

# Evaluating Causes of Delay in Construction Projects of Pakistan

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## Abstract

A project takes extra time for completion is called delay. Schedule delay in construction industry is a global phenomenon. Schedule delay is the time overrun either beyond completion date specified in the contract, or beyond the date that the parties agreed upon for the delivery of the project. There are some hurdles causes project delay are called delay causes or factors. The study examines the fifty four delay causes in forty two first class construction firms of Pakistan. Study categorizes these fifty four delay causes in seven groups: (1) Owner related (2) Consultant related (3) Contractor related (4) Material related (5) Labor and equipment related (6) project related and (7) External related. Study use questionnaire for collection of feedback of different professionals. In total sixty questionnaires were sent to forty-two first class firms, out of which forty one responded with sixty nine percent of response rate. Severity index, frequency index, relative importance index and weighted median tools of descriptive statistics uses for analyzing data. From weighted median study conclude that owner related and external related delay groups have maximum impact over project schedule delay. Top five delay causes using severity index were (1) Poor site management and Supervision (2) improper project feasibility study (3) Delay in finance and payments by owner (4) Inadequate experience of consultant and Rework due to errors during construction (5) Difficulties in financing project by contractor, Unqualified workforce and effects of subsurface conditions. Using frequency index top five delay causes were 1) Delay in finance and payments by owner (2) Delay in getting work permit (3) Bureaucracy (4) Slow decision making and Unrealistic inspection and testing methods proposed in contract (5) Slow permit by government. While according to RII top delay causes were (1) Delay in Finance and Payments by owner (2) poor site management and supervision (3) Delay in getting work permit from local govt authorities (4) Unqualified workforce (5) Slow decision making.

**Keywords:** Construction delays, types of delays, Disputes, Statistical analysis.

## 1. Introduction

A globally phenomenon construction projects are facing is delay. In Saudi Arabia 70% projects are facing schedule delay (Assaf & Al-Hejji, 2006). In 37 surveyed projects of UK 35.6% were delayed, it ranged from 1 to 12 months (Meng, 2012). A report publishes in India by ministry of statistics and programmed implementation (MOSPI) shows that 50% of construction projects are facing delay (Doloi et al, 2012). In owner prospective delay simply means loss while in contractor prospective it means higher overhead costs due to longer work duration. There are so many hurdles or reasons that cause delay in construction projects are called delay factors or delay causes.

Delay may be defined as an event, activity or project taking extra time for its completion is called delay. Assaf & Al-Hejji, (2006) defined it as "The time overrun either beyond completion date specified in the contract, or beyond the date that the parties agreed upon for the delivery of the project". Construction industry play vital role in the development of any country. According to Navon, (2005) in developing countries it contribute 10% to the gross national product. In India it is second largest economic activity after agriculture and has contributed 6 to 9% of India's GDP (Doloi et al, 2012).

Construction industry is the main contributor to the GDP of Pakistan, yet its actual potential is not fully explored. Construction industry is contributing 11.42% of all industrial growth. In 2012-2013 annual growth rate of construction and material industry was 5.2%. It is worth mentioning that Pakistan is among top five cement exporters. Total cement production in 2012-2013 was 35 million tons while total capacity of cement production was 44.5 million tons. It is major investment area for international investors to invest. International investment on Bin Qasim Island is \$ 43 billion while Hawakes Bay project of new city it is \$ 68 billion. With all these growth in Pakistan housing shortfall is 0.27 million. Regardless of the economic importance, issues like war and terrorism, political instability, bureaucracy and lack qualified professionals plague the industry.

Schedule delay has many effects on construction projects such as increase in cost, lost productivity, project termination and bankruptcy. In 2005-6 M/S Fazal & Sons, lowest bidding company take the Nilore factory project of Rs 10,000 million. During project prices of material increases because of October 2005 earthquake, Company delayed this project for a year because of it cost of project increases and company becomes bankrupt. Hurdles that cause delay in construction project are known as delay causes or factors. Only through successful identification of these delay factors, successful completion of project is possible.

