 4.3: Qualification of respondents**

- **Appointment/Position of Respondent**

From Figure 4.4 it is clear that more than 44 % of respondents were Directors/Dy Director, Asst Directors and MD and about 18 % of them were CEO/CE of their respective firms. Also more than 16% of them were having appointments like GM /PM and 15% of them were engineers like Project engineers/senior engineers/Resident engineers. Lastly only 8% of them were site engineers.

**Table4.9: Appointments of respondents**

| | **Appointment** | **Frequency** | **Percent** | **Valid Percent** | **Cumulative Percent** |
|---|---|---|---|---|---|
| Valid | Director/Asst and Dy Director/MD | 45 | 44.11 | 44.11 | 44.11 |
| | CEO/CE | 18 | 17.65 | 17.65 | 61.76 |
| | GM | 5 | 4.90 | 4.90 | 66.66 |
| | PM | 11 | 10.78 | 10.78 | 77.44 |
| | PE/SE/RE | 10 | 9.80 | 9.80 | 87.24 |
| | Architect/Structural engrs | 5 | 4.90 | 4.90 | 92.14 |
| | Site Engr | 8 | 7.84 | 7.84 | 100 |
| | Total | 102 | 100 | 100 | |

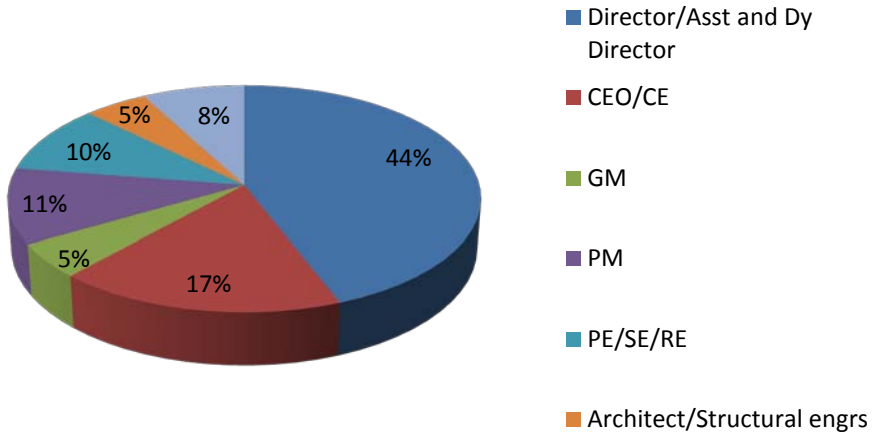


**Figure 4.4: Appointment/position of respondents in organization**

- **Respondent's Average Experience**

From Figure 4.5, it is evident that a considerable majority (59%) of the respondents are having an average working experience of more than 10 years, about 31% of them having 5 to 10 years and only 12% of them having less than 5 years of average working experience in construction industry and housing projects. This shows that data collected from the respondents are largely valid.

**Table 4.10: Average experience of respondents**

| | Experience(Years) | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | <5 | 12 | 11.76 | 11.76 | 11.76 |
| | 5-10 | 31 | 30.40 | 30.40 | 42.16 |
| | 11-15 | 29 | 28.43 | 28.43 | 70.59 |
| | >15 | 30 | 29.41 | 29.41 | 100 |
| | Total | 102 | 100.0 | 100.0 | |

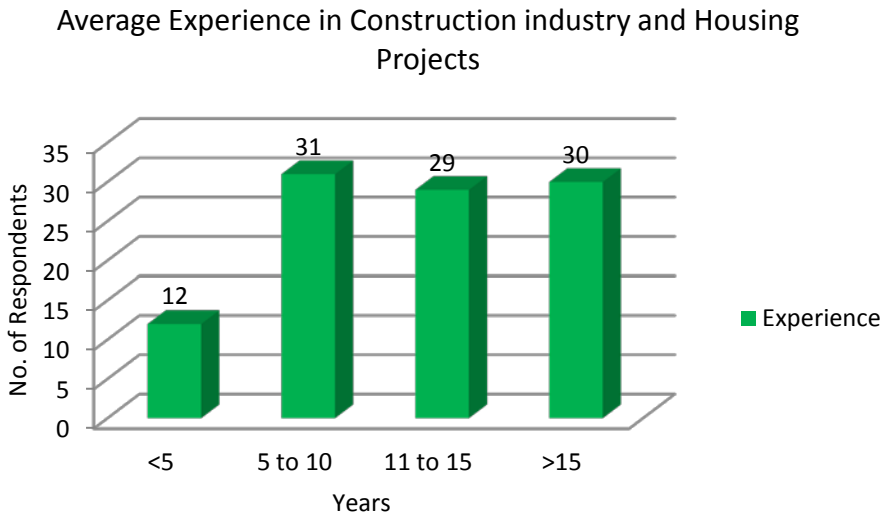


**Figure 4.5: Respondent's average experience in construction industry and housing projects**

### 4.4.4 Information about Housing Schemes Surveyed

- **Percentage of Delay from Planned Project Duration**

About 76% of respondents indicated that housing projects got late from estimated project duration. Figure 4.6 depicts the trend of average ranges of time overruns observed in major housing schemes of Pakistan. It can be observed that majority of housing schemes are in the lower range of time overrun between 6-10%. Figure 4.6 also depicts that 14% of housing schemes are in the range of more than 20% time overrun. Figure 4.6 also depicts that Bahria housing schemes are facing more time overrun than Askari and DHA, which means that majority of Bahria housing schemes are facing time overrun between 16-20% from estimated original duration. Figure 4.6 also shows that majority of Askari and DHA housing schemes are facing time overrun between 6-10% from original duration.

**Table 4.11 Average range of time overrun in major housing Schemes**

| Average Range Of Time Overrun | | | | |
|---|---|---|---|---|
| **Time overrun** | **Overall (%)** | **Askari (%)** | **DHA (%)** | **Bahria (%)** |
| 0-5% | 24 | 27.8 | 16.7 | 0 |
| 6-10% | 29 | 38.9 | 33.33 | 25 |
| 11-15% | 19 | 11 | 16.7 | 12 |

| | | | | |
|---|---|---|---|---|
| 16-20% | 13.9 | 8.33 | 16.7 | 38 |
| >20% | 14 | 13.9 | 16.7 | 25 |

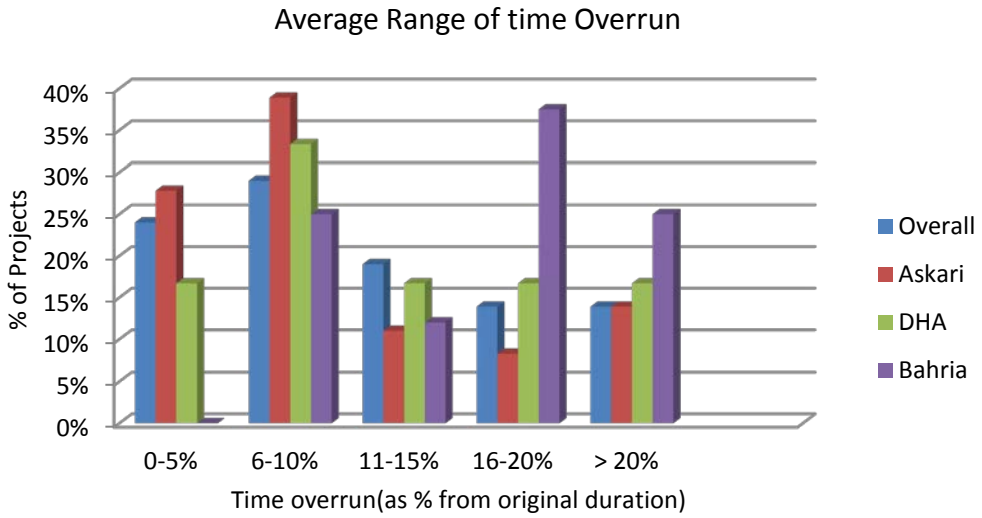


**Figure 4.6: Average range of time overrun in major housing schemes of Pakistan**

- **Percentage of Cost Overrun from Planned Project Cost**

About 93% of respondents have revealed that housing projects faced cost overrun from estimated project cost. Figure 4.7 depicts the trend of average ranges of cost overruns observed in major housing schemes of Pakistan. It can be observed that majority of projects in all types of projects still bundles in the middle range of 11-15% of cost overruns. Another fact that is represented by the Figure 4.7 is that for more than 9% of Askari and Bahria housing projects, the range of cost overrun is between more than 20%. Also in Bahria housing schemes there is a cost overrun of 58 %( the highest among three schemes).Figure 4.7 also depicts that majority of these projects have faced cost overrun from estimated project cost.

**Table 4.12: Average range of cost overrun in major housing schemes**

| Average Range Of Cost Overrun | | | | |
|---|---|---|---|---|
| **Cost overrun** | **Overall (%)** | **Askari (%)** | **DHA (%)** | **Bahria (%)** |
| 0-5% | 31 | 42 | 28.6 | 0 |
| 6-10% | 18.6 | 13.2 | 42.9 | 0 |
| 11-15% | 24.5 | 29 | 28.6 | 58 |
| 16-20% | 10.8 | 5.3 | 0 | 33 |
| >20% | 9 | 10.6 | 0 | 9 |

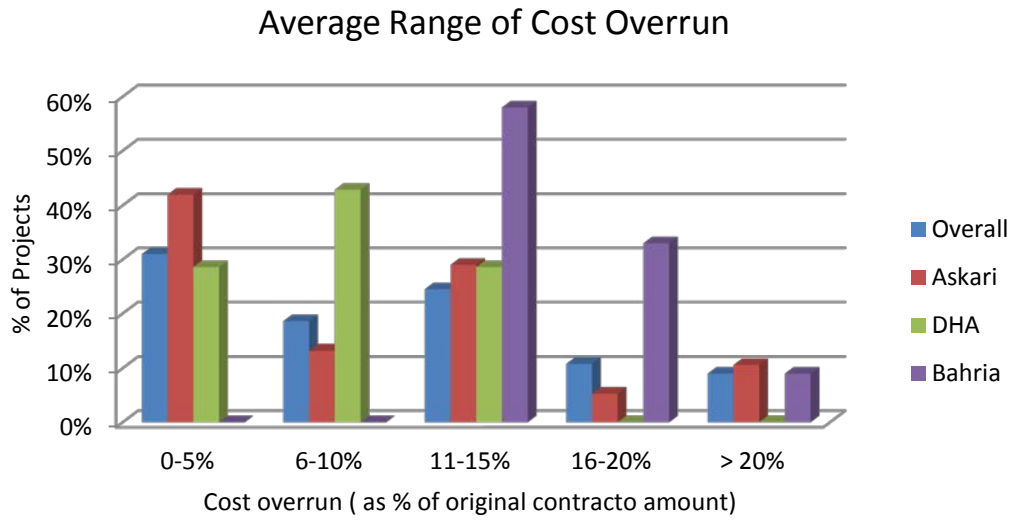


**Figure 4.7: Average range of cost overrun in major housing schemes**

- **Status of Housing Projects**

The analysis of the collected data is based on 55% completed housing projects, 25% partially completed and 20% in progress projects. This indicates that data represents all categories of housing projects from completed up to in progress projects.

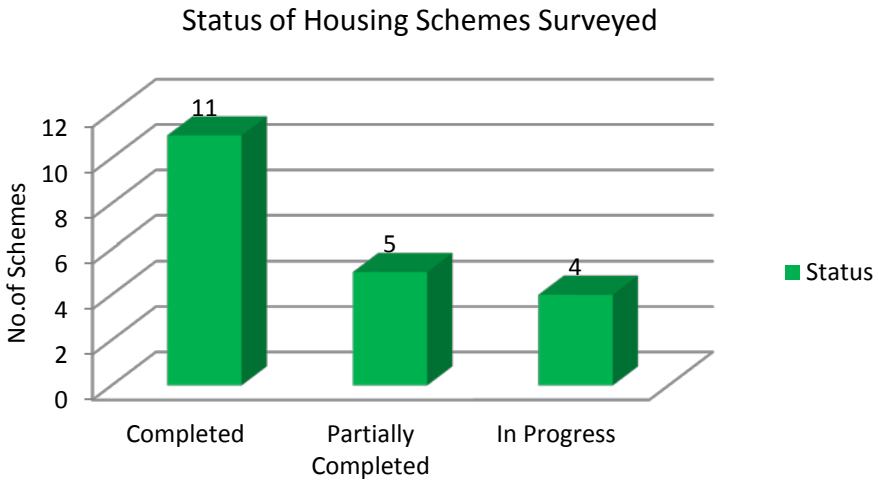


**Figure 4.8: Status of housing projects surveyed for this research work**

- **Number of Housing Schemes Surveyed**

The data for analysis were collected from housing projects of public as well as private sectors. The public sector projects includes mainly Askari housing schemes (50%), DHA (15%), PM housing schemes (5%) , PHA flats (5%) , Naval housing scheme (5%) and private sector housing projects includes Bahria Town(15%) and Sukk Chayn housing scheme(5%). Hence these data are collected mainly from public sector housing projects (80%).

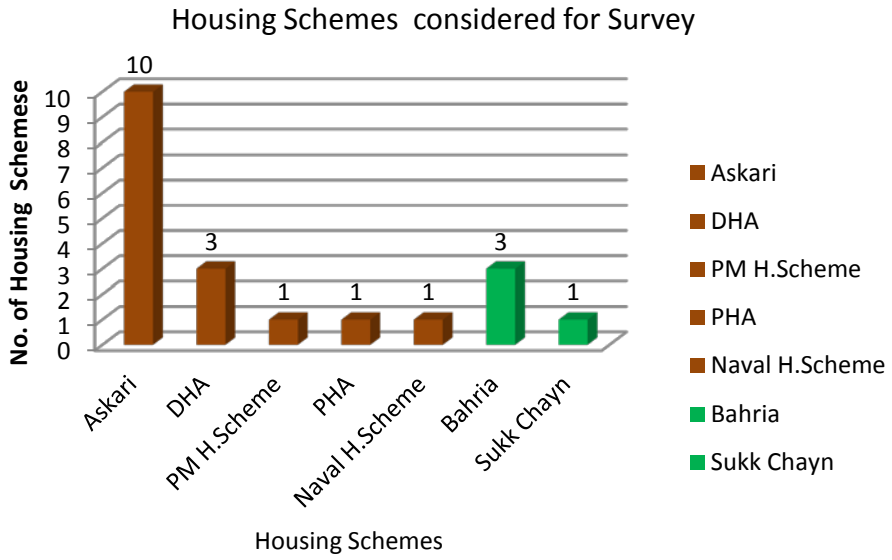


**Figure 4.9: Number of housing projects surveyed for this research work**

### 4.4.5 Mean Score and Ranking of Delay Contributors

#### 4.4.5.1 For Client Related Delays

- **Contractor's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.13. The contractor's perception about client related delays vary from 2.48 (CLR14: Unrealistic contract duration imposed by client) to 1.55 (CLR15: Poor management of contract issues by the client).

- **Consultant's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.13. The consultant's perception about client related delays vary from 3.3 (CLR4: Delay in progress payments to the contractor) to 2.07 (CLR9: Approval of low bid contractor by the client on the recommendation of consultant).

- **Overall Perception of Consultant and Contractor**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.13. The consultant and contractor's perception about client related delays vary from 2.79 (CLR2: Slow decision making by the client project matters) to1.98 (CLR11: Delay to furnish and deliver the site to the contractor). From the analysis of the results, it is found that CLR2: Slow decision making by the client project matters, CLR7: Undue interference by client and his representatives and CLR4: Delay in progress payments to the contractor are ranked high by both the contractors and consultants. Although the contractors and consultants agreed on most of the factors, there was some disagreement. CLR5: Lengthy and cumbersome payment process was ranked higher (Rank 2) by the consultants, where as contractors ranked much lower (Rank 8).Similarly CLR14: Unrealistic contract duration imposed by client was ranked higher by the contractor (Rank1) but the consultants ranked this factor much lower (Rank7).