What are successful projects?. Yaw et al, (2003) defined it as “meeting goals, objectives and technical performance as planned”. Time, cost and quality are three parameters that can be use for measuring success of any project. This concept of project successful completion is also known as Iron Triangle (Oisen, 1971). Latterly Wright, (1997) suggest that only time and cost can be use for measuring project success. Mostly construction projects are considered successful if it achieves its goals within time and budget watched closely by contractors (Memon et al, 2011). Harold Kerzner, (2014) in early editions of his book defined project success as “The completion of an activity within constraints of time, cost and performance” but latterly in tenth edition he modified the definition of project success and include following points:

- I. Within allocated time period
- II. Within the budgeted cost
- III. At the proper performance or specification level
- IV. With acceptance of customer/user
- V. With minimum or mutually agreed upon scope changes
- VI. Without disturbing the main workflow of the organization
- VII. Without changing the corporate culture

Applicability of research on construction delay causes in Pakistan’s context is still unexplored. There is no exception for Pakistan in global phenomenon of delay. So there is a dire need to explore or indentify the delay factors that cause delay in construction industry of Pakistan.

#### Research Objectives

This research was aimed at identifying the major causes of delay. To achieve the aims, objectives have been identified as following:

1. To identify and evaluate the causes of delay in construction projects.
2. To identify the critical delay causes in construction industry Pakistan.
3. To study the perception’s differences of owners, consultants and contractors about schedule delay causes of construction projects.
4. To examine the effect of delay causes groups over project schedule delay.

## 2. Literature review

When execution of construction project concede more time than planned schedule for its outcomes then delay happen. It could be because of unrealistic goals, improper planning, contractor’s financial difficulties, environmental changes and overtime to catch up with work. In light and residential construction projects it usually happens because of miscommunications and misunderstandings between owner and contractor. Globally Various studies have been conducted in order to find out the delay causes so that their impact can be minimized, successful completion of project can be achieved. Literatures which mainly focus on delay causes identification and relevant to our research is reviewed below:

Owolabi et al, (2014) investigate the delay causes and their effects on projects. Lack of funds to finance the project to completion, changes in drawings, lack of effective communication among the parties involved, lack of adequate information from consultants and slow decision making are top five delay causes among 15. While top three effects of delay factors were time overrun, increase in project final cost and waste underutilization on construction project among nine. Research use mean index for raking delay factors and their effect on project.

In Egypt construction industry 43 delay causes of 7 delay groups were evaluated by Marzouk & El-Rasas, (2014) find out that Type of project bidding and award, Ineffective planning and scheduling and variation in orders/change in scope by owner were top three delay cause by using frequency index. While by using severity index Shortage of construction materials in market, fluctuation cost/currency and finance and payments of completed work by owner were top three delay causes. Among 7 delay groups Owner, contractor and external related impact over project schedule delay is very high, high and medium respectively. Remaining 4 delay groups impact over project schedule delay was low and very low.

A study conducted in Malaysia investigated the 31 delay causes and found that Financial difficulties and economic problems, financial problems, too late supervision and slowness in decision making, slow to give instructions and lack of material in market were top five delay causes. While Contractors, consultants, owners and external causes were raked 1st 2nd 3rd and 4th respectively in terms of impact over project. Mean and Standard deviation were used by study for data analysis (Alaghbari et al, 2007).

Shortage of Skilled & unskilled labor, changes in design, fluctuation of prices, high waiting time and

rework due to errors were the top delay factors of the study conducted in India, Study used Mean to rank these delay factors of construction industry (Ravisankar, 2014).

A study carried out in Malaysia investigates the effects of delay and found that most significant effects of delay were time overrun and cost overrun. Results revealed that 90% MARA (a government agency in Malaysia spend high amount in construction industry) construction project were facing time overrun problems. Data of 30 MARA large construction projects were analyzed by using correlation and spearman formula Memon et al, (2014).