**Table 4.13: Overall mean scores and ranking for client related delays**

| Code | Consultant's View | | Contractor's View | | Overall | |
|---|---|---|---|---|---|---|
| CLR | Mean | Rank | Mean | Rank | Mean | Rank |
| CLR1 | 2.96 | 5 | 1.98 | 9 | 2.48 | 9 |
| CLR2 | 3.13 | 3 | 2.45 | 2 | 2.79 | 1 |
| CLR3 | 2.98 | 4 | 2.18 | 5 | 2.58 | 6 |
| CLR4 | 3.30 | 1 | 2.18 | 5 | 2.74 | 2 |
| CLR5 | 3.20 | 2 | 2 | 8 | 2.61 | 5 |
| CLR6 | 2.60 | 8 | 2.36 | 3 | 2.48 | 9 |
| CLR7 | 2.95 | 6 | 2.45 | 2 | 2.70 | 3 |
| CLR8 | 2.96 | 5 | 2.06 | 7 | 2.51 | 8 |
| CLR9 | 2.07 | 14 | 2.25 | 4 | 2.16 | 12 |
| CLR10 | 2.95 | 6 | 2.15 | 6 | 2.55 | 7 |
| CLR11 | 2.10 | 13 | 1.86 | 10 | 1.98 | 16 |
| CLR12 | 2.34 | 11 | 1.78 | 12 | 2.06 | 14 |
| CLR13 | 2.18 | 12 | 1.98 | 9 | 2.08 | 13 |
| CLR14 | 2.90 | 7 | 2.48 | 1 | 2.69 | 4 |
| CLR15 | 2.45 | 10 | 1.55 | 13 | 2.00 | 15 |
| CLR16 | 2.55 | 9 | 1.81 | 11 | 2.18 | 11 |

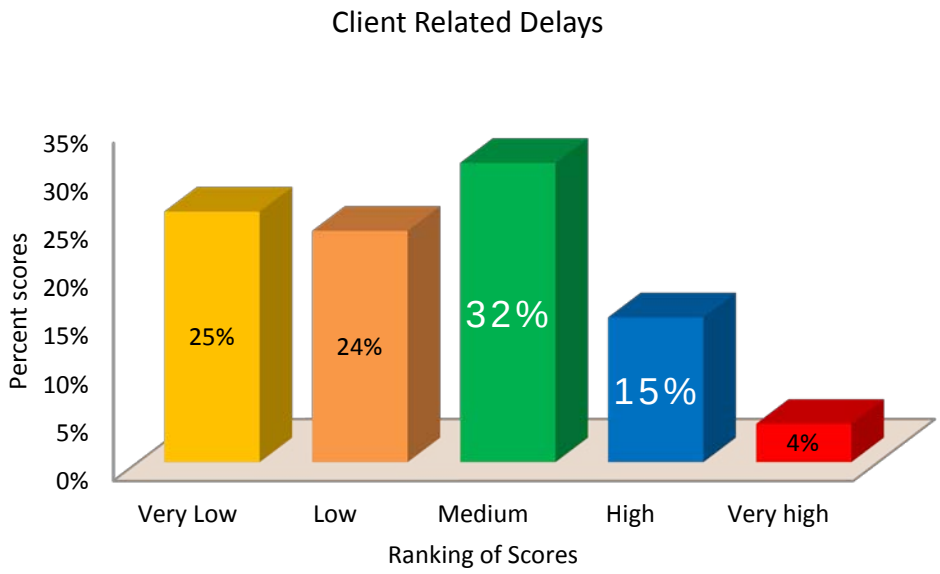


**Figure 4.10: Distribution of respondent's perception about client related delays**

Similarly Figure 4.10 shows that overall respondent's perception ranges from medium to very high with 51% to 49% of very low to low**.** This result depicts that generally client related delays are the issues for the successful completion of projects in major housing schemes. There is a need for considerable thoughts to address this issue and concerted efforts to be made to minimize this issue at an earliest before the start of any project.

### 4.4.5.2 For Contractor Related Delays

- **Client's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.14. The client' perception about contractor related delays vary from 3.21(COR22: Poor safety/risk management by the contractor) to 2.17(COR24: Late submittals of progress payments/bills by the contractor).

- **Consultant's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.14. The consultant's perception about contractor related delays vary from 3.57 (COR22: Poor safety/risk management by the contractor) to 2.75 (COR24: Late submittals of progress payments/bills by the contractor).

- **Overall Perception of Client and Consultant**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.14. The client and consultant's perception about contractor related delays vary from 3.39 (COR22: Poor safety/risk management by the contractor) to2.46 (COR24: Late submittals of progress payments/bills by the contractor). From the analysis of the results, it is found that COR22: Poor safety/risk management by the contractor, COR23: Poor contingency planning specially in case of law & order and security situation/electric load shading etc, COR19: Escalation of material prices due to poor material planning by the contractor, COR6: Hiring of unreliable and incompetent subcontractor and COR15: Shortage of qualified staff are ranked high by both the contractors and consultants. There was perfect agreement between clients and consultants about some factors like COR6: Hiring of unreliable and incompetent subcontractor, COR15: Shortage of qualified staff and COR22: Poor safety/risk management by the contractor, which were ranked similarly by both of them. Although the clients and consultants agreed on most of the factors, there was some disagreement. COR3: Inaccurate time and cost estimates by the contractor ( Rank2 ) by the clients ,where as consultants ranked much lower (Rank19 ).Similarly COR5: Poor project planning and scheduling by the contractor and COR9: Poor financial capability of contractor were ranked much higher by the clients(Rank6 and 3 respectively), where as consultants ranked these factors much lower(Rank17 and 16 respectively). Similarly COR14: Getting the contract by unfair means, COR18: Late procurement of materials/equipment by the contractor , and COR21: Inadequate fund allocation/late payments to sub-contractors/suppliers/labors due to poor financial planning were ranked higher by the consultants (Rank8 ,2 and 3 respectively) but clients ranked these much lower

(Rank21,18 and 16 respectively).

**Table 4.14: Overall mean scores and ranking for contractor related delays**

| Code | Client's View | | Consultant's View | | Overall | |
|---|---|---|---|---|---|---|
| COR | Mean | Rank | Mean | Rank | Mean | Rank |
| COR1 | 2.34 | 20 | 3.21 | 11 | 2.78 | 21 |
| COR2 | 2.55 | 15 | 3.13 | 14 | 2.84 | 20 |
| COR3 | 3.00 | 2 | 2.90 | 19 | 2.95 | 14 |
| COR4 | 2.91 | 5 | 3.15 | 13 | 3.03 | 6 |
| COR5 | 2.88 | 6 | 3.06 | 17 | 2.97 | 12 |
| COR6 | 2.84 | 7 | 3.32 | 7 | 3.08 | 4 |
| COR7 | 2.38 | 19 | 2.92 | 18 | 2.65 | 23 |
| COR8 | 2.68 | 12 | 3.35 | 6 | 3.015 | 9 |
| COR9 | 2.97 | 3 | 3.07 | 16 | 3.02 | 8 |
| COR10 | 2.70 | 11 | 3.24 | 9 | 2.97 | 12 |
| COR11 | 2.80 | 9 | 3.10 | 15 | 2.95 | 16 |
| COR12 | 2.50 | 17 | 3.20 | 12 | 2.85 | 19 |
| COR13 | 2.68 | 12 | 3.22 | 10 | 2.95 | 14 |
| COR14 | 2.29 | 21 | 3.25 | 8 | 2.77 | 22 |
| COR15 | 2.83 | 8 | 3.25 | 8 | 3.04 | 5 |
| COR16 | 2.67 | 13 | 3.39 | 5 | 3.03 | 6 |
| COR17 | 2.60 | 14 | 3.12 | 14 | 2.86 | 18 |
| COR18 | 2.47 | 18 | 3.55 | 2 | 3.01 | 10 |
| COR19 | 2.77 | 10 | 3.46 | 4 | 3.13 | 3 |
| COR20 | 2.52 | 16 | 3.24 | 9 | 2.88 | 17 |
| COR21 | 2.52 | 16 | 3.50 | 3 | 3.01 | 11 |
| COR22 | 3.21 | 1 | 3.57 | 1 | 3.39 | 1 |
| COR23 | 2.95 | 4 | 3.55 | 2 | 3.25 | 2 |
| COR24 | 2.17 | 22 | 2.75 | 20 | 2.46 | 24 |

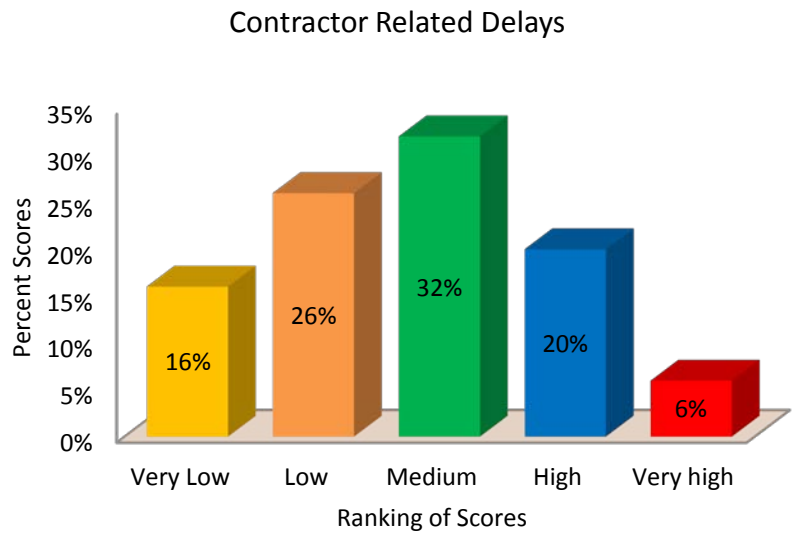


**Figure 4.11: Distribution of respondent's perception about contractor related delays**

Similarly Figure 4.11 shows that overall respondent's perception ranges from medium to very high with 58% to 42% of very low to low**.** This result depicts that generally contractor related delays are the core issues for the successful completion of projects in major housing schemes. There is a need for serious considerable thoughts to address this issue and concerted efforts to be made to minimize this issue at an earliest before the start of any project.

**4.4.5.3 For Consultant Related Delays**

- **Client's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.15. The client' perception about consultant related delays vary from 2.53 (CSR12: Delay in verification and submission of contractor's interim payment certificates by the consultant) to 1.56 (CSR11: Monetary gains and kick backs in revised work).

- **Contractor's Perception**

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.15. The contractor's perception about consultant related delays vary from 2.9 (CSR9: Delay in approving shop

drawings and sample materials by the consultant) to 1.48 (CSR11: Monetary gains and kick backs in revised work).

- **Overall Perception of Client and Con**tractor

In this sub section, the ranking of the factors based on mean scores after conducting on SPSS is illustrated in the Table 4.15. The client and contractor's perception about consultant related delays vary from 2.71 (CSR9: Delay in approving shop drawings and sample materials by the consultant) to 1.52 (CSR11: Monetary gains and kick backs in revised work). From the analysis of the results, it is found that CSR1: Delay in approving major changes in the scope of work by the consultant, CSR9: Delay in approving shop drawings and sample materials by the consultant and CSR8: Inaccurate site investigation by the consultant, were ranked high by both the clients and contractors. Although the clients and contractors agreed on most of the factors, there was some disagreement. CSR5: Non utilization of advanced engineering design software by the consultant was ranked higher (Rank3) by the clients, where as contractors ranked much lower (Rank 10).Similarly CSR2: Poor communication and coordination with the contractor and client, was ranked higher by the contractors (Rank4) but the clients ranked this factor much lower (Rank9).

**Table 4.15: Overall mean scores and ranking for consultant related delays**

| Code | Client's View | | Contractor's View | | Overall | |
|---|---|---|---|---|---|---|
| CSR | Mean | Rank | Mean | Rank | Mean | Rank |
| CSR1 | 2.38 | 4 | 2.59 | 2 | 2.47 | 2 |
| CSR2 | 2.15 | 9 | 2.25 | 4 | 2.20 | 6 |
| CSR3 | 1.85 | 12 | 1.75 | 11 | 1.80 | 12 |
| CSR4 | 2.35 | 5 | 2.18 | 6 | 2.28 | 5 |
| CSR5 | 2.40 | 3 | 1.76 | 10 | 2.08 | 9 |
| CSR6 | 1.94 | 11 | 1.75 | 11 | 1.85 | 11 |
| CSR7 | 2.10 | 10 | 1.86 | 9 | 1.98 | 10 |
| CSR8 | 2.23 | 7 | 2.55 | 3 | 2.39 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CSR9 | 2.50 | 2 | 2.90 | 1 | 2.71 | 1 |
| CSR10 | 2.20 | 8 | 2.05 | 7 | 2.13 | 7 |
| CSR11 | 1.56 | 13 | 1.48 | 13 | 1.52 | 13 |
| CSR12 | 2.53 | 1 | 2.19 | 5 | 2.36 | 4 |
| CSR13 | 2.32 | 6 | 1.92 | 8 | 2.12 | 8 |

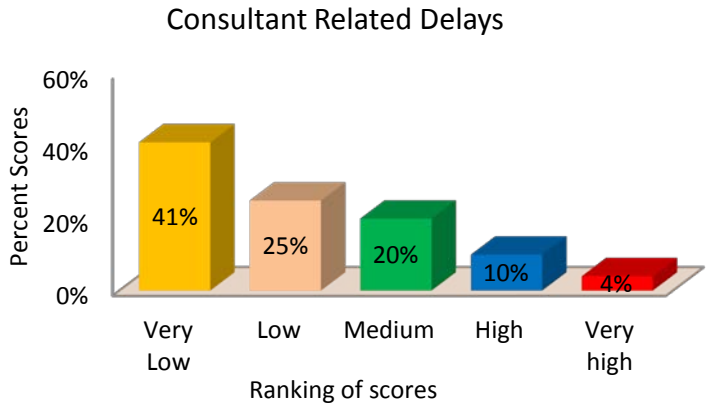


**Figure 4.12: Distribution of respondent's perception about consultant related delays**

Similarly Figure 4.12 shows that overall respondent's perception ranges from medium to very high with 34% to 66% of very low to low**.** This result depicts that generally consultant related delays are the not a serious issue for the successful completion of projects in major housing schemes. This factor needs considerable thoughts to address this issue to minimize this issue at an earliest before the start of any project.

### 4.4.6 Main Group Mean and Ranking as per Combined Views of Respondents

In this sub section Table 4.16 shows the overall mean and ranking of main group of delay contributors in which it is evident that contractor related delays are on the top in the ranking, followed by client related delays and lastly consultant related delays. Hence it can be inferred that the main delay contributors are the contractor generated which implies that they can be held responsible for the delays of projects and need special attention.

**Table 4.16: Overall mean scores and ranking for main groups of construction delays**

| Group | Overall | |
|---|---|---|
| | **Mean** | **Rank** |
| Contractor Related Delays | 2.95 | 1 |
| Client Related Delays | 2.41 | 2 |
| Consultant Related Delays | 2.15 | 3 |

## 4.5 TESTS OF NORMALITY

Chan (2003), concluded that there are three ways available to check the normality of the quantitative data .These are:(1) Graphs/Histograms and Q-Q Plots,(2) Descriptive Statistics using skewness & kurtosis and (3) Formal Statistical tests like Kolmogorov-Smirnov one sample test & Shapiro-Wilk test. In this research, formal statistical tests approach was adopted to check the normality, as adopted by Jehanzeb (2011) and Ansari (2011).These formal statistical tests are very sensitive to the sample size of the variable concerned. The result is then presented in "*Kolomogorov-Smirnov*" and "*Shapiro-Wilk*" Tests. Since N<2000, results of shapiro-wilk test was considered (Park, 2008).For this research our sample size was 95 which was less than 2000, hence we used Shapiro-wilk test of normality.

For conducting such tests, a hypothesis or assumption about the population is considered for the data to be normally distributed known as null hypothesis (H0).For instance if H0 is rejected then another hypothesis known as alternative hypothesis (H1) would be required to be accepted. For this research following hypothesis or assumptions are made for the test of normality:

H0: The sample or Data is normally distributed (Claim)

H1: The sample or Data is not normally distributed

In order to check whether sample or data is normally distributed or not, there are certain conditions which have to be fulfilled: (1) For the data to be normally distributed, the values of skewness and kurtosis should be equal or approximate to zero, (2) For the data to be normally distributed, the significance value must be greater than 0.05 (sig.>0.05). If the significance value of formal Statistical tests is greater than 0.05 (level of significance),then null hypothesis(H0) would not be

rejected and if the significance value is less than 0.05 (level of significance),then null hypothesis (H0) would have to be rejected and an alternate hypothesis( H1) have to be accepted.

### 4.5.1 Client Related delays

The outcome of normality test for client related delays as per contractor and consultant's perception is shown in Table 4.17 below. Significance value "Shapiro-wilk" is less than 0.05 (level of significance), we have to reject our null hypothesis (H0) and accept the alternate hypothesis (H1). Therefore the data is not normally distributed

**4.17: Test of normality for client related delays (as per contractor and consultant's perspective)**

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| CLR | .090 | 65 | .008 | .939 | 65 | .005 |

a. Lilliefors Significance Correction

### 4.5.2 Contractor Related delays

The outcome of normality test for contractor related delays as per client and consultant's perception is shown in Table 4.18 below. Significance value "Shapiro-wilk" is less than 0.05 (level of significance), we have to reject our null hypothesis (H0) and accept the alternate hypothesis (H1). Therefore the data is not normally distributed

**4.18: Test of normality for contractor related delays (as per client and consultant's perspective)**

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| COR | .075 | 57 | .042 | .955 | 57 | .038 |

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

### 4.5.3 Consultant Related delays

The outcome of normality test for consultant related delays as per client and contractor's perception is shown in Table 4.19 below. Significance value "Shapiro-wilk" is less than 0.05 (level of significance), we have to reject our null hypothesis (H0) and accept the alternate hypothesis (H1). Therefore the data is not normally distributed.

**4.19 : Test of normality for consultant related delays (as per client and contractor' perspective)**

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| CSR | .159 | 82 | .000 | .918 | 82 | .000 |

a. Lilliefors Significance Correction

## 4.6 CORRELATION TEST

A correlation is performed to test the degree to which the scores on the two variables co-relate. That is, the extent to which the variation in the scores on one variable results in a corresponding variation in the scores on the second variable. There are times when we wish to correlate data when it is ordinal (one or both variables are not measured on an interval scale), when data is not normally distributed, or when other assumptions of the Pearson correlation are violated. On these occasions we use the Spearman correlation coefficient, which is the nonparametric equivalent of the Pearson correlation (Perry Hinton, 2005). Furthermore a correlation describes the relationship between the variables depicting the type of relationship including the strength as well as direction of the relationship (Pallant, 2007). For this research, SPSS 18.0 was used to check and analyze the correlation coefficients between the pairs of variables listed, along with the level of significance. Spearman's Rho Test (commonly known as Spearman rank correlation coefficient) is used to check the strength of relationship between two sets of ranking .This test is used for the said purpose being the non-parametric statistics. Further it is to be noted is the strength of the relationship by considering the size of the correlation coefficient. It is ranged from -1.00 to 1.00. The value of -1.00 or 1.00

indicates the perfect negative and positive relationships respectively between the variable, whereas 0.00 dictates the absence of any relationship (no relationship) between the variables. Here in the spearman's correlation results we have correlation coefficient or value of rho mostly very high showing very strong relationship between the variables. The results of the Spearman's Rho Correlation Test are shown in Tables below:

### 4.6.1 Client Related Delays

From the test result in Table 4.20, it is evident that the **Spearman's rho** correlation test statistic 0.254. The positive sign indicates a positive correlation between contractors and consultants ranking about client related delays. It means that there is more than 25% agreement between these two respondent's perceptions. The actual *p* value is shown to be 0.343 with two tails. The reason for selecting two tailed significance value is that our prediction does not state whether we expect a positive or negative correlation, therefore we have a two-tailed prediction. If we predicted that our correlation would be either positive or negative then we would have a one-tailed prediction.

These figures are duplicated in the matrix. By observing the Spearman correlation output matrix it can be seen that contractor' view (COV) is perfectly correlated with contractor' view (COV), hence the Spearman's rho correlation coefficient is 1.000. Similarly, consultant' view (CSV) is perfectly correlated with consultant' view (CSV), with a Spearman's rho correlation coefficient of 1.000. A conventional way of reporting these figures is as follows:

$$rs = 0.254,\ N = 16,\ p > 0.05$$

**Table: 4.20 Spearman test on client related delays as per contractor (COV) and consultant's (CSV) view**

**Correlations**

| | | | COV | CSV |
|---|---|---|---|---|
| Spearman's rho | COV | Correlation Coefficient | 1.000 | .254 |
| | | Sig. (2-tailed) | . | .343 |
| | | N | 16 | 16 |
| | CSV | Correlation Coefficient | .254 | 1.000 |
| | | Sig. (2-tailed) | .343 | . |
| | | N | 16 | 16 |

### 4.6.2 Contractor Related Delays

From the test result in Table 4.21, it is evident that the **Spearman's rho** correlation test statistic 0.353 positive sign indicates a positive correlation between clients and consultants ranking about contractor related delays. It means that there is more than 35% agreement between these two respondent's perceptions. The actual *p* value is shown to be 0.091 with two tails. These figures are duplicated in the matrix. By observing the Spearman correlation output matrix it can be seen that client's view (CLV) is perfectly correlated with client's view (CLV), hence the Spearman's rho correlation coefficient is 1.000. Similarly, consultant' view (CSV) is perfectly correlated with consultant' view (CSV), with a Spearman's rho correlation coefficient of 1.000. A conventional way of reporting these figures is as follows:

$$rs=0.353,\ N = 24,\ p > 0.05$$

**Table: 4.21 Spearman test on contractor related delays as per client (CLV) and consultant's (CSV) view**

**Correlations**

| | | | CLV | CSV |
|---|---|---|---|---|
| Spearman's rho | CLV | Correlation Coefficient | 1.000 | .353 |
| | | Sig. (2-tailed) | . | .091 |
| | | N | 24 | 24 |
| | CSV | Correlation Coefficient | .353 | 1.000 |
| | | Sig. (2-tailed) | .091 | . |
| | | N | 24 | 24 |

### 4.6.3 Consultant Related Delays

From the test result in Table 4.22, it is evident that the **Spearman's rho** correlation test statistic is 0.708. The positive sign indicates a positive correlation between clients and contractors ranking about consultant related delays. It means that there is more than 70% agreement between these two respondent's perceptions. The actual *p* value is shown to be 0.007 with two tails. These figures are duplicated in the matrix. By observing the Spearman correlation output matrix it can be seen that client's view (CLV) is perfectly correlated with client's view (CLV), hence the Spearman's rho correlation coefficient is 1.000. Similarly, contractor' view (COV) is

perfectly correlated with contractor' view (COV), with a Spearman's rho correlation coefficient of 1.000. A conventional way of reporting these figures is as follows:

$$rs=0.708,\ N = 13,\ p < 0.01$$

**Table: 4.22 Spearman test on consultant related delays as per client (CLV) and contractor's (COV) view**

**Correlations**

| | | | CLV | COV |
|---|---|---|---|---|
| Spearman's rho | CLV | Correlation Coefficient | 1.000 | .708** |
| | | Sig. (2-tailed) | . | .007 |
| | | N | 13 | 13 |
| | COV | Correlation Coefficient | .708** | 1.000 |
| | | Sig. (2-tailed) | .007 | . |
| | | N | 13 | 13 |

**. Correlation is significant at the 0.01 level (2-tailed).

## 4.7 KRUSKAL-WALLIS TEST

In order to undertake a nonparametric analysis having a single independent measures factor (independent variable) with more than two samples we choose the Kruskal– Wallis test. The key feature of many nonparametric tests is that the data is treated as ordinal and the first part of the analysis involves ranking the data. The Kruskal–Wallis test is no different. All the scores (from all the conditions) are ranked from lowest to highest. After that an analysis similar to the ANOVA is undertaken on the ranks. The statistic *H* (rather than *F* in the ANOVA) gives a measure of the relative strength of the variability in the ranks between the conditions compared to a standard value for this number of participants, but in the test statistics result the Kruskal-Wallis chi square does the similar function. This is because the distribution of *H* closely approximates that of the chi-square. (Perry Hinton, 2005).

The Kruskal-Wallis test is used for a non parametric data to determine whether two or more independent groups (client, consultant and contractor) are the identical or diverse on some variable of interest when an ordinal level of data or an interval or ratio level of data is available. It is more appropriate for finding statistical evidence of *inconsistency* or difference across the means of the various groups. If Asymptotic significance( which gives the probability value at 95% confidence interval) is less than 0.05 then it shows that there is significant difference between the rating or

perception of respondents, and if this value is greater than 0.05 then it means that there is no significant difference between the ratings or perception of respondents. For this research this test is conducted for comparing the mean scorings of all respondents regarding the delay contributors in housing schemes of Pakistan.

### 4.7.1 Overall Comparison of Respondent's View

In this sub section Table 4.23 shows less significant value of client related delays (.009< .05) at 95% confidence interval, which depicts that there is a significant difference between the rating or perception of consultant and contractors regarding client related delay contributors in housing schemes of Pakistan. Table 4.23 also shows that significance values of contractor related delays (as per client and consultant's view) and consultant related delays (as per client and contractor's view) are greater than 0.05 that is 0.076> 0.05 and 0.722>0.05 respectively, which means that there is no significant difference between the ratings or perception of respondents about these two categories of delays in housing schemes of Pakistan.

**Table 4.23 Krukal-Wallis test for delay contributors as per combined views of clients, contractors and consultants**

| S.No | Test Statistics[a,b] | Combined view of Respondents About |
|---|---|---|
| 1 | | **Client Related Delays** |
| | Chi-Square | 6.873 |
| | df | 1 |
| | Asymptotic Significance | .009 |
| 2 | | **Contractor Related Delays** |
| | Chi-Square | 3.156 |
| | df | 1 |
| | Asymptotic Significance | .076 |
| 3 | | **Consultant Related Delays** |
| | Chi-Square | .127 |
| | df | 1 |
| | Asymptotic Significance | .722 |

a. Kruskal-Wallis Test

b. Grouping Variable: RESPONDENTS

### 4.7.2 Scheme wise comparison of respondent's view

Table 4.24 shows that significance value of delay contributors from the combined perspective of respondents from all housing schemes specially Askari, DHA and Bahria, is less than 0.05 (that is 0.000<0.05), thus clearly depicting that overall there is there is a significant difference between the perception of respondents.

**Table 4.24 Krukal-Wallis test for delay contributors as per combined views of respondents from all schemes**

**Test Statistics[a,b]**

| Overall Combined View of Respondents From All Housing schemes | Delay Factors |
|---|---|
| Chi-Square | 56.834 |
| df | 6 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

In Table 4.25, the significance values of delay contributors and its effects from respondents of Askari housing schemes and DHA; Askari housing schemes and Bahria; DHA and Bahria; respectively are 0.014, 0.000 and 0.000 respectively, which are less than 0.05 thus depicting that there is a significant difference in the perception of respondents from these categories of housing schemes regarding the delay contributors in Pakistan.

**Table 4.25 Krukal-Wallis test for delay contributors as per combined views of respondents (from each scheme separately)**

| S.No | Test Statistics[a,b] | Combined view of Respondents About |
|---|---|---|
| 1 | **Delays Contributors (Askari and DHA)** | |
| | Chi-Square | 5.995 |
| | df | 1 |
| | Asymptotic Significance | .014 |
| 2 | **Delays Contributors (Askari and Bahria)** | |
| | Chi-Square | 18.992 |
| | df | 1 |
| | Asymptotic Significance | .000 |
| | **Delays Contributors (DHA and Bahria)** | |

| | | |
|---|---|---|
| 3 | Chi-Square | 14.034 |
| | df | 1 |
| | Asymptotic Significance | .000 |

### 4.7.3 Category wise comparison of respondent's view

In this sub section, Table 4.26 shows that the significance value is less than 0.05 (that is 0.000<0.05), thus depicts that there is a significant difference in the perception of respondents from these public and private sectors regarding the delay contributors and its effects in housing schemes of Pakistan.

**Table 4.26 Krukal-Wallis test for delay contributors as per combined views of respondents (from public and private scheme separately)**

**Test Statistics[a,b]**

| Overall Combined View of Respondents From Public and Private schemes | Delay Factors |
|---|---|
| Chi-Square | 17.789 |
| df | 1 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

## 4.8 COMPARATIVE ANALYSIS OF DELAY CONTRIBUTORS

- **Client Related Delays**
  - **Public and Private Housing Schemes**

From Table 4.27, it is indicated that top most significant (rank wise) client related delays in public housing schemes are CLR2: Slow decision making by the client project matters, CLR7: Undue interference by owner and his representatives, CLR16: Frequent transfer of well settled project team member, CLR14: Unrealistic contract duration imposed by the client, CLR1: Frequent Change orders and delay in their issuance. Similarly in private housing schemes the top most significant (rank wise) client related delays are CLR4: Delay in progress payments to the contractor,CLR3: Client's financial instability,CLR5: Lengthy and cumbersome payment process,CLR14: Unrealistic contract duration imposed by the client and CLR7: Undue interference by owner and his representatives .After

analyzing these, it can be inferred that the most common and frequent delay factors in both public and private housing schemes are CLR7: Undue interference by owner and his representatives and CLR14:Unrealistic contract duration imposed by the client.

From the Figure 4.13, it is also concluded that in public housing schemes, the range of delay criticality for majority of delay factors is between low to medium (CLR2 with maximum mean of 2.57) and it can be inferred that delay is not in the alarming state i.e. these delay factors are considered as minor and moderate delays. On the contrary, in private housing schemes, figure 4.13 clearly shows that about 50% of delay factors are in the range of medium to high delay categories with CLR4 having a maximum mean of 3.65.This clearly shows that there is a serious problem of delay in private housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.14 show a comparative profile between public and private housing schemes with regard to client related delays. This clearly depicts that private schemes suffer more delay problems as compared to public schemes mainly due to the reasons of late payments to the contractors, client's financial instability and unrealistic project duration imposed by the clients.

**Table: 4.27 Top most significant client related delay contributors**

| Rank | Overall | | Askari | | DHA | | Bahria | | Public | | Private | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* |
| 1 | CLR2 | 2.79 | CLR1 | 3.1 | CLR16 | 2.36 | CLR4 | 4.00 | CLR2 | 2.57 | CLR4 | 3.65 |
| 2 | CLR4 | 2.74 | CLR16 | 2.31 | CLR12 | 2.14 | CLR2 | 3.75 | CLR7 | 2.35 | CLR3 | 3.25 |
| 3 | CLR7 | 2.7 | CLR14 | 2.25 | CLR10 | 2.09 | CLR5 | 3.75 | CLR16 | 2.31 | CLR5 | 3.25 |
| 4 | CLR14 | 2.69 | CLR7 | 2.16 | CLR14 | 2.00 | CLR3 | 3.25 | CLR14 | 2.28 | CLR14 | 3.10 |
| 5 | CLR5 | 2.61 | CLR10 | 2.14 | CLR6 | 1.96 | CLR14 | 3.25 | CLR1 | 2.25 | CLR7 | 3.05 |

F*= Coded Delay Factors M*= Mean Scores

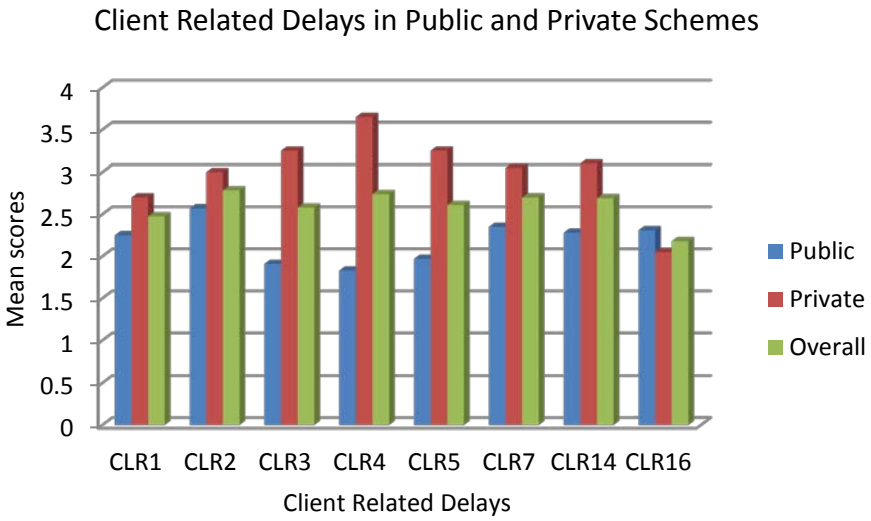


**Figure 4.13: Client related delays in public and private housing schemes**

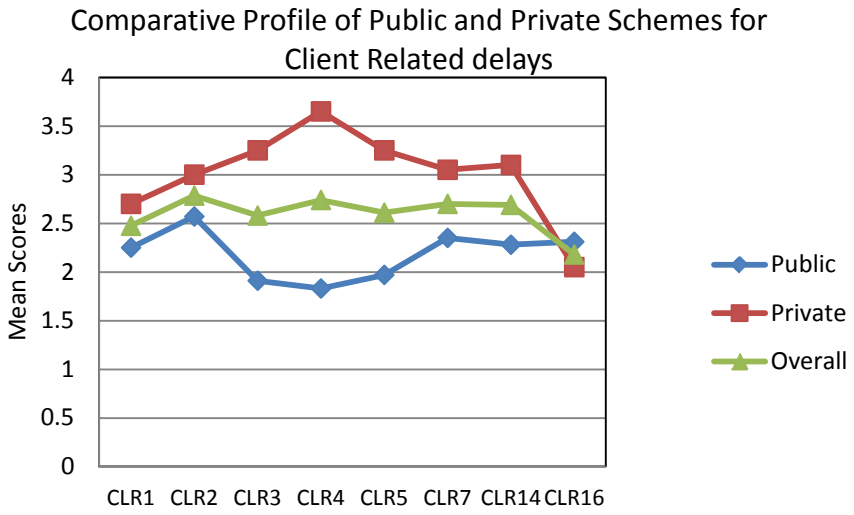


**Figure 4.14: Comparative profile of top most significant client related delays in public and private housing schemes**

- **Askari ,DHA and Bahria Housing Schemes**

From Table 4.27, it is indicated that top most significant (rank wise) client related delays in Askari housing schemes are CLR1: Frequent Change orders and delay in their issuance, CLR16: Frequent transfer of well settled project team member, CLR14: Unrealistic contract duration imposed by the client, CLR7: Undue interference by owner and his representatives and CLR10: Lack of communication

& coordination and site meetings. Similarly in DHA the top most significant (rank wise) client related delays are CLR16: Frequent transfer of well settled project team member, CLR12: Conflicts between joint-ownership of the project, CLR10: Lack of communication & coordination and site meetings, CLR14: Unrealistic contract duration imposed by the client and CLR6: Inadequate fund allocation to the contractor. Also in Bahria housing schemes the top most significant (rank wise) client related delays are CLR4: Delay in progress payments to the contractor, CLR2: Slow decision making by the client in project matters, CLR5: Lengthy and cumbersome payment process, CLR3: Client's financial instability and CLR14: Unrealistic contract duration imposed by the client. After analyzing these, it can be inferred that the most common and frequent delay factor in all three housing schemes is CLR 14: Unrealistic contract duration imposed by the client.

From the Figure 4.15, it is also concluded that in Askari housing schemes, the range of delay criticality for 50% of delay factors is between low to medium (CLR1 with maximum mean of 3.10) and it can be inferred that delay is not in the alarming state i.e. these delay factors are considered as minor and moderate delays. In DHA the range of delay criticality is almost same as Askari and half of these delay factors fall between low to medium delay categories. On the contrary, in Bahria 45% of delay factors fall between medium to high category of delay with CLR4 having maximum mean score of 4.0.This clearly shows that there is a serious problem of delay in Bahria housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.16 show a comparative profile between Askari, DHa and Bahria housing schemes with regard to client related delays. This clearly depicts that Bahria housing schemes suffer more delay problems as compared to Askari and DHA schemes mainly due to the reasons of late payments to the contractors, client's slow decision making in project matters and unrealistic project duration imposed by the clients.