A study in Vietnam reveal that management of construction project is being poor in Vietnam, Effective management at corporate process project and activity should be introduce to improve the performance of construction projects. Study also reveal that most of the problems with Vietnam construction projects were human and management problems not technical one. Inaccurate time estimation, slow site clearance, slow government permits, lack of capable owner's representatives, obsolete technology and unsatisfactory site compensation, high ratings in terms degree of occurrence and level of influence were the most influencing factors in Vietnam construction industry (Long et al, 2004).

A study by Doloi et al, (2014) in India find out that Lack of commitment, inefficient site management, poor site coordination, improper planning, lack of clarity in project scope, lack of communication and substandard contract were most important factors by applying relative importance index. While regression analysis revealed that slow decision from owner, poor labor productivity, architects reluctance for change and rework due to mistakes were main reasons of delay.

In Egypt a study was conducted to investigate the impact of delay factors after Egypt revolution. Ninety-nine factors were classified in nine groups using Relative importance index for ranking the factors and groups as well. RII percentage of contractor, Equipment, Owner, Project, Design, Consultant, External, Material and Labor related factors were 79.91%, 77.49%, 76.54%, 76.05%, 75.77%, 74.30%, 74.28%, 73.99%, and 72.64% ranked as first, second, third, fourth, fifth, sixth, seventh, eight, and ninth respectively. Top five delay factors were delay in progress payments, different tactics patterns for bribes, shortage of equipment, ineffective project planning and scheduling and poor site management and supervision (Aziz, 2013).

In Saudi Arabia, Assaf, Al-Khalil & Al-Hazmi, (1995) identified 56 delay causes of 9 delay groups in large construction projects. Study results shows that most significant causes that affect the project performance are as (1) shop drawings approval; (2) payment to contractors delay due to lack of cash during construction; (3) changes in design; (4) subcontractors clashes in work schedules; (5) In owner's organizations the executive bureaucracy and slow in decision; (6) errors in design; (7) shortage of labor; and (8) Insufficient labor skills.

In 2012 a study was conducted in Nigeria to examine the stakeholder perception about delay factors and its effect. Judgmental sampling technique was use for sample selection. Result shows that client's financial related problems, changes in design, failure to pay for completed works and shortage of resources were main causes while extension of time on the project, cost overrun and accumulations of interest rate on the capital to finance the project were main effects of delay factors (Akinsiku & Akinsulire, 2012).

A study in Turkey use Relative importance index to investigate the 83 delay causes in 9 groups. Contractor related factors (RII=0.773), owner (RII=0.730), consultant (RII=0.723), design (RII=0.704), material (RII=0.692) and equipment (RII=0.683) stand 1st 2nd 3rd 4th 5th and 6th respectively in terms of impact on project. This paper suggest that by awarding the project to experience contractor, paying more attention to planning and scheduling, proper site management, less changes in design and timely availability of materials the impact of delay causes can be minimized (Gunduz et al, 2012).

Twenty seven identified factors were ranked by using relative importance index. Factors with highest relative importance index were law and order situation, design changes, improper availability of funds, war and terrorism and poor site management. Study reveal that employer of the project were the main cause of delays in Pakistan construction industry (Gardezi et al 2014).

Financial ability of client's, priority on construction time, not definite about material, not properly time decision, late payment of bills, completeness and time lines of project knowledge, preceding working relationships, missing some feature in drawings, acquire out of data and machinery and changes in government policies and laws were the most significant factors towards project delay with mean of 7.5-10 and 4 critical index. Effects of these factors on project were over cost, over time, disputes, abandonment, negotiations, litigations and lawsuits (Haseeb et al, 2011).

Rahsid ul Haq & Aslam, (2013) the research reveal that the variables related to builder, customer, specialist, material and supplies has significant impact over project schedule delay.

Lack of trusts, fast market fluctuations, administration of business sector players, inadequacy of site administration, delay in site preparation, absence of the cutting edge plan programming, defer in regards of shop drawings, successive changes amid execution, absence of inclusion of customer in arranging were most important delay causes of a study conducted in Pakistan (Nawaz et al, 2013).

Suggestions in Literature

Globally various researches have been conducted on evaluating delay causes of construction projects with the primary objective “to eliminate or minimize the effects of these delay causes”. Suggestions of minimizing the impact of delay causes by different researcher are as under:

In 2014 a study review articles published from 1997-2014 and suggest that via effective and efficient stakeholder management system performance of project can be improved. Mega construction project should use social network approach (SNA) which clearly identified the issues, facilitates the stakeholder influences and improve the decision making in large construction projects (Mok et al, 2015).

In 2011 study suggests that windows based delay analysis is best for identifying, measuring and analyzing the schedule delay in construction projects (Yang & Kao, 2012).

Suggestions by Ashwini & Rahul, (2014) were (1) Proper communication and coordination with document system should be developed. (2) Decisions beneficial for project performance should be made. (3) Effective material management and quality assurance system should be imposed. (4) Training programs should be developed for improving labor productivity.

Research suggests that performance of project can be improved by adopting the partnering approach with strengthen the project management system. Time delay can be significantly reduced by joint and collaborative working environment (Meng, 2012).

By awarding the project to experience contractor, paying more attention to planning and scheduling, proper site management, less changes in design and timely availability of materials, Quick decisions and proper monitoring systems can be use for minimizing the impact of delay causes (Gunduz et al, 2012).

Globally various researches have been conducted on evaluating delay causes of construction projects. In most researches priority has been given to identifying the delay causes. Because of complex nature and large number of people involvement in construction projects research results of one country cannot fit in the context of other country. So there is dire need to evaluate the delay causes in construction industry of Pakistan.

### 3. Methodology

Research has been conducted to find out the causes of schedule delay so that its impact on construction projects of Pakistan could be eliminated or minimized. Questionnaire has been used for data collection about 54 delay causes of 9 delay groups. For this simple and brief questionnaire development was necessary.

#### Survey and Delay Causes

The questionnaire was designed for collection of data from first class construction firms in construction industry of Pakistan. It comprised of respondents demographic information (Name optional, gender, age, experience and role in project) and 54 delay causes of seven delay groups: owner, consultant, contractor, material, labor & equipment, project and external related (Table 1). For frequency index respondents were requested to choose one degree of 5 likert scale for each delay cause. While for severity index were requested to choose one degree of 5 likert scale for each delay cause. For frequency 5 likert scale was from very low to very high (1 very low, 2 low, 3 average, 4 high, 5 Very high). While for severity index it was from rarely to always (1 Rarely , 2 Sometimes , 3 Often , 4 Very often , 5 Always).

**Table1 Delay causes and groups of construction projects.**

Delay Groups	Causes of Delay
<b>1. Owner Related</b>	1.1 Slow decision making 1.2 Suspension of work 1.3 Late in revising and approving design documents by owner 1.4 Delay to furnish and deliver the site to contractor 1.5 Delay in finance and payments of completed work by owner 1.6 Variation orders/changes of scope by owner during construction 1.7 Type of project bidding and award (negotiation, lowest bidder) 1.8 Unrealistic contract duration 1.9 Ineffective delay penalties 1.10 Owner interference
<b>2. Consultant Related</b>	2.1 Inadequate experience of consultant 2.2 Delay in approving shop drawings and sample materials 2.3 Mistakes and discrepancies in design documents 2.4 Unclear and inadequate details in drawings 2.5 Quality assurance/control 2.6 Inaccurate specification of site condition
<b>3. Contractor Related</b>	3.1 Difficulties in financing project by contractor 3.2 Poor site management and supervision 3.3 Ineffective planning and scheduling of project 3.4 Rework due to errors during construction