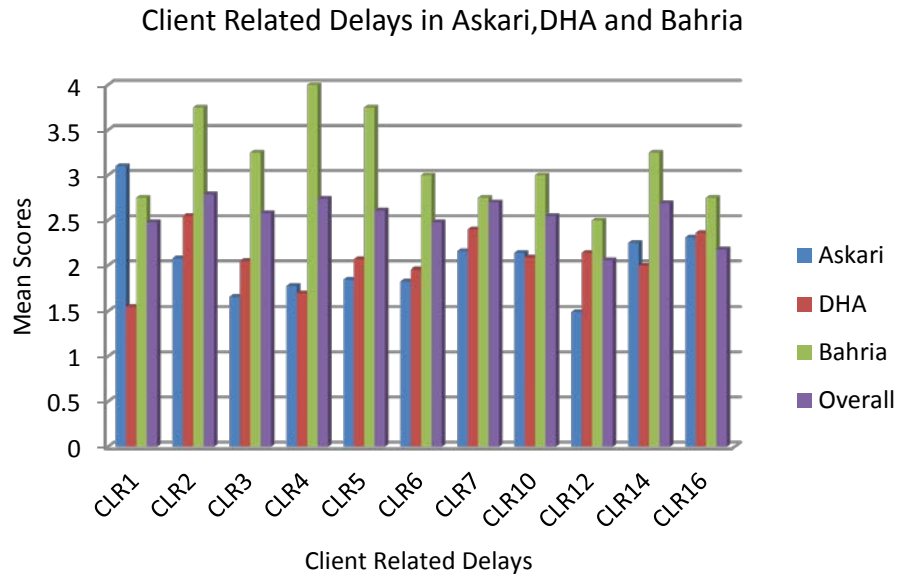


**Figure 4.15: Client related delays in Askari, DHA and Bahria housing schemes**

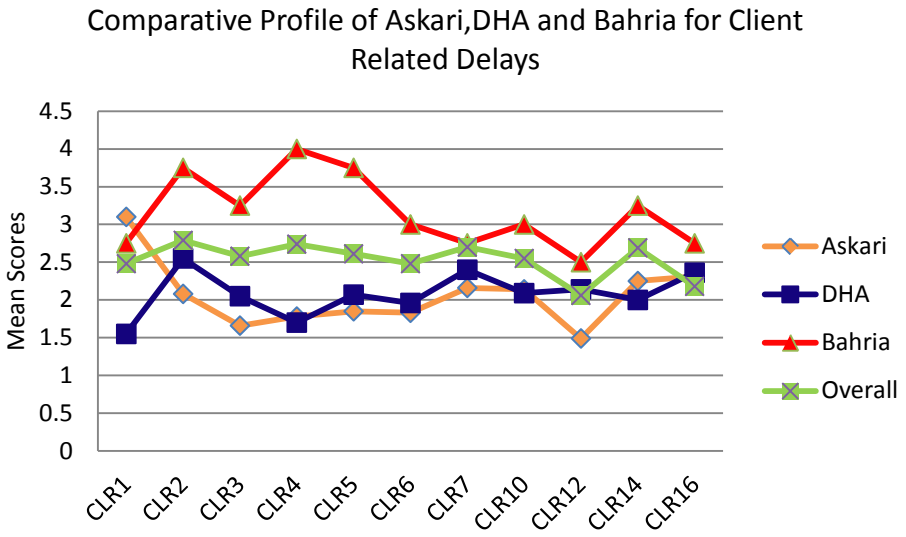


**Figure 4.16: Comparative profile of top most significant client related delay in Askari, DHA and Bahria housing schemes**

- **Overall Top Most Client Related Delay Factors**

From Table 4.27, it can be indicated that overall top most significant delay factors are CLR2: Slow decision making by the client project matters,CLR4: Delay in progress payments to the contractor,CLR7: Undue interference by owner and his

representative specially from non-professionals and non-engineers,CLR14: Unrealistic contract duration imposed by client and CLR5: Lengthy and cumbersome payment process. Figure 4.16 shows that trend of delay occurring generally falls between low to medium delay categories.

- **Contractor Related Delays**
  - Public and Private housing Schemes

From Table 4.28, it is also indicated that top most significant (rank wise) contractor related delays in public housing schemes are COR8: Rework due to errors during construction, COR22: Poor safety/risk management by the contractor,COR23: Poor contingency planning,COR9: Poor financial capability of contractor ,COR5: Poor project planning and scheduling by the contractor, COR6: Hiring of unreliable and incompetent subcontractor,COR15: Shortage of qualified staff,COR7: Lack of communication & coordination and site meetings and COR11: Use of inexperienced labor by the contractor. Similarly in private housing schemes the top most significant (rank wise) contractor related delays are COR22: Poor safety/risk management by the contractor, COR19: Escalation of material prices due to poor material planning by the contractor,COR16: Shortage of construction material/equipment,COR23: Poor contingency planning ,COR20: Use of old age equipment by the contractor due to which frequent failure of equipment occurs, COR21: Inadequate fund allocation/late payments to sub-contractors/suppliers/labors,COR6: Hiring of unreliable and incompetent subcontractor,COR4: Poor site management and supervision by the contractor during construction ,COR10: Shortage of labors(skilled and unskilled) and COR14: Getting the contract by unfair means. After analyzing these, it can be inferred that the most common and frequent delay factors in both public and private housing schemes are COR22: Poor safety/risk management by the contractor, COR23: Poor contingency planning specially in case of law & order and security situation/electric load shading etc, COR6: Hiring of unreliable and incompetent subcontractor, and COR4: Poor site management and supervision by the contractor during construction.

From the Figure 4.17, it is also concluded that in public housing schemes, the range of delay criticality for majority of delay factors is between low to medium (COR8 with maximum mean of 2.83) and it can be inferred that delays is not in the

alarming state i.e. these delay factors are considered as minor delays. On the contrary, in private housing schemes, Figure 4.14 clearly shows that about 50% of delay factors are in the range of medium to high delay categories with COR22 having a maximum mean of 3.96.This clearly shows that there is a serious problem of delay in private housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.18 show a comparative profile between public and private housing schemes with regard to contractor related delays. This clearly depicts that private schemes suffer more delay problems as compared to public schemes mainly due to the reasons of poor safety/risk management by the contractor, escalation of material prices due to poor material planning by the contractor and shortage of construction material/equipment.

**Table: 4.28 Top most significant contractor related delay contributors**

| Rank | Overall | | Askari | | DHA | | Bahria | | Public | | Private | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* |
| 1 | COR22 | 3.39 | COR4 | 3.33 | COR8 | 2.58 | COR22 | 4.50 | COR8 | 2.83 | COR22 | 3.96 |
| 2 | COR23 | 3.25 | COR6 | 3.29 | COR22 | 2.45 | COR3 | 4.00 | COR22 | 2.82 | COR19 | 3.86 |
| 3 | COR19 | 3.13 | COR2 | 3.23 | COR7 | 2.43 | COR23 | 4.00 | COR23 | 2.76 | COR16 | 3.76 |
| 4 | COR6 | 3.08 | COR5 | 3.19 | COR24 | 2.42 | COR4 | 3.75 | COR9 | 2.74 | COR23 | 3.73 |
| 5 | COR15 | 3.04 | COR8 | 3.17 | COR9 | 2.37 | COR16 | 3.75 | COR5 | 2.68 | COR20 | 3.56 |
| 6 | COR4 | 3.03 | COR22 | 3.15 | COR18 | 2.33 | COR17 | 3.75 | COR6 | 2.66 | COR21 | 3.56 |
| 7 | COR16 | 3.03 | COR1 | 3.08 | COR23 | 2.32 | COR18 | 3.75 | COR15 | 2.64 | COR6 | 3.50 |
| 8 | COR9 | 3.02 | COR9 | 3.08 | COR10 | 2.30 | COR19 | 3.75 | COR7 | 2.63 | COR4 | 3.46 |
| 9 | COR8 | 3.015 | COR12 | 2.94 | COR15 | 2.13 | COR20 | 3.75 | COR4 | 2.59 | COR10 | 3.46 |
| 10 | COR18 | 3.01 | COR13 | 2.94 | COR21 | 2.13 | COR5 | 3.50 | COR11 | 2.59 | COR14 | 3.43 |

F*=Coded Delay Factors M*=Mean Scores

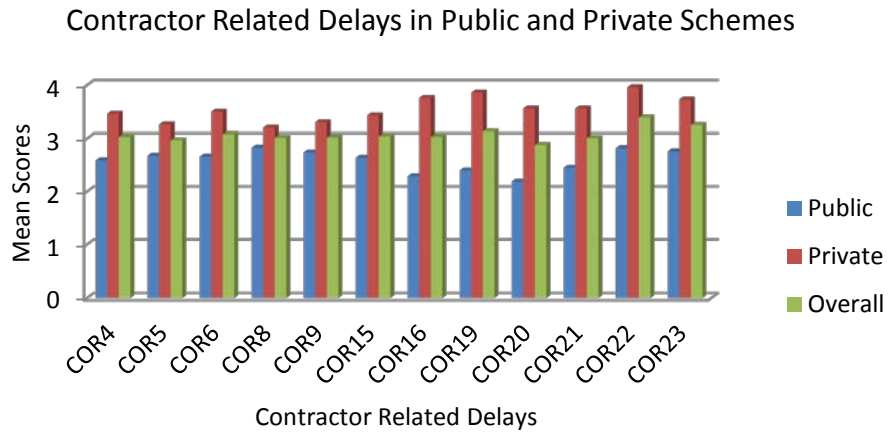


**Figure 4.17: Contractor related delays in public and private housing schemes**

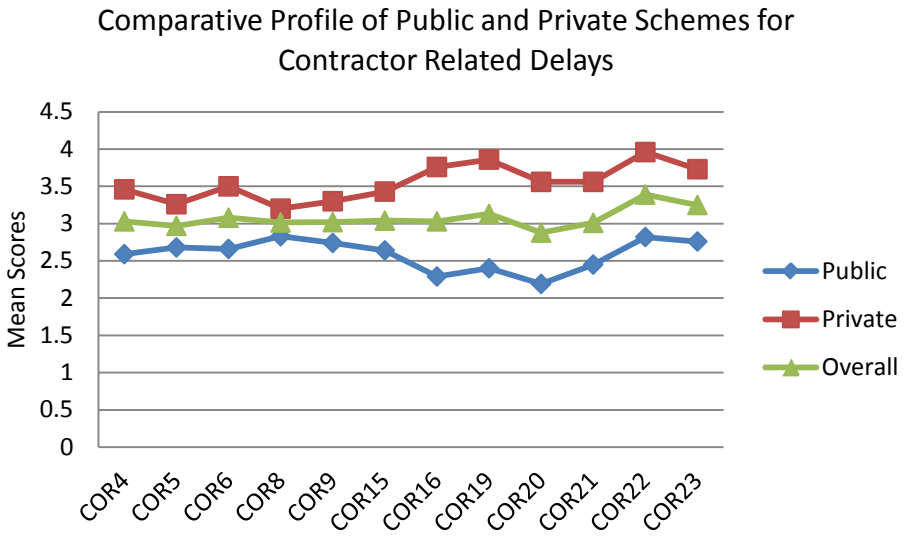


**Figure 4.18: Comparative profile of top most significant contractor related delays in public and private housing schemes**

- **Askari, DHA and Bahria Housing Schemes**

From Table 4.28, it is also indicated that top most significant (rank wise) contractor related delays in Askari housing schemes are COR4: Poor site management and supervision during construction,COR6: Hiring of unreliable and incompetent subcontractor,COR2: Improper construction methods ,COR5: Poor project planning and scheduling ,COR8: Rework due to errors during construction , COR22: Poor safety/risk management ,COR1: Inadequate contractor experience

,COR9: Poor financial capability of contractor and COR12: Delays in mobilization of labor and equipment. Similarly in DHA the top most significant (rank wise) contractor related delays are COR8: Rework due to errors during construction , COR22: Poor safety/risk management ,COR7: Lack of communication & coordination and site meetings,COR24: Late submittals of progress payments/bills ,COR9: Poor financial capability of contractor , COR18: Late procurement of materials/equipment ,COR23: Poor contingency planning,COR10: Shortage of labors(skilled and unskilled) ,COR15: Shortage of qualified staff and COR21: Inadequate fund allocation/late payments to sub-contractors/suppliers/labors due to poor financial planning. Also in Bahria housing schemes the top most significant contractor related factors are COR22: Poor safety/risk management,COR3: Inaccurate time and cost estimates ,COR23: Poor contingency planning ,COR4: Poor site management and supervision during construction,COR16:, Shortage of construction material/equipment COR17: Delay in material /equipment delivery by the supplier,COR18: Late procurement of materials/equipment by the contractor,COR19: Escalation of material prices due to poor material planning by the contractor,COR20: Use of old age equipment by the contractor due to which frequent failure of equipment occurs and COR5: Poor project planning and scheduling . After analyzing these, it can be inferred that the most common and frequent delay factors in Askari and DHA housing schemes are COR8: Rework due to errors during construction, COR9: Poor financial capability of contractor and COR22: Poor safety/risk management. Similarly COR4: Poor site management and supervision during construction, COR5: Poor project planning and scheduling by the contractor and COR22: Poor safety/risk management, are most common factors in Askari and Bahria housing schemes. Also COR22: Poor safety/risk management, COR18: Late procurement of materials/equipment by the contractor and COR23: Poor contingency planning, are the most common factors in Bahria and DHA housing schemes.

From the Figure 4.19, it is also concluded that in Askari housing schemes, the range of delay criticality for 33% of delay factors is between medium to high (COR4 with maximum mean of 3.33) and it can be inferred that delay is in the alarming state i.e. these delay factors are considered as moderate delays . In DHA the range of delay criticality is between low to medium with COR8 having

maximum mean of 2.58, and half of these delay factors are fall minor delays. On the contrary, in Bahria 13% of delay factors fall between high to very high category of delay with COR22 having maximum mean score of 4.5 and more than 63% fall between medium to high delay category with COR4 having mean of 3.75.This clearly shows that there is a much serious problem of delay in Bahria housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.20 show a comparative profile between Askari, DHa and Bahria housing schemes with regard to contractor related delays. This clearly depicts that Bahria housing schemes suffer more delay problems as compared to Askari and DHA schemes mainly due to the reasons of poor safety/risk management by the contractors, inaccurate time and cost estimates, poor contingency planning and poor site management and supervision during construction work.

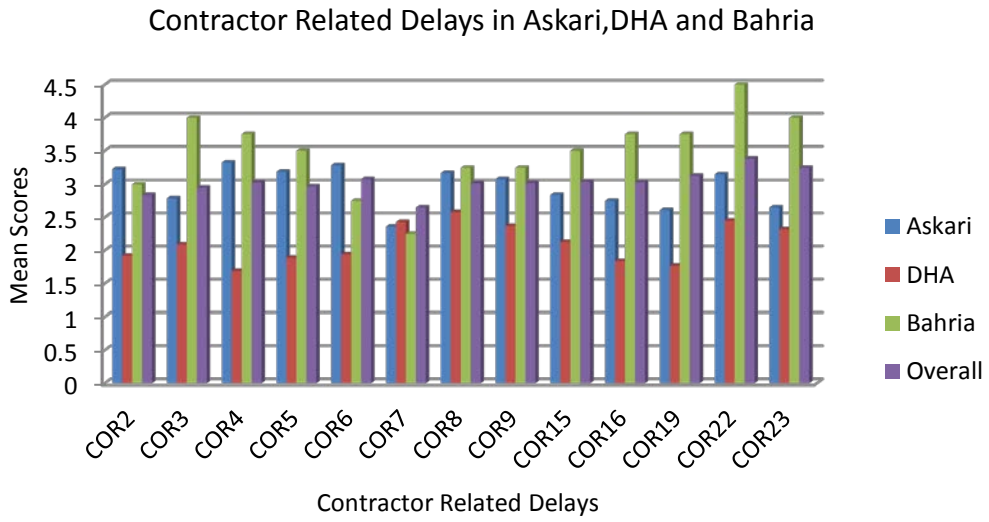


**Figure 4.19: Contractor related delays in Askari, DHA and Bahria housing schemes**

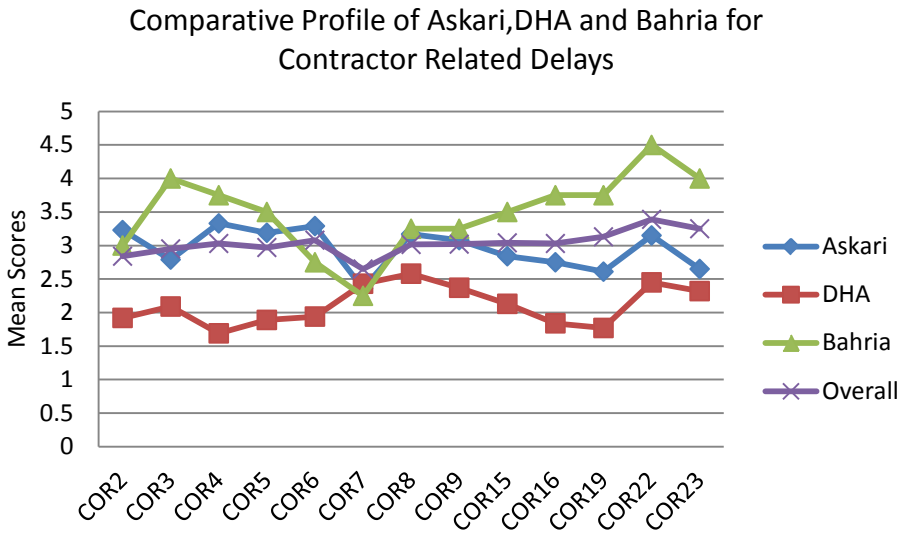


**Figure 4.20: Comparative profile of top most significant contractor related delays in Askari, DHA and Bahria housing schemes**

- **Overall Top Most Contractor Related Delay Factors**

From Table 4.28,it can be indicated that overall top most contractor related delays are COR22: Poor safety/risk management by the contractor,COR23: Poor contingency planning specially in case of law & order and security situation/electric load shading etc,COR19: Escalation of material prices due to poor material planning by the contractor,COR6: Hiring of unreliable and incompetent subcontractor,COR15: Shortage of qualified staff,COR4: Poor site management and supervision by the contractor during construction,COR16: Shortage of construction material/equipment,COR9: Poor financial capability of contractor,COR8: Rework due to errors during construction and COR18: Late procurement of materials/equipment by the contractor. Figure 4.20 shows that trend of delay occurrence generally falls between medium to high delay categories.