	3.5 Delays in sub-contractors work 3.6 Inadequate contractor experience 3.7 Delay in site mobilization 3.8 Delay in preparation of shop drawings and material samples 3.9 Low financial capability of construction firms
<b>4. Material Related</b>	4.1 Shortage of construction materials in market 4.2 Delay in material delivery 4.3 Changes in material types and specifications during construction
<b>5. L &amp; E Related</b>	5.1 Shortage of labors 5.2 Strikes 5.3 Unqualified workforce 5.4 Low productivity level of labors 5.5 Equipment availability and failure 5.6 Least use of high tech tools/equipment in construction
<b>6. Project Related</b>	6.1 Effects of subsurface conditions (e.g., soil, high water table,) 6.2 Incompetent project team 6.3 Traffic control and restriction at job site 6.4 Unavailability of utilities in site or Delay in providing services from utilities such as (water, etc.) 6.5 Accident during construction 6.6 Problem with neighbors 6.7 Improper project feasibility study
<b>7. External Related</b>	7.1 Weather effect (hot, rain, etc.) 7.2 Environmental restrictions 7.3 War and terrorism 7.4 Law & order situation 7.5 Delay in getting work permit from local govt authorities 7.6 Bureaucracy 7.7 Changes in government regulations and laws 7.8 Slow permit by government/municipality 7.9 Delay in performing final inspection & certification by 3 <sup>rd</sup> party 7.10 Lack of communication between the parties 7.11 Political Instability 7.12 Force Majeure as war, revolution, riot, strike, and earthquake, 7.13 Fluctuations in cost/ currency

The questionnaire was distributed to the owner, consultants, contractors and project managers of first class construction firms (firms registered with Pakistan engineering council (PEC) in CA and CB category). Total 41 experts responded in which 16 were owner, 9 were contractor, 10 were consultant and 6 were project managers. Kish, (1965) method has been used for calculation of sample size from targeted population. Minimum sample size required was

$$n_0 = \frac{p*q}{v^2} \quad (1)$$

$$n = \frac{n_0}{1 + \frac{n_0}{N}} \quad (2)$$

Where  $n_0$  is first estimate of sample size,  $p$  is characteristic of sample measured from targeted population,  $q$  is the complement of  $p$  or  $q=1-p$ .  $v$  is the maximum standard error allowed.  $N$  is the population and  $n$  is the sample size.

Total registered construction firms with Pakistan engineering council (PEC) are 30511. In which 317 were first class firms. So  $p$  is  $317/30511 = 0.01039$  this means  $q = 0.989$ . Maximum standard error  $v$  is 10%. By putting values in equation (1) and (2),  $n = 10.89$ , approximately 11. Respondent selections were not discriminated by any trait, level, experience or authenticity. However stratified random sampling was used for respondent selection.

### 3.1 Data analysis

Three descriptive statistics tools Severity Index, Frequency index and Relative Importance Index is being used for analyzing and ranking the perception of professionals including owner, consultant, contractor and project manager. Also used by Assaf & Al-Hejji, (2006) and Marzouk & El-Rasas, (2014).

$$\text{Severity Index (SI) (\%)} = \sum_{i=1}^5 \frac{a_{is} * n_{is}}{5 * N} \times 100$$



$$\text{Frequency Index (FI) (\%)} = \sum_{i=1}^5 \frac{a_{if} * n_{if}}{5 * N} \times 100$$

Where ais and aif are number of respondents choose certain degree for severity and frequency index. While nis and nif are degrees of severity and frequency. N is total number of respondents.

$$\text{Relative Importance Index RII \%} = \frac{SI\% * FI\%}{100}$$

### 3.2 Case Study

M/S Fazal & Sons was a lowest bidding company for Nilore Factory in 2005-6 in abbottabad. It was a project of Rs.10.000 Million. The project was delayed for 1 year because of October 2005 earth quake. Delays reasons are as under:

- Lowest bidding (Delay cause 1.7 in table 1).
- October 2005 earthquake (Delay cause 7.12 in table 1).
- Shortage of materials (Delay cause 4.1 in table 1).
- Delay in material delivery (Delay cause 4.2 in table 1)
- Fluctuation in cost (Delay cause 7.13 in table 1).

### 4. Research Results

Descriptive statistics tools and techniques such as Severity Index, Frequency Index and Relative importance index for drawing results from the data collected from first class construction firms of Pakistan are presented here. Average values of severity index, frequency index and relative importance index are in figure 1. While ranked delay causes are shown in table 2 to 3.

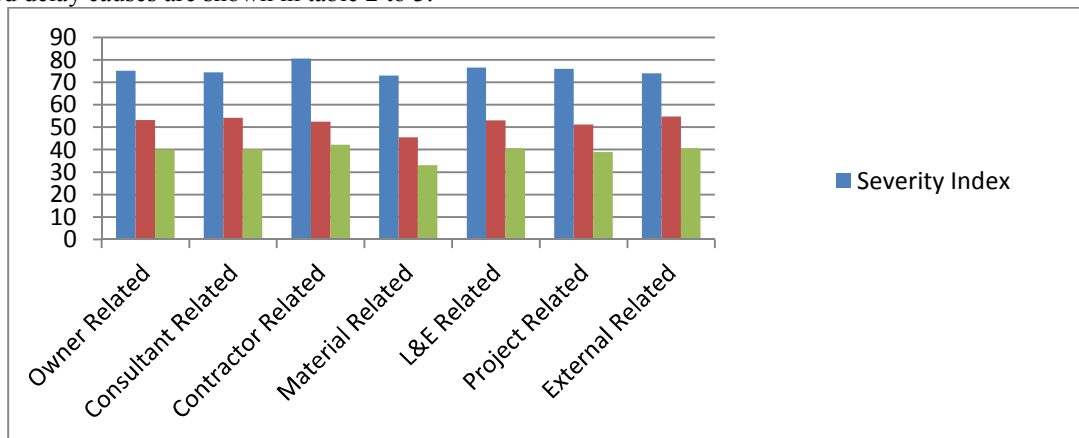


Figure 1: Average of Severity, frequency and relative importance index of all respondents

Tables 2-4 contain the top ten delay causes by using frequency index (FI), severity index (SI) and relative importance index (RII) respectively. In table 2 delay cause at 1st rank has maximum impact on overall project schedule delay while delay cause ranked at 10th has comparatively less impact on overall project schedule delay using frequency index. Delay in payments to finance project by owner with FI 62.9% is ranked at 1st, while poor site management and supervision and ineffective planning and scheduling of project with FI 56.1% are ranked at 10th.

ineffective planning and scheduling of project with FI 56.1% are ranked at 10<sup>th</sup>.

**Table 2: All respondent's feedback by using Frequency Index**

S #	Attributes	Delay Group	FI %	Rank
1	Delay in finance and payments of completed work by owner	Owner Related	62.9	1
2	Delay in getting work permit from local govt authorities	External Related	61.9	2
3	Bureaucracy	External Related	61.0	3
4	Slow decision making	Owner Related	60.0	4
5	Fluctuation in Cost/Currency	External Related	60.0	4
6	Slow permit by government/municipality	External Related	59.0	5
7	Unclear and inadequate details in drawings	Consultant Related	58.5	6
8	Inaccurate specification of site condition	Consultant Related	58.5	6
9	Delay in performing final inspection and certification by a third party	External Related	58.5	6
10	Unqualified workforce	L&E Related	57.6	7
11	Variation orders/changes of scope by owner during construction	Owner Related	57.1	8
12	Ineffective delay penalties	Owner Related	57.1	8
13	Problem with neighbors	Project Related	56.6	9
14	Poor site management and supervision	Contractor Related	56.1	10
15	Ineffective planning and scheduling of project	Contractor Related	56.1	10

In total there are forty one respondent including sixteen client, nine contractor, ten consultant and six project managers. Result of all respondents using severity index are in the table 3. It contains top 10 delay causes that are sorted with respect to level of significance. Poor site management and supervision with SI 89.7% is at 1st rank while shortages of labor and equipment availability with SI of 78.5 are at 10th.