- **Consultant Related Delays**
  - **Public and Private housing Schemes**

From Table 4.29, it is also indicated that top most significant (rank wise) consultant related delays in public housing schemes are CSR1: Delay in approving major changes in the scope of work, CSR10: Lack of qualified staff on site, CSR9: Delay in approving shop drawings and sample materials, CSR2: Poor communication and coordination, and CSR4: Mistakes and discrepancies in the

design documents. Also top most (rank wise) consultant related delays in private housing schemes are CSR9: Delay in approving shop drawings and sample materials, CSR12: Delay in verification of contractor's interim payment certificates, CSR8: Inaccurate site investigation by the consultant, CSR4: Mistakes and discrepancies in the design documents and CSR1: Delay in approving major changes in the scope of work. After analyzing it can be inferred that most common and frequent factors in public and private schemes are CSR1: Delay in approving major changes in the scope of work, CSR9: Delay in approving shop drawings and sample materials, and CSR4: Mistakes and discrepancies in the design documents.

From the Figure 4.21, it is also concluded that in public housing schemes, the range of delay criticality for majority of delay factors is between low to medium (CSR1 with maximum mean of 2.43) and it can be inferred that delay is not in the alarming state i.e. these delay factors are considered as minor and moderate delays. On the contrary, in private housing schemes, figure 4.1 clearly shows that more than 23% of delay factors are in the range of medium to high delay categories with CSR9 having a maximum mean of 3.33.This clearly shows that there is a serious problem of consultant related delay in private housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.22 shows a comparative profile between public and private housing schemes with regard to consultant related delays. This clearly depicts that private schemes suffer more delay problems as compared to public schemes mainly due to the reasons of delay in approving of shop drawings and delay in verification of contractor's interim payment certificates.

**Table: 4.29 Top most significant consultant related delay contributors**

| Rank | Overall | | Askari | | DHA | | Bahria | | Public | | Private | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* | F* | M* |
| 1 | CSR9 | 2.71 | CSR1 | 2.15 | CSR1 | 2.98 | CSR9 | 3.25 | CSR1 | 2.43 | CSR9 | 3.33 |
| 2 | CSR1 | 2.47 | CSR9 | 1.99 | CSR2 | 2.80 | CSR12 | 3.00 | CSR10 | 2.15 | CSR12 | 3.08 |
| 3 | CSR8 | 2.40 | CSR10 | 1.97 | CSR10 | 2.58 | CSR1 | 2.50 | CSR9 | 2.08 | CSR8 | 3.00 |
| 4 | CSR12 | 2.36 | CSR4 | 1.83 | CSR5 | 2.45 | CSR4 | 2.50 | CSR2 | 1.99 | CSR4 | 2.60 |
| 5 | CSR4 | 2.28 | CSR6 | 1.81 | CSR4 | 2.25 | CSR8 | 2.50 | CSR4 | 1.95 | CSR1 | 2.50 |

F*=Coded Delay Factors M*=Mean Scores

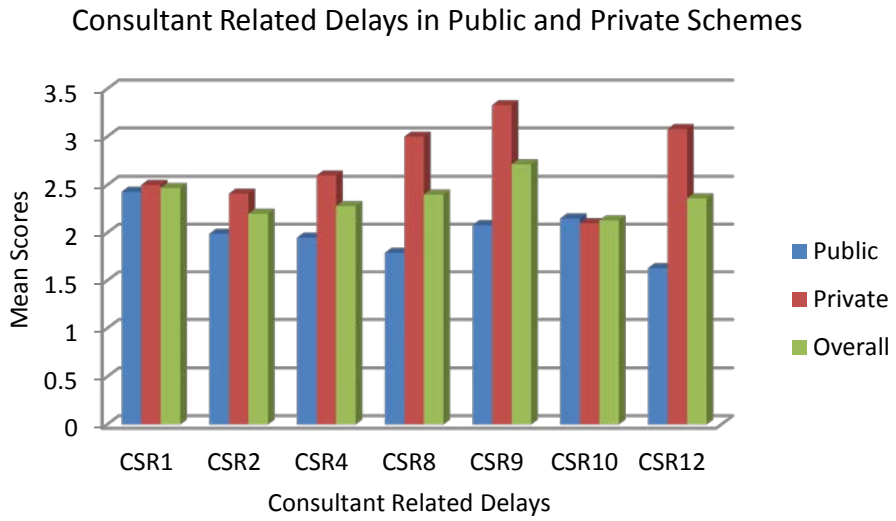


**Figure 4.21: Consultant related delays in public and private housing schemes**

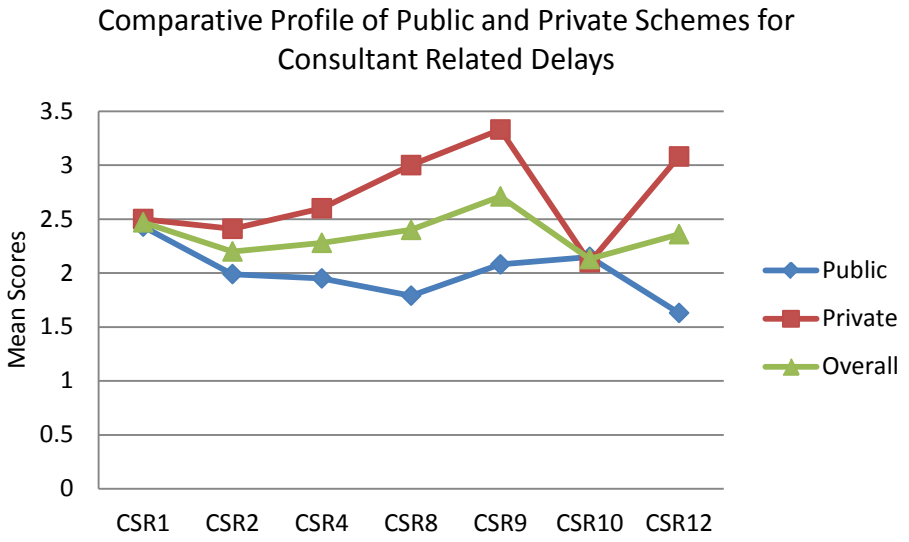


**Figure 4.22: Comparative profile of top most significant consultant related delays in public and private housing schemes**

- **Askari, DHA and Bahria Housing Schemes**

From Table 4.29, it can be concluded that the top most significant consultant related delays in Askari housing schemes are CSR1: Delay in approving major changes in the scope of work by the consultant, CSR9: Delay in approving shop drawings and sample materials by the consultant, CSR10: Lack of qualified staff on

site, CSR4: Mistakes and discrepancies in the design documents and CSR6: Poor supervision and quality assurance of work. Similarly top most significant factors in DHA are CSR1: Delay in approving major changes in the scope of work, CSR2: Poor communication and coordination, CSR10: Lack of qualified staff on site, CSR5: Non utilization of advanced engineering design software and CSR4: Mistakes and discrepancies in the design documents. Also top most significant factors in Bahria housing schemes are CSR9: Delay in approving shop drawings and sample materials, CSR12: Delay in verification of contractor's interim payment, CSR1: Delay in approving major changes in the scope of work, CSR4: Mistakes and discrepancies in the design documents and CSR8: Inaccurate site investigation by the consultant. After analyzing the results, it can be inferred that most common and frequent factors in all three schemes are CSR1: Delay in approving major changes in the scope of work and CSR4: Mistakes and discrepancies in the design documents. Similarly most common factors in Askari and DHA are CSR1: Delay in approving major changes in the scope of work, CSR10: Lack of qualified staff on site and CSR4: Mistakes and discrepancies in the design documents. Most common factors in Askari and Bahria are CSR1: Delay in approving major changes in the scope of work by the consultant, CSR9: Delay in approving shop drawings and sample materials by the consultant and CSR4: Mistakes and discrepancies made by the consultant in the design documents. Also most common factors in DHA and Bahria are CSR1: Delay in approving major changes in the scope of work and CSR4: Mistakes and discrepancies in the design documents.

From the Figure 4.23, it is also concluded that in Askari housing schemes, the range of delay criticality for 8% of delay factors is between low to medium (CSR1 with maximum mean of 2.15) and it can be inferred that delay due to consultants is not a serious issue. In DHA the range of delay criticality falls between low to medium with CSR1 having mean of 2.98 and 50% of these delay factors fall between low to medium delay categories. On the contrary, in Bahria 15% of delay factors fall between medium to high category of delay with CSR9 having maximum mean score of 3.25 and about 50% of delay factors fall in the range of low to medium. This shows that there is a considerable problem of delay in Bahria housing schemes which needs due consideration from all concerned stakeholders.

Figure 4.24 show a comparative profile between Askari, DHa and Bahria housing schemes with regard to consultant related delays. This clearly depicts that Bahria housing schemes suffer slightly more delay problems as compared to Askari and DHA schemes mainly due to delay in approving shop drawings and sample materials and delay in verification of interim payment certificates.

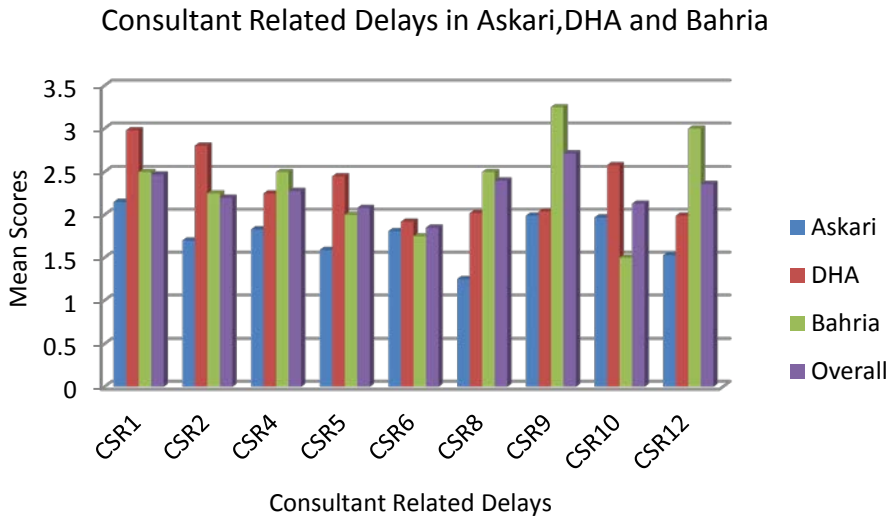


**Figure 4.23: Consultant related delays in Askari, DHA and Bahria housing schemes**

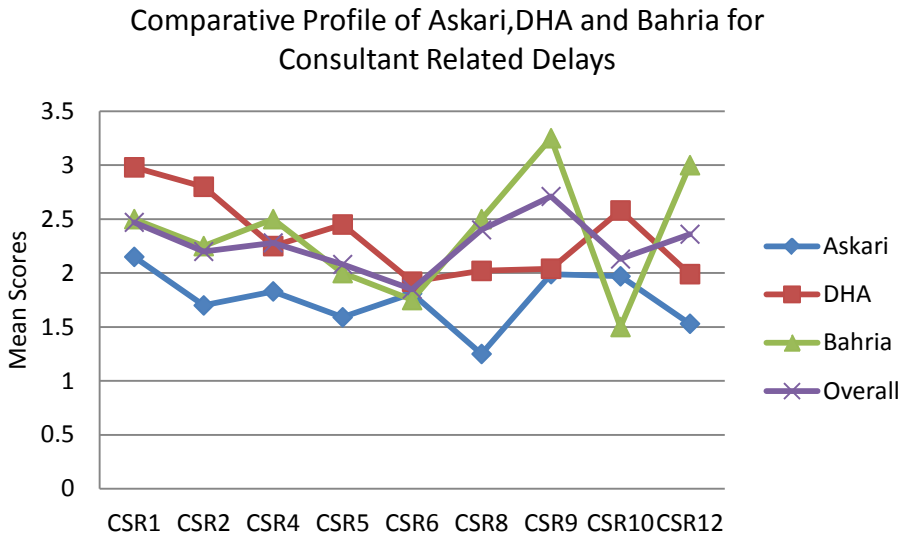


**Figure 4.24: Comparative profile of top most significant consultant related delays in Askari, DHA and Bahria housing schemes**

- **Overall Top Most Significant Consultant Related Delays**

From Table 4.29, it can be indicated that overall top most consultant related delays are CSR9: Delay in approving shop drawings and sample materials by the consultant, CSR1: Delay in approving major changes in the scope of work by the consultant, CSR8: Inaccurate site investigation by the consultant, CSR12: Delay in verification and submission of contractor's interim payment certificates by the consultant and CSR4: Mistakes and discrepancies made by the consultant in the design documents. Figure 4.24 depicts that trend of delay factors follows low to medium thus it can be inferred that consultant related delays are not a serious issue.

*Chapter 5*

# CONCLUSIONS AND RECOMMENDATIONS

## 5.1 CONCLUSIONS

Results of this research work revealed that construction delay is generally the most common, costly and risky problem encountered in construction industry of Pakistan and especially in housing projects. Knowing the cause of any particular delay in a construction project would help avoiding the same. This research study was therefore, aimed at identifying, ranking and comparing the most significant causes of delays in major housing schemes of Pakistan through a survey by getting perceptions of clients, contractors and consultants. Based on the results of the questionnaire survey, the following conclusions have been drawn:

- Fifty three (53) delay contributors were identified through extensive literature review and then combined these contributors into three basic categories like client related, contractor related and consultant related delays.
- A total of one hundred and two (102) respondents from all major cities of Pakistan (including clients, contractors and consultants) participated in the survey and majority (59%) of them having experience of more than 10 years in construction industry with more than 63% engineers and architects having executive appointments.
- Survey results showed that 76% of the projects faced time overrun and 93% of projects faced cost overrun as per the respondent's view.
- Results of statistical analysis showed that data collected from the respondents were in the range of high to extremely reliable and were found to be non-parametric data after application of normality test. Further Spearman correlation tests were applied to check the strength of relationship between the two sets of ranking of delay contributors as per the perception of respondents and the results showed a positive correlation between the rankings of delay contributors by the respondents. Kruskal-Wallis tests were applied in order to compare the strength of variability among the ratings or perceptions of

respondents regarding the delay contributors and the results have depicted that there is a significant difference between the ratings of consultants and contractors regarding client related delays. Also results showed that there is no significant difference among the ratings of respondents regarding the contractor and consultant related delays in housing schemes of Pakistan. Further results of this test depicted that there is a significant difference among the ratings of respondents of Askari, DHA and Bahria housing schemes.

- Based on the overall results, it can be concluded that top most significant delay contributors(identified and ranked) are:
  - Client related delays:
    - Slow decision making by the client in project matters
    - Delay in progress payments to the contractors
    - Undue interference by owner and his representative
    - Unrealistic contract duration imposed by client
    - Lengthy and cumbersome payment process
  - Contractor related delays:
    - Poor safety/risk management by the contractor
    - Poor contingency planning
    - Escalation of material prices due to poor material planning by the contractor
    - Hiring of unreliable and incompetent subcontractor
    - Shortage of qualified staff
  - Consultant related delays:
    - Delay in approving shop drawings and sample materials
    - Delay in approving major changes in the scope of work
    - Inaccurate site investigation by the consultant
    - Delay in verification of contractor's interim payment certificates
    - Mistakes and discrepancies in the design documents
- Based on the comparative analysis of delay contributors as per respondent's view in Askari, DHA and Bahria housing schemes, it was found that top most client related significant delays are:
  - Askari housing schemes:
    - Frequent Change orders and delay in their issuance

- Frequent transfer of well settled project team member
- Unrealistic contract duration imposed by client
- Undue interference by owner and his representative
- Lack of communication & coordination and site meetings

- DHA:
  - Frequent transfer of well settled project team member
  - Conflicts between joint-ownership of the project
  - Lack of communication & coordination and site meetings
  - Unrealistic contract duration imposed by client
  - Inadequate fund allocation to the contractor
- Bahria housing schemes:
  - Delay in progress payments to the contractor
  - Slow decision making by the client in project matters
  - Lengthy and cumbersome payment process
  - Client's financial instability
  - Unrealistic contract duration imposed by client

- Similarly based on the comparative analysis of delay contributors as per respondent's view in Askari, DHA and Bahria housing schemes, it was found that top most contractor related significant delays are:
  - Askari housing schemes:
    - Poor site management and supervision during construction
    - Hiring of unreliable and incompetent subcontractor
    - Improper construction methods
    - Poor project planning and scheduling
    - Rework due to errors during construction
  - DHA:
    - Rework due to errors during construction
    - Poor safety/risk management
  - Bahria housing schemes:
    - Poor safety/risk management
    - Inaccurate time and cost estimates by the contractor
    - Poor contingency planning

- Poor site management and supervision during construction
- Shortage of construction material/equipment
- Delay in material /equipment delivery by the supplier
- Late procurement of materials/equipment by the contractor
- Escalation of material prices due to poor material planning by the contractor
- Use of old age equipment due to which frequent failure of equipment occurs

- Similarly based on the comparative analysis of delay contributors as per respondent's view in Askari, DHA and Bahria housing schemes, it was found that top most consultant related significant delays are:
  - Askari housing schemes:
    - Delay in approving major changes in the scope of work
    - Delay in approving shop drawings and sample materials
  - DHA:
    - Delay in approving major changes in the scope of work
    - Poor communication and coordination
    - Lack of qualified staff on site
  - Bahria:
    - Delay in approving shop drawings and sample materials
    - Delay in verification of contractor's interim payment certificates
    - Delay in approving major changes in the scope of work
- Based on comparative analysis of delay contributors in public and private schemes, it was found that most significant, common and frequent client related delays in both public and private schemes were:
  - Undue interference by owner and his representative
  - Unrealistic contract duration imposed by client
- Similarly common contractor related delays in both public and private schemes were:
  - Poor safety/risk management
  - Poor contingency planning
  - Hiring of unreliable and incompetent subcontractor
  - Poor site management and supervision during construction

- Also common consultant related delays in both public and private schemes were:
  - Delay in approving major changes in the scope of work
  - Delay in approving shop drawings and sample materials
  - Mistakes and discrepancies in the design documents

## 5.2 RECOMMENDATIONS

After having gone through the research findings and conclusions, some recommendations are enlisted below to minimize the delays in housing schemes. All the key stakeholders i.e. clients, contractors and consultants are suggested to focus on these so as to make an improved contribution towards better projects success.

- Timely consideration of contractor's problems and solving these through proper decision making are the essence for any successful project. Clients should give these issues a serious thought and ensure their solution at priority through quick decision making and frequent site meetings with the contractors. They should also employ capable and experienced professionals to make timely and quick decisions on the project issues. They should focus on the issues and problems developed at project sites and make an endeavor to solve them. They should acts as a solution provider rather than a problem creator.
- Fund allocation and timely release of progress payments to the contractors are means for smooth running of the construction projects. Client's cash flow should be sound enough and forecasted well in advance in order to ensure timely and successful completion of the projects.
- One of the major success factors in project is the completion of project well within contract duration and it can only be possible once this duration is a realistic one. Keeping in view the ground realities, clients should include achievable and agreeable project duration in the contract. All stakeholders must adopt a realistic and an agreed- upon time schedules for a successful project completion.

- Change orders have devastating effects on the overall project. Clients should minimize the number of change orders during construction work in order to avoid delays.
- Employment of a permanent well settled team member (besides other success factors) can definitely lead towards a successful project completion and creating an environment of mutual understanding among the key project stakeholders. It is recommended that clients and contractors should not transfer their well settled team members more frequently from their respective sites in order to avoid hampering project activities and make them employed till final project completion.
- Safety, risk management and contingency planning are the major factors contributing towards projects delivery. These factors can have both positive and negative impacts on project's financial matters and its completion. It is recommended that proper awareness of these factors among contractors should be imparted through education, training and by involving them in design phase of project. Clients should demand safety management, risk management and contingency plans from the contractors and include these factors in contract agreement and impose penalty in case of non implementation. Also contractors should adopt a proactive approach, allocate sufficient funds for implementation of these factors and utilize risk management tools and techniques (Palisade @Risk, Primavera Monte Carlo simulation and PERT scheduling etc).
- It is recommended that contractors should have qualified technical staffs with appropriate experience of the project in order to follow the different technical supervision and managerial aspects of the projects.
- Price adjustment cost may be included in the bill of quantities (BOQ) as a provisional sum so that further variations due to material price escalation can be avoided.
- It is recommended that well reputed, competent and reliable sub-contractors/suppliers should be employed by the main contractors in order to ensure timely completion of sublet work/availability of construction material on site.

- Consultants should develop a framework to provide timely and quick approvals of contractor's submittals and shop drawings without delaying the project activities.
- There is a serious need for the consultants to improve their technical skills in order to produce error-free project drawings and minimize issuance of revised drawings/design documents.

## 5.3 FUTURE DIRECTIONS

- The scope of this thesis was the comparative study of delay contributors in major housing schemes like Askari, DHA and Bahria, in major cities of Pakistan. Further study on these lines can be carried out for a detailed comparison of delay contributors in all public and private housing schemes in each province separately, to get a wider view point of the respondents.
- This study provides a basis for comparison of delay contributors in other sectors of construction industry like heavy engineering construction(dams , tunnels, irrigation canals, bridges, railways, airports, highways, sea ports and harbor structures ) and industrial construction ( Petroleum refineries, petrochemical plants, steel mills, manufacturing plants).
- Further studies can also be carried out on delay management practices in all public and private housing schemes separately in Pakistan.

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# APPENDICES

## APPENDIX: I LIST OF HOUSING SCHEMES AND RESPONDENTS

### 1. Housing Schemes

| Project Category | | Name | Location |
|---|---|---|---|
| Public | 1 | Askari Housing Schemes | Lahore, Karachi, Quetta, Peshawar, Rawalpindi, Multan, Gujranwala |
| | 2 | Defence Housing Authority (DHA) | Lahore ,Islamabad/Rawalpindi |
| | 3 | Naval Housing Schemes | Karachi |
| | 4 | Pakistan Housing Authority (PHA) | Islamabad |
| | 5 | Prime Minister Housing Scheme | Quetta |
| Private | 1 | Bahria Housing Schemes | Lahore, Islamabad/Rawalpindi |
| | 2 | Sukh Chayn Housing Scheme | Lahore |
| | | | |
| Total | | | 20 |

### 2. Respondents

**List of Clients**

| Sr.No. | Project | Name | Company | Designation | Experience (Years) |
|---|---|---|---|---|---|
| 1 | DHA Ph-2 Isd | Khalid Bashir | DHA | Project Director | >15 |
| 2 | DHA Ph-2 Isd | Saif ur Rehman | DHA | Project Engineer | >15 |
| 3 | Bahria Ph-8 DV Isd | Ashar Mehboob | Bahria Town | General Manager | 10-15 |
| 4 | Askari 1&2 Gjwla | Ghazanfar Abbas | Askari Housing | Dy Asst Director | 5-10 |
| 5 | Askari-13 Rwp | Imtiaz Ahmed | Askari Housing | Dy Asst Director | 5-10 |
| 6 | Askari-14 Rwp | Zaeem Siraj | Askari Housing | Dy Asst Director | >15 |
| 7 | Askari-6 Psr | Muhammad Rafiq | Askari Housing | Dy Asst Director | 5-10 |
| 8 | Askari-10&11 Lhr | Areeb Ahmed | Askari Housing | Assat Director | 10-15 |
| 9 | Askari-1 Extn Lhr | Sami Ullah | Askari Housing | Dy Asst Director | 5-10 |
| 10 | Askari-10&11 Lhr | Faizan Tayyab | Askari Housing | Dy Asst Director | 5-10 |
| 11 | Askari-10Lhr | Jawad Ansari | Askari Housing | Dy Asst Director | <5 |
| 12 | Askari-10Lhr | Atif Rehman | Askari Housing | Dy Asst Director | <5 |
| 13 | Askari-11Lhr | Ehsan Ullah | Askari Housing | Assat Director | 10-15 |
| 14 | Askari-2 Mtn | Atif Rehman | Askari Housing | Dy Asst Director | <5 |
| 15 | Askari-10&11 Lhr | Adnan Khalid | Askari Housing | Dy Asst Director | 5-10 |
| 16 | Askari-9,10&11 Lhr | Pervez Akhtar | Askari Housing | Dy Asst Director | >15 |
| 17 | Askari-10&11 Lhr | Awais Hussain | Askari Housing | Dy Asst Director | <5 |
| 18 | Askari-11Lhr | Abid Hussain | Askari Housing | Dy Asst Director | >15 |
| 19 | Askari-10&11 Lhr | Aamir Rauf | Askari Housing | Dy Asst Director | <5 |
| 20 | Askari-10Lhr | Rana Nadeem | Askari Housing | Dy Asst Director | <5 |
| 21 | Askari-10Lhr | Aamir Mehmood | Askari Housing | Asst Director | <5 |

| | | | | | |
|---|---|---|---|---|---|
| 22 | Askari-10 Lhr | Khalid Ishaq | Askari Housing | Dy Asst Director | 5-10 |
| 23 | Askari-10 Lhr | Adnan Aftab | Askari Housing | Dy Asst Director | 10-15 |
| 24 | Bahria SV Lhr | Wasim Ahmed | Bahria Town | General Manager | 10-15 |
| 25 | Sukk Chayn Lhr | Faisal yousaf | Sukk Chayn H.Scheme | Chief Engineer | >15 |
| 26 | DHA Ph-6 Lhr | Ghazanfar Ali | DHA | Director Housing | 10-15 |
| 27 | DHA Kci | - | DHA | General Manager | 5-10 |
| 28 | DHA Kci | - | DHA | Project Manager | 5-10 |
| 29 | DHA Kci | - | DHA | Senior Engineer | 10-15 |
| 30 | Askari-1 Qta | - | Askari Housing | Dy Asst Director | 5-10 |
| 31 | Askari-5 Kci | Ather Waqar | Askari Housing | Dy Asst Director | 5-10 |
| 32 | Askari-5 Kci | - | Askari Housing | Dy Asst Director | 5-10 |
| 33 | Askari-5 Kci | - | Askari Housing | Asst Director | 10-15 |
| 34 | Naval H.Scheme Kci | - | Naval Housing | Dy Asst Director | 5-10 |
| 35 | Naval H.Scheme Kci | - | Naval Housing | Managing Director | 10-15 |

## List of Contractors

| Sr.No. | Project | Name | Company | Designation | Experience (Years) |
|---|---|---|---|---|---|
| 1 | Bahria Ph-8 Isd | Ihsan | M/S Artova Engg & Consultancy Pvt Ltd | Site Engineer | 5-10 |
| 2 | Askari-1 Qta | Malik Javed | M/S Al Musawwar Const coy | Chief Exec Officer | >15 |
| 3 | Askari-14 Rwp | Yasin Butt | M/S Sunrise contractors | Chief Engineer | >15 |
| 4 | PM H.Scheme Qta | Mirza zahid | M/S Khalis Pervez and coy | Senior Engineer | 5-10 |
| 5 | DHA Ph-2 Isd | Abdur Rehman | M/S Habib Rafiq Pvt Ltd | Project Manager | 10-15 |
| 6 | PHA Flats Isd | Matloob Hussain | M/SAbdul Majeed and coy | Senior Engineer | >15 |
| 7 | Askari-14 Rwp | Jehangir Hussain | M/S AJ Construction | Managing Director | 5-10 |
| 8 | Askari-6 Psr | Mohd Ishaq | M/S Ishaq Khan and coy | Managing Director | 5-10 |
| 9 | Askari-11 Lhr | Usman | M/S Green Power Associates | Project Manager | <5 |
| 10 | Askari 10&11 Lhr | Zaheer Abbas | M/S Amanat and Coy | Site Engineer | 5-10 |
| 11 | Askari-11 Lhr | Hafiz Imtiaz | M/S Imtiaz Associates | Chief Executive | 5-10 |
| 12 | Askari-11 Lhr | Munir Khan | M/S Munir Khan and coy | Managing Director | <5 |
| 13 | Askari 9,10&11 Lhr | Mohd Afzal | M/S Bismillah Construction | Managing Director | >15 |

| | | | | | |
|---|---|---|---|---|---|
| 14 | Askari-11 Lhr | Mohd Maqsood | M/S Maqsood And Coy | Managing Director | >15 |
| 15 | Askari-10&11 Lhr | Sajid Ali | M/S Ellahi Associates | Managing Director | 5-10 |
| 16 | Askari-1 Extn Lhr | Azhar Islam | H#10,St#53/A Infantry Rd Lhr | Managing Director | 5-10 |
| 17 | Askari-1 Extn Lhr | Anwar Bhutta | 736-1-D2 Green Town Lhr | Managing Director | <5 |
| 18 | Askari-1 Extn Lhr | Ch. Afzal | John Bldg AB rd Lhr | Managing Director | 5-10 |
| 19 | Askari-1 Extn Lhr | Javed Ali | M/S Javed and Coy | Managing Director | 5-10 |
| 20 | DHA Ph-6 Lhr | Qazi Asif Ullah | 164/3 DHA Commercial Block Lhr | Chief Exec officer | >15 |
| 21 | DHA Ph-6 Lhr | Hasnain Nasar | M/S Warriach Associates | Chief Exec officer | 5-10 |
| 22 | Bahria Sec-B Lhr | Mohd Ali Qureshi | M/S Dascon Construction coy | Project Manager | <5 |
| 23 | Askari-5 Kci | Nadeem Iqbal | M/S NSC Const coy | Asst Director | <5 |
| 24 | Askari-5 Kci | Haji Zareen | M/SZareen Khan Const coy | Managing Director | <5 |
| 25 | Askari-5 Kci | Sajid Nawaz | M/S NSC Const coy | Managing Director | <5 |
| 26 | Askari-5 Kci | Imran Siddiqui | M/S New World Developers | Chief Exec officer | 5-10 |
| 27 | Askari-5 Kci | Mohd Nabeel | M/S Nobel Enterprise | Chief Exec officer | 10-15 |
| 28 | Askari-5 Kci | Ghulam Rasool | M/S Qasmi Builders | Managing Director | 5-10 |
| 29 | Askari-5 Kci | Shabbir Ahmed | M/S Sound Const coy | Chief Exec officer | 10-15 |
| 30 | Askari-5 Kci | Laiq Hashmi | M/S Homeland Associates | Chief Exec officer | <5 |
| 31 | Askari-5 Kci | Saleem | M/S Aman Developers | Chief Exec officer | 5-10 |
| 32 | DHA Kci | Fazal Hussain | M/SHazaConst coy | Managing Director | <5 |
| 33 | DHA Kci | Israr | M/SRabia Enterprises | Director | <5 |
| 34 | DHA Kci | Jawad | M/SJawad const coy | Project Director | <5 |
| 35 | DHA Kci | Mansoor | M/S Fazil const | Chief Exec officer | 5-10 |
| 36 | Naval H.Sch Kci | Mahmood | M/S Waseem Builders | Chief Exec officer | <5 |
| 37 | Naval H.Sch Kci | Raheem | M/S Toufeeq & co | Managing Director | <5 |
| 38 | Naval H.Sch Kci | Kamran | M/S Bestway Engg | Asst Director | <5 |
| 39 | Naval H.Sch Kci | Asif Khan | M/S Dear Construction | Managing Director | <5 |
| 40 | Naval H.Sch Kci | Khalid Javed | M/SUnited Const coy | Managing Director | <5 |

## List of Consultants

| Sr.No. | Project | Name | Company | Designation | Experience (Years) |
|---|---|---|---|---|---|
| 1 | DHA Ph-2 Isd | Uzair | GHQ Design Directorate Rwp | Principal Senior Engineer | <5 |
| 2 | PM H.Scheme Qta | Shabbir Hussain | Asadullah Associates | RE | 10-15 |
| 3 | PM H.Scheme Qta | Humayun | Asadullah Associates | Senior Architect | >15 |
| 4 | Bahria SV Lhr | Irfan | Bahria Town | RE | <5 |
| 5 | All Askari Colonies | Sarfraz Ahmad | GHQ Housing Directorate | Dy Asst Director | 10-15 |
| 6 | All Askari Colonies | Syed Javed Hussain | NFRD | RE | >15 |
| 7 | All Askari Colonies | Ahsan Bilal | NFRD | GM | >15 |
| 8 | PM H.Scheme Qta | Ejaz Qadri | Qadri Associates | Managing Director | >15 |
| 9 | Askari-1 Qta | Shazad | Qadri Associates | Managing Partner | 10-15 |
| 10 | Bahria Ph-6 Rwp | Mehmood Alam | Bahria Town | Project Manager | 10-15 |
| 11 | PHA,FGE H.Sch Isd | Adnan | Nespak Pvt Ltd | Senior Engineer | <5 |
| 12 | PHA,FGE H.Sch Isd | Tariq Hussain | Nespak Pvt Ltd | Senior Architect | 5-10 |
| 13 | PHA,FGE H.Sch ,WWF H.Sch Isd | Aamir Rasheed | Nespak Pvt Ltd | Project Engineer | 10-15 |
| 14 | PHA, Isd | Mohd Naveed- | Nespak Pvt Ltd | Senior Architect | <5 |
| 15 | DHA Kci | - | GHQ Design Directorate | Senior Architect | 5-10 |
| 16 | DHA Kci | - | GHQ Design Directorate | Project Manager | <5 |
| 17 | DHA Kci | - | GHQ Design Directorate | Asst Director | 10-15 |
| 18 | DHA Kci | - | GHQ Design Directorate | RE | 10-15 |
| 19 | Naval H.Sch Kci | - | Naval Housing | GM | 5-10 |
| 20 | Naval H.Sch Kci | - | Naval Housing | Project Manager | 5-10 |

## APPENDIX: II DETAILS OF DELAY CONTRIBUTORS

### Client Related Delays

| Code | Variables |
|---|---|
| CLR1 | Frequent Change orders (in scope of work /material type& specification) and delay in their issuance |
| CLR2 | Slow decision making by the client project matters |
| CLR3 | Client's financial instability |
| CLR4 | Delay in progress payments to the contractor |
| CLR5 | Lengthy and cumbersome payment process |
| CLR6 | Inadequate fund allocation to the contractor |
| CLR7 | Undue interference by owner and his representative specially from non-professionals and non-engineers |
| CLR8 | Client's lack of experience in the construction business |
| CLR9 | Approval of low bid contractor by the client on the recommendation of consultant |
| CLR10 | Lack of communication & coordination and site meetings with the contractor and consultant |
| CLR11 | Delay to furnish and deliver the site to the contractor |
| CLR12 | Conflicts between joint-ownership of the project |
| CLR13 | Unnecessarily suspension of work by the client |
| CLR14 | Unrealistic contract duration imposed by client |
| CLR15 | Poor management of contract issues by the client |
| CLR16 | Frequent transfer of well settled project team member |

### Contractor Related Delays

| Code | Variables |
|---|---|
| COR1 | Inadequate contractor experience |
| COR2 | Improper construction methods |
| COR3 | Inaccurate time and cost estimate by the contractor |
| COR4 | Poor site management and supervision by the contractor during construction |
| COR5 | Poor project planning and scheduling by the contractor |
| COR6 | Hiring unreliable and incompetent subcontractor |
| COR7 | Lack of communication & coordination and site meetings with client, consultant and sub-contractors |
| COR8 | Rework due to errors during construction |
| COR9 | Poor financial capability of contractor |
| COR10 | Shortage of labors(skilled and unskilled) |
| COR11 | Use of inexperienced labor by the contractor |

| | |
|---|---|
| COR12 | Delays in mobilization of labor and equipment by the contractor |
| COR13 | Poor qualification of the contractor's technical staff |
| COR14 | Getting the contract by unfair means |
| COR15 | Shortage of qualified staff |
| COR16 | Shortage of construction material/equipment |
| COR17 | Delay in material /equipment delivery by the supplier |
| COR18 | Late procurement of materials/equipment by the contractor |
| COR19 | Escalation of material prices due to poor material planning by the contractor |
| COR20 | Use of old age equipment by the contractor due to which frequent failure of equipment occurs |
| COR21 | Inadequate fund allocation/late payments to sub-contractors/suppliers/labors due to poor financial |
| COR22 | Poor safety/risk management by the contractor |
| COR23 | Poor contingency planning specially in case of law & order and security situation/electric load |
| COR24 | Late submittals of progress payments/bills by the contractor |

## Consultant Related Delays

| Code | Variables |
|---|---|
| CSR1 | Delay in approving major changes in the scope of work by the consultant |
| CSR2 | Poor communication and coordination with the contractor and client |
| CSR3 | Consultant's lack of experience |
| CSR4 | Mistakes and discrepancies made by the consultant in the design documents |
| CSR5 | Non utilization of advanced engineering design software by the consultant |
| CSR6 | Poor supervision and quality assurance of work by the consultant |
| CSR7 | Lack of meetings with the contractor to evaluate project performance and progress |
| CSR8 | Inaccurate site investigation by the consultant |
| CSR9 | Delay in approving shop drawings and sample materials by the consultant |
| CSR10 | Lack of qualified staff on site |
| CSR11 | Monetary gains and kick backs in revised work |
| CSR12 | Delay in verification and submission of contractor's interim payment certificates by the |
| CSR13 | Non availability of quality control personnel including lab assistance at site |

**APPENDIX: III COVERING LETTER AND QUESTIONNAIRE SURVEY**

## SCHOOL OF CIVIL & ENVIRONMENTAL ENGINEERING (SCEE)

# SURVEY QUESTIONNAIRE

### COVERING LETTER

Dear Sir,

Construction delays in developing world are one of the major challenges faced by the planners and designers in construction industry that results in cost and time overruns. Delay is generally acknowledged as the most common, costly complex and risky problem encountered in construction projects.

Most of the housing schemes in Pakistan also suffer construction delays due to various reasons. These projects get completed beyond the scheduled time with additional cost above the estimated budget which is not beneficial to stakeholders involved.

In partial fulfillment of the requirements for the degree of Master of Science in Construction, Engineering & Management from NUST, H-12, Islamabad, the undersigned intends to conduct a field survey to get feedback from clients, contractors and consultants regarding the current delay management practices and future measures in housing schemes of Pakistan. For this purpose a questionnaire (attached) has been developed and as a representative of the client/ contractor / consultant, you are kindly requested to take few minutes from your valuable time to fill this questionnaire in order to add your input/experience to identify the likely cause of construction delays, current delay management practices and some future measures in housing schemes of Pakistan.

All the information provided in this regard will only be used for academic purposes and kept confidential.

Thanks for your cooperation in advance.

Sincerely,

**Ali Raza**
Post Graduate Student
Construction Engineering & Management, NUST
Cell No: 0300-5918394
Email: alirazadc@yahoo.com

**DR. MUHAMMAD BABAR KHAN**
**(PhD)**
Thesis Advisor
National Institute of Transportation (NIT)
School of Civil & Environmental Engineering (SCEE)
NUST, Islamabad.

## QUESTIONNAIRE

## SECTION-1

| **General Information** (Will Not be Published) | **Date: _____** |
|---|---|
| Name(Optional) | |
| Qualification | |
| Appointment / Designation/ Position/ Rank | |
| Category of Respondent | Client ☐ Contractor ☐ Consultant ☐ |
| Experience in Construction Industry (Years) | < 5 ☐ 5-10 ☐ 10-15 ☐ >15 ☐ |
| Experience in Housing Projects (Years) | < 5 ☐ 5-10 ☐ 10-15 ☐ >15 ☐ |
| Number of Housing Projects undertaken by You | 1-3 ☐ 4-6 ☐ 6-9 ☐ >9 ☐ |
| Number of Delayed Housing Projects faced by You | 1-3 ☐ 4-6 ☐ 6-9 ☐ >9 ☐ |
| Percentage of Delays from Estimated Project Duration | 0-5% ☐ 5-10% ☐ 10-15% ☐ 15-20% ☐ >20% ☐ |
| Percentage of cost overrun from Estimated Project Cost | 0-5% ☐ 5-10% ☐ 10-15% ☐ 15-20% ☐ >20% ☐ |
| State of Project | Completed ☐ Partially Completed ☐ In progress ☐ |
| Contact Address | |
| Phone /Cell No. | |
| Any other information | |

## SECTION-2

### SIGNIFICANCE OF CLIENT-RELATED CONTRIBUTERS OF CONSTRUCTION DELAYS IN HOUSING PROJECTS

### (To be filled by Contractors and Consultants only)

**Objective of the study:** To evaluate the client-related main factors contributing to construction delay in Housing Projects.

**Question: -** Please read the following factors being considered by your organization/firm and tick the appropriate box accordingly as per their significance/contribution in housing projects:

| S. No | Factors Causing delay | Degree of Contribution 1=Very Low , 2= Low , 3=Medium , 4= High , 5=Very High | | | | |
|---|---|---|---|---|---|---|
| 1 | Frequent Change orders (in scope of work /material type& specification) and delay in their issuance | 1 | 2 | 3 | 4 | 5 |
| 2 | Slow decision making by the client project matters | 1 | 2 | 3 | 4 | 5 |
| 3 | Client's financial instability | 1 | 2 | 3 | 4 | 5 |
| 4 | Delay in progress payments to the contractor | 1 | 2 | 3 | 4 | 5 |
| 5 | Lengthy and cumbersome payment process | 1 | 2 | 3 | 4 | 5 |
| 6 | Inadequate fund allocation to the contractor | 1 | 2 | 3 | 4 | 5 |
| 7 | Undue interference by owner and his representative specially from non-professionals and non-engineers | 1 | 2 | 3 | 4 | 5 |
| 8 | Client's lack of experience in the construction business | 1 | 2 | 3 | 4 | 5 |
| 9 | Approval of low bid contractor by the client on the recommendation of consultant | 1 | 2 | 3 | 4 | 5 |
| 10 | Lack of communication & coordination and site meetings with the contractor and consultant | 1 | 2 | 3 | 4 | 5 |
| 11 | Delay to furnish and deliver the site to the contractor | 1 | 2 | 3 | 4 | 5 |
| 12 | Conflicts between joint-ownership of the project | 1 | 2 | 3 | 4 | 5 |
| 13 | Unnecessarily suspension of work by the client | 1 | 2 | 3 | 4 | 5 |
| 14 | Unrealistic contract duration imposed by client | 1 | 2 | 3 | 4 | 5 |
| 15 | Poor management of contract issues by the client | 1 | 2 | 3 | 4 | 5 |
| 16 | Frequent transfer of well settled project team member | 1 | 2 | 3 | 4 | 5 |

## SECTION-3

### SIGNIFICANCE OF CONTRACOR-RELATED CONTRIBUTERS OF CONSTRUCTION DELAYS IN HOUSING PROJECTS
### (To be filled by Clients and Consultants only)

**Objective of the study:** To evaluate the contractor-related main factors contributing to construction delay in Housing Projects.

**Question: -** Please read the following factors being considered by your organization/firm and tick the appropriate box accordingly as per their significance/contribution in housing projects:

| S. No | Factors Causing delay | Degree of Contribution 1=Very Low , 2= Low , 3=Medium , 4= High , 5=Very High | | | | |
|---|---|---|---|---|---|---|
| 1 | Inadequate contractor experience | 1 | 2 | 3 | 4 | 5 |
| 2 | Improper construction methods | 1 | 2 | 3 | 4 | 5 |
| 3 | Inaccurate time and cost estimates by the contractor | 1 | 2 | 3 | 4 | 5 |
| 4 | Poor site management and supervision by the contractor during construction | 1 | 2 | 3 | 4 | 5 |
| 5 | Poor project planning and scheduling by the contractor | 1 | 2 | 3 | 4 | 5 |
| 6 | Hiring of unreliable and incompetent subcontractor | 1 | 2 | 3 | 4 | 5 |
| 7 | Lack of communication & coordination and site meetings with the client , consultant and sub-contractors | 1 | 2 | 3 | 4 | 5 |
| 8 | Rework due to errors during construction | 1 | 2 | 3 | 4 | 5 |
| 9 | Poor financial capability of contractor | 1 | 2 | 3 | 4 | 5 |
| 10 | Shortage of labors(skilled and unskilled) | 1 | 2 | 3 | 4 | 5 |
| 11 | Use of inexperienced labor by the contractor | 1 | 2 | 3 | 4 | 5 |
| 12 | Delays in mobilization of labor and equipment by the contractor | 1 | 2 | 3 | 4 | 5 |
| 13 | Poor qualification of the contractor's technical staff | 1 | 2 | 3 | 4 | 5 |
| 14 | Getting the contract by unfair means | 1 | 2 | 3 | 4 | 5 |
| 15 | Shortage of qualified staff | 1 | 2 | 3 | 4 | 5 |
| 16 | Shortage of construction material/equipment | 1 | 2 | 3 | 4 | 5 |
| 17 | Delay in material /equipment delivery by the supplier | 1 | 2 | 3 | 4 | 5 |
| 18 | Late procurement of materials/equipment by the contractor | 1 | 2 | 3 | 4 | 5 |
| 19 | Escalation of material prices due to poor material planning by the contractor | 1 | 2 | 3 | 4 | 5 |
| 20 | Use of old age equipment by the contractor due to which frequent failure of equipment occurs | 1 | 2 | 3 | 4 | 5 |
| 21 | Inadequate fund allocation/late payments to sub-contractors/suppliers/labors due to poor financial planning | 1 | 2 | 3 | 4 | 5 |
| 22 | Poor safety/risk management by the contractor | 1 | 2 | 3 | 4 | 5 |
| 23 | Poor contingency planning specially in case of law & order and security situation/electric load shading etc | 1 | 2 | 3 | 4 | 5 |
| 24 | Late submittals of progress payments/bills by the contractor | 1 | 2 | 3 | 4 | 5 |

## SECTION-4

## SIGNIFICANCE OF CONSULTANT-RELATED CONTRIBUTERS OF CONSTRUCTION DELAYS IN HOUSING PROJECTS
## (To be filled by Clients and Contractors only)

**Objective of the study:** To evaluate the consultant-related main factors contributing to construction delay in Housing Projects.

**Question:-** Please read the following factors being considered by your organization/firm and tick the appropriate box accordingly as per their significance/contribution in housing projects:

| S.No | Factors Causing delay | Degree of Contribution 1=Very Low , 2= Low , 3=Medium , 4= High , 5=Very High | | | | |
|---|---|---|---|---|---|---|
| 1 | Delay in approving major changes in the scope of work by the consultant | 1 | 2 | 3 | 4 | 5 |
| 2 | Poor communication and coordination with the contractor and client | 1 | 2 | 3 | 4 | 5 |
| 3 | Consultant's lack of experience | 1 | 2 | 3 | 4 | 5 |
| 4 | Mistakes and discrepancies made by the consultant in the design documents | 1 | 2 | 3 | 4 | 5 |
| 5 | Non utilization of advanced engineering design software by the consultant | 1 | 2 | 3 | 4 | 5 |
| 6 | Poor supervision and quality assurance of work by the consultant | 1 | 2 | 3 | 4 | 5 |
| 7 | Lack of meetings with the contractor to evaluate project performance and progress | 1 | 2 | 3 | 4 | 5 |
| 8 | Inaccurate site investigation by the consultant | 1 | 2 | 3 | 4 | 5 |
| 9 | Delay in approving shop drawings and sample materials by the consultant | 1 | 2 | 3 | 4 | 5 |
| 10 | Lack of qualified staff on site | 1 | 2 | 3 | 4 | 5 |
| 11 | Monetary gains and kick backs in revised work | 1 | 2 | 3 | 4 | 5 |
| 12 | Delay in verification and submission of contractor's interim payment certificates by the consultant | 1 | 2 | 3 | 4 | 5 |
| 13 | Non availability of quality control personnel including lab assistance at site | 1 | 2 | 3 | 4 | 5 |

**THANKS FOR YOUR CO-OPERATION**

# APPENDIX: IV STATISTICAL ANALYSIS

## Reliability Test

### 1. Reliability Test for Client related delays

#### a. Contractor's View

**CLR = Client Related Delays**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .797 | .807 | 16 |

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| CLR1 | 28.9000 | 68.041 | .350 | .577 | .790 |
| CLR2 | 28.4250 | 62.046 | .515 | .558 | .776 |
| CLR3 | 29.0750 | 64.892 | .328 | .813 | .792 |
| CLR4 | 29.1750 | 67.738 | .209 | .859 | .800 |
| CLR5 | 29.2500 | 67.731 | .296 | .671 | .792 |
| CLR6 | 28.5250 | 67.999 | .187 | .435 | .802 |
| CLR7 | 28.5750 | 60.046 | .583 | .733 | .770 |
| CLR8 | 28.9750 | 64.948 | .455 | .703 | .782 |
| CLR9 | 28.4500 | 66.613 | .256 | .436 | .797 |
| CLR10 | 28.8500 | 61.823 | .628 | .630 | .769 |
| CLR11 | 28.9500 | 66.562 | .381 | .542 | .787 |
| CLR12 | 29.1500 | 64.438 | .574 | .695 | .776 |
| CLR13 | 29.0000 | 62.000 | .630 | .714 | .769 |
| CLR14 | 28.6500 | 65.054 | .348 | .444 | .790 |
| CLR15 | 29.1750 | 66.097 | .487 | .375 | .782 |
| CLR16 | 28.8750 | 66.420 | .275 | .417 | .796 |

#### b. Consultant's View

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .901 | .895 | 16 |

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| CLR1 | 37.3000 | 128.958 | .292 | .935 | .905 |
| CLR2 | 37.2500 | 121.039 | .535 | .849 | .897 |
| CLR3 | 37.5000 | 119.316 | .640 | .859 | .893 |
| CLR4 | 37.5500 | 113.418 | .812 | .838 | .886 |
| CLR5 | 37.4500 | 117.945 | .647 | .913 | .893 |
| CLR6 | 37.8000 | 127.432 | .468 | .935 | .899 |
| CLR7 | 37.3500 | 119.818 | .721 | .879 | .890 |
| CLR8 | 37.4000 | 118.674 | .647 | .910 | .893 |
| CLR9 | 37.9500 | 120.997 | .771 | .954 | .890 |
| CLR10 | 37.4500 | 123.945 | .560 | .868 | .896 |
| CLR11 | 37.9000 | 116.621 | .768 | .971 | .888 |
| CLR12 | 37.9000 | 138.832 | -.038 | .921 | .910 |
| CLR13 | 38.1500 | 131.713 | .369 | .594 | .901 |
| CLR14 | 37.4500 | 118.892 | .659 | .864 | .892 |
| CLR15 | 37.6500 | 123.082 | .564 | .787 | .896 |
| CLR16 | 37.4500 | 122.997 | .602 | .788 | .894 |

## 2. Reliability Test for Contractor Related Delays

### a. Client's view

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .957 | .957 | 24 |

**COR = Contractor Related Delays**

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| COR1 | 55.9429 | 321.644 | .639 | .836 | .955 |
| COR2 | 56.0857 | 323.139 | .665 | .807 | .955 |
| COR3 | 55.5714 | 313.252 | .741 | .925 | .954 |
| COR4 | 55.5714 | 309.429 | .819 | .904 | .953 |
| COR5 | 55.6000 | 308.541 | .819 | .877 | .953 |
| COR6 | 55.6571 | 317.232 | .764 | .851 | .954 |
| COR7 | 56.0000 | 325.412 | .555 | .828 | .956 |
| COR8 | 55.7714 | 318.829 | .652 | .852 | .955 |

| | | | | | |
|---|---|---|---|---|---|
| COR9 | 55.5143 | 321.257 | .627 | .815 | .955 |
| COR10 | 55.8857 | 319.810 | .709 | .853 | .954 |
| COR11 | 55.7143 | 311.681 | .804 | .888 | .953 |
| COR12 | 56.0857 | 319.081 | .674 | .858 | .955 |
| COR13 | 55.8000 | 318.224 | .651 | .818 | .955 |
| COR14 | 56.3429 | 317.938 | .618 | .750 | .955 |
| COR15 | 55.6571 | 313.467 | .802 | .910 | .953 |
| COR16 | 56.1143 | 322.339 | .673 | .925 | .955 |
| COR17 | 56.0857 | 315.904 | .686 | .915 | .955 |
| COR18 | 56.0286 | 316.676 | .826 | .920 | .953 |
| COR19 | 55.9143 | 312.551 | .733 | .872 | .954 |
| COR20 | 56.2571 | 318.255 | .683 | .787 | .955 |
| COR21 | 55.8571 | 318.891 | .577 | .851 | .956 |
| COR22 | 55.3714 | 327.476 | .403 | .761 | .958 |
| COR23 | 55.6000 | 315.071 | .662 | .889 | .955 |
| COR24 | 56.1429 | 323.773 | .524 | .747 | .956 |

**b. Consultant's View**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .942 | .939 | 24 |

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| COR1 | 66.7000 | 273.905 | .640 | . | .939 |
| COR2 | 66.7500 | 272.618 | .592 | . | .940 |
| COR3 | 67.0000 | 268.526 | .712 | . | .938 |
| COR4 | 66.8000 | 253.747 | .835 | . | .936 |
| COR5 | 66.7500 | 262.934 | .649 | . | .939 |
| COR6 | 66.5500 | 265.839 | .690 | . | .938 |
| COR7 | 66.7500 | 287.671 | .174 | . | .944 |
| COR8 | 66.3500 | 284.661 | .330 | . | .942 |
| COR9 | 66.6500 | 275.608 | .648 | . | .939 |
| COR10 | 66.7000 | 272.326 | .746 | . | .938 |
| COR11 | 66.7000 | 270.853 | .659 | . | .939 |
| COR12 | 66.7000 | 264.853 | .734 | . | .938 |
| COR13 | 66.7500 | 267.776 | .703 | . | .938 |

| | | | | | |
|---|---|---|---|---|---|
| COR14 | 66.8000 | 263.642 | .626 | . | .940 |
| COR15 | 66.5500 | 265.839 | .753 | . | .938 |
| COR16 | 66.6500 | 273.397 | .595 | . | .940 |
| COR17 | 67.0000 | 289.158 | .151 | . | .944 |
| COR18 | 66.4500 | 278.261 | .612 | . | .940 |
| COR19 | 66.8000 | 267.221 | .677 | . | .939 |
| COR20 | 66.8500 | 261.187 | .875 | . | .936 |
| COR21 | 66.6000 | 261.095 | .745 | . | .937 |
| COR22 | 66.5500 | 256.892 | .812 | . | .936 |
| COR23 | 66.4500 | 268.997 | .610 | . | .940 |
| COR24 | 66.9500 | 290.576 | .082 | . | .945 |

### 3. Reliability Test for Consultant Related Delays

#### a. Client's View

**CSR = Consultant Related Delays**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .911 | .911 | 13 |

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| CSR1 | 22.9714 | 73.617 | .471 | .525 | .911 |
| CSR2 | 23.3143 | 70.634 | .701 | .712 | .901 |
| CSR3 | 23.6000 | 70.776 | .662 | .671 | .903 |
| CSR4 | 23.2286 | 71.064 | .601 | .610 | .906 |
| CSR5 | 23.2857 | 70.151 | .635 | .767 | .904 |
| CSR6 | 23.3429 | 70.114 | .750 | .767 | .900 |
| CSR7 | 23.4286 | 71.664 | .667 | .596 | .903 |
| CSR8 | 23.4571 | 74.726 | .499 | .550 | .909 |
| CSR9 | 23.2571 | 72.373 | .568 | .505 | .907 |
| CSR10 | 23.0857 | 69.081 | .723 | .713 | .900 |
| CSR11 | 23.7714 | 75.417 | .477 | .583 | .910 |
| CSR12 | 23.4000 | 70.012 | .688 | .743 | .902 |
| CSR13 | 23.2857 | 68.916 | .775 | .785 | .898 |

**b. Contractor's view**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .891 | .895 | 13 |

**Item-Total Statistics**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| CSR1 | 21.4250 | 56.969 | .536 | .585 | .887 |
| CSR2 | 21.8250 | 55.533 | .646 | .752 | .880 |
| CSR3 | 22.4500 | 59.331 | .626 | .685 | .882 |
| CSR4 | 22.0750 | 58.071 | .610 | .646 | .882 |
| CSR5 | 22.4500 | 59.946 | .574 | .584 | .884 |
| CSR6 | 22.2250 | 59.871 | .561 | .647 | .884 |
| CSR7 | 22.3250 | 56.225 | .755 | .748 | .875 |
| CSR8 | 22.0750 | 55.199 | .620 | .598 | .882 |
| CSR9 | 21.7250 | 56.051 | .696 | .708 | .877 |
| CSR10 | 21.9250 | 60.020 | .436 | .606 | .890 |
| CSR11 | 22.5250 | 62.666 | .475 | .490 | .888 |
| CSR12 | 22.4250 | 59.533 | .519 | .685 | .886 |
| CSR13 | 22.2500 | 59.218 | .636 | .643 | .881 |

## Normality Test

### 1. Contractor and Consultant's View about Client Related Delays

**CLR=Client Related Delays**

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| CLR | 65 | 100.0% | 0 | .0% | 65 | 100.0% |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Contractor And Consultant' View About CLR | .090 | 65 | .008 | .939 | 65 | .005 |

a. Lilliefors Significance Correction

## 2. Client and Consultant's View about Contractor Related Delays

**COR = Contractor Related Delays**

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| COR | 57 | 100.0% | 0 | .0% | 57 | 100.0% |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| **COR** | .075 | 57 | .042 | .955 | 57 | .038 |

a. Lilliefors Significance Correction

## 3. Client and Contractor's View about Consultant Related Delays

**CSR=Consultant Related Delays**

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | **Total** | |
| | N | Percent | N | Percent | N | Percent |
| CSR | 82 | 100.0% | 0 | .0% | 82 | 100.0% |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| CSR | .159 | 82 | .000 | .918 | 82 | .000 |

a. Lilliefors Significance Correction

## Correlation Tests

### 1. Spearman Correlation Test for Client Related Delays

**COV=Contractor's View, CSV=Consultant's View**

**Correlations**

| | | | COV | CSV |
|---|---|---|---|---|
| Spearman's rho | COV | Correlation Coefficient | 1.000 | .254 |
| | | Sig. (2-tailed) | . | .343 |
| | | N | 16 | 16 |
| | CSV | Correlation Coefficient | .254 | 1.000 |
| | | Sig. (2-tailed) | .343 | . |
| | | N | 16 | 16 |

### 2. Spearman Correlation Test for Contractor Related Delays

**CLV=Client's View, CSV=Consultant's View**

**Correlations**

| | | | CLV | CSV |
|---|---|---|---|---|
| Spearman's rho | CLV | Correlation Coefficient | 1.000 | .353 |
| | | Sig. (2-tailed) | . | .091 |
| | | N | 24 | 24 |
| | CSV | Correlation Coefficient | .353 | 1.000 |
| | | Sig. (2-tailed) | .091 | . |
| | | N | 24 | 24 |

### 3. Spearman Correlation Test for Consultant Related Delays

**CLV=Client's View, COV=Contractor's View**

**Correlations**

| | | | CLV | COV |
|---|---|---|---|---|
| Spearman's rho | CLV | Correlation Coefficient | 1.000 | .708** |
| | | Sig. (2-tailed) | . | .007 |
| | | N | 13 | 13 |
| | COV | Correlation Coefficient | .708** | 1.000 |
| | | Sig. (2-tailed) | .007 | . |
| | | N | 13 | 13 |

**. Correlation is significant at the 0.01 level (2-tailed).

## Kruskal-Wallis Tests

### 1. Kruskal-Wallis Test for Client Related Delays

**Ranks**

| RESPONDENTS | | N | Mean Rank |
|---|---|---|---|
| CLIENT RELATED DELAYS | CONTRACTOR | 45 | 26.33 |
| | CONSULTANT | 20 | 38.85 |
| | Total | 65 | |

**Test Statistics[a,b]**

| | CLIENT RELATED DELAYS |
|---|---|
| Chi-Square | 6.873 |
| df | 1 |
| Asymptotic Significance | .009 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

### 2. Kruskal-Wallis Test for Contractor Related Delays

**Ranks**

| RESPONDENTS | | N | Mean Rank |
|---|---|---|---|
| CONTRACTOR RELATED DELAYS | CLIENT | 37 | 25.10 |
| | CONSULTANT | 20 | 33.08 |
| | Total | 57 | |

**Test Statistics[a,b]**

| | CONTRACTOR RELATED DELAYS |
|---|---|
| Chi-Square | 3.156 |
| df | 1 |
| Asymptotic Significance | .076 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

### 3. Kruskal-Wallis Test for Consultant Related Delays

**Ranks**

| RESPONDENTS | | N | Mean Rank |
|---|---|---|---|
| CONSULTANT RELATED DELAYS | CLIENT | 37 | 38.96 |
| | CONTRACTOR | 45 | 37.16 |
| | Total | 82 | |

**Test Statistics[a,b]**

| | CONSULTANT RELATED DELAYS |
|---|---|
| Chi-Square | .127 |
| df | 1 |
| Asymptotic Significance | .722 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

### Kruskal-Wallis Test (Project Wise)

**Ranks**

| RESPONDENTS | | N | Mean Rank |
|---|---|---|---|
| DELAY FACTORS | ASKARI | 150 | 115.52 |
| | DHA | 54 | 142.78 |
| | NAVAL | 27 | 129.80 |
| | BAHRIA | 18 | 211.81 |
| | PHA | 15 | 222.63 |
| | PM H.SCH | 12 | 213.29 |
| | SUKH CHAYN | 1 | 249.50 |
| | Total | 277 | |

**Test Statistics[a,b]**

| | DELAY FACTORS |
|---|---|
| Chi-Square | 56.834 |
| df | 6 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

a. Grouping Variable: RESPONDENTS

## 1. Kruskal-Wallis Test (Askari Versus DHA)

**Ranks**

| | RESPONDENTS | N | Mean Rank |
|---|---|---|---|
| DELAY FACTORS | ASKARI | 150 | 96.43 |
| | DHA | 54 | 119.36 |
| | Total | 204 | |

**Test Statistics[a,b]**

| | DELAY FACTORS |
|---|---|
| Chi-Square | 5.995 |
| df | 1 |
| Asymptotic Significance | .014 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

## 2. Kruskal-Wallis Test (Askari Versus Bahria)

**Ranks**

| | RESPONDENTS | N | Mean Rank |
|---|---|---|---|
| DELAY FACTORS | ASKARI | 150 | 78.84 |
| | BAHRIA | 18 | 131.69 |
| | Total | 168 | |

**Test Statistics[a,b]**

| | DELAY FACTORS |
|---|---|
| Chi-Square | 18.992 |
| df | 1 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

### 3. Kruskal-Wallis Test (DHA Versus Bahria)

**Ranks**

| | RESPONDENTS | N | Mean Rank |
|---|---|---|---|
| DELAY FACTORS | DHA | 54 | 31.17 |
| | BAHRIA | 18 | 52.50 |
| | Total | 72 | |

**Test Statistics[a,b]**

| | DELAY FACTORS |
|---|---|
| Chi-Square | 14.034 |
| df | 1 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

### Kruskal-Wallis Test (Public versus Private)

**Ranks**

| | RESPONDENTS | N | Mean Rank |
|---|---|---|---|
| DELAY FACTORS | PUBLIC | 258 | 133.49 |
| | PRIVATE | 19 | 213.79 |
| | Total | 277 | |

**Test Statistics[a,b]**

| | DELAY FACTORS |
|---|---|
| Chi-Square | 17.789 |
| df | 1 |
| Asymptotic Significance | .000 |

a. Kruskal Wallis Test

b. Grouping Variable: RESPONDENTS

## APPENDIX: V Comparative Analysis of Delay Contributors

### 1- Public and Private Housing Scheme

| Code | Public | | Private | | Overall | |
|---|---|---|---|---|---|---|
| | Mean | Rank | Mean | Rank | Mean | Rank |
| **CLR** | | | | | | |
| CLR1 | 2.25 | 5 | 2.7 | 10 | 2.475 | 9 |
| CLR2 | 2.57 | 1 | 3 | 6 | 2.785 | 1 |
| CLR3 | 1.91 | 14 | 3.25 | 2 | 2.58 | 6 |
| CLR4 | 1.83 | 15 | 3.65 | 1 | 2.74 | 2 |
| CLR5 | 1.97 | 12 | 3.25 | 2 | 2.61 | 5 |
| CLR6 | 2.2 | 9 | 2.75 | 9 | 2.475 | 9 |
| CLR7 | 2.35 | 2 | 3.05 | 5 | 2.7 | 3 |
| CLR8 | 2.21 | 8 | 2.8 | 8 | 2.505 | 8 |
| CLR9 | 2.22 | 7 | 2.1 | 13 | 2.16 | 12 |
| CLR10 | 2.25 | 5 | 2.85 | 7 | 2.55 | 7 |
| CLR11 | 2.01 | 11 | 1.95 | 15 | 1.98 | 16 |
| CLR12 | 1.97 | 12 | 2.15 | 12 | 2.06 | 14 |
| CLR13 | 1.81 | 16 | 2.35 | 11 | 2.08 | 13 |
| CLR14 | 2.28 | 4 | 3.1 | 4 | 2.69 | 4 |
| CLR15 | 2.05 | 10 | 1.95 | 15 | 2 | 15 |
| CLR16 | 2.31 | 3 | 2.05 | 14 | 2.18 | 11 |
| **COR** | | | | | | |
| COR1 | 2.52 | 13 | 3.03 | 22 | 2.775 | 21 |
| COR2 | 2.37 | 19 | 3.3 | 16 | 2.835 | 20 |
| COR3 | 2.57 | 12 | 3.33 | 15 | 2.95 | 14 |
| COR4 | 2.59 | 9 | 3.46 | 8 | 3.025 | 6 |
| COR5 | 2.68 | 5 | 3.26 | 20 | 2.97 | 12 |
| COR6 | 2.66 | 6 | 3.5 | 7 | 3.08 | 4 |
| COR7 | 2.63 | 8 | 2.66 | 23 | 2.645 | 23 |
| COR8 | 2.83 | 1 | 3.2 | 21 | 3.015 | 9 |
| COR9 | 2.74 | 4 | 3.3 | 16 | 3.02 | 8 |
| COR10 | 2.48 | 15 | 3.46 | 8 | 2.97 | 12 |
| COR11 | 2.59 | 9 | 3.3 | 16 | 2.945 | 16 |
| COR12 | 2.39 | 18 | 3.3 | 16 | 2.845 | 19 |
| COR13 | 2.5 | 14 | 3.4 | 13 | 2.95 | 14 |
| COR14 | 2.1 | 24 | 3.43 | 10 | 2.765 | 22 |
| COR15 | 2.64 | 7 | 3.43 | 10 | 3.035 | 5 |
| COR16 | 2.29 | 22 | 3.76 | 3 | 3.025 | 6 |
| COR17 | 2.31 | 21 | 3.4 | 13 | 2.855 | 18 |
| COR18 | 2.59 | 9 | 3.43 | 10 | 3.01 | 10 |
| COR19 | 2.40 | 17 | 3.86 | 2 | 3.13 | 3 |
| COR20 | 2.19 | 23 | 3.56 | 5 | 2.875 | 17 |
| COR21 | 2.45 | 16 | 3.56 | 5 | 3.005 | 11 |
| COR22 | 2.82 | 2 | 3.96 | 1 | 3.39 | 1 |
| COR23 | 2.76 | 3 | 3.73 | 4 | 3.245 | 2 |
| COR24 | 2.36 | 20 | 2.56 | 24 | 2.46 | 24 |
| **CSR** | | | | | | |
| CSR1 | 2.43 | 1 | 2.5 | 5 | 2.465 | 2 |
| CSR2 | 1.99 | 4 | 2.41 | 6 | 2.2 | 6 |
| CSR3 | 1.6 | 12 | 2 | 11 | 1.8 | 12 |
| CSR4 | 1.95 | 5 | 2.6 | 4 | 2.275 | 5 |
| CSR5 | 1.75 | 9 | 2.4 | 8 | 2.075 | 9 |
| CSR6 | 1.8 | 7 | 1.9 | 12 | 1.85 | 11 |
| CSR7 | 1.70 | 10 | 2.25 | 9 | 1.975 | 10 |
| CSR8 | 1.79 | 8 | 3 | 3 | 2.395 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CSR9 | 2.08 | 3 | 3.33 | 1 | 2.705 | 1 |
| CSR10 | 2.15 | 2 | 2.1 | 10 | 2.125 | 7 |
| CSR11 | 1.46 | 13 | 1.58 | 13 | 1.52 | 13 |
| CSR12 | 1.63 | 11 | 3.08 | 2 | 2.355 | 4 |
| CSR13 | 1.82 | 6 | 2.41 | 6 | 2.115 | 8 |