**Table 3: All respondent's feedback by using Severity Index**

S #	Attributes	Delay Group	SI %	Rank
1	Poor site management and supervision	Contractor Related	89.7	1
2	Improper project feasibility study	Project Related	88.8	2
3	Delay in finance and payments of completed work by owner	Owner Related	84.9	3
4	Inadequate experience of consultant	Consultant Related	82.9	4
5	Rework due to errors during construction	Contractor Related	82.9	4
6	Difficulties in financing project by contractor	Contractor Related	82.4	5
7	Unqualified workforce	L&E Related	82.4	5
8	Effects of subsurface conditions (e.g., soil, high water table, etc.)	Project Related	82.4	5
9	low financial capability of construction firms	Contractor Related	81.5	6
10	Suspension of work	Owner Related	81.0	7
11	Inadequate contractor experience	Contractor Related	81.0	7
12	Owner interference	Owner Related	80.5	8
13	Delays in sub-contractors work	Contractor Related	80.5	8
14	Strikes	L&E Related	80.5	8
15	Law & order situation	External Related	80.5	8
16	Problem with neighbors	Project Related	79.5	9
17	Shortage of labors	L&E Related	78.5	10
18	Equipment availability and failure	L&E Related	78.5	10

In table 4 schedule delay causes are ranked with level of impact over overall project schedule delay. Schedule delay ranked at 1st means it has maximum impact on overall schedule delay while factor ranked at last means it has minimum level of impact on schedule delay. For example delay cause "delay in payments by owner" with RII of 53.41% has maximum impact on project schedule delay. For successful completion of project, management must have plans for controlling its impact. "Shortage of material in market" with RII 28.63% is ranked at last or 54 have minimum impact on project schedule delay, so management can pay less attention to it.

**Table 4: All Respondent's feedback by using RII**

S #	Attributes	Delay Group	RII %	Rank
1	Delay in finance and payments of completed work by owner	Owner Related	53.4	1
2	Poor site management and supervision	Contractor Related	50.3	2
3	Delay in getting work permit from local govt authorities	External Related	47.7	3
4	Unqualified workforce	L&E Related	47.4	4
5	Slow decision making	Owner Related	46.8	5
6	Fluctuation in Cost/Currency	External Related	45.9	6
7	Bureaucracy	External Related	45.8	7
8	Delay in performing final inspection and certification by a third party	External Related	45.4	8
9	Difficulties in financing project by contractor	Contractor Related	45.0	9
10	Problem with neighbors	Project Related	45.0	9
11	Slow permit by government/municipality	External Related	44.9	10

Perceptions difference of client, consultant, contractor and project manager can be examine in tables 5-8, which contain the client's, consultant's contractor's and project manager's feedback. Top three delay causes according to client's, consultant's contractor's and project manager's feedback by using frequency index and severity index are in tables 5-8.

**Table 5: Client's Feedback**

S #	Attributes	FI%	Rank	Attributes	SI%	Rank
1	Fluctuation in cost/currency	75	1	Improper project feasibility study	91.3	1
2	Delay in performing final inspection and certification by third party	70	2	Poor site management and supervision	88.7	2
3	Slow permit by govt	68	3	Rework due to errors during construction	86.25	3
4	Bureaucracy	68	3			

**Table 6: Consultant's Feedback**

S #	Attributes	FI%	Rank	Attributes	SI%	Rank
1	Inaccurate specification of site condition	66.00	1	Inadequate experience of consultant	90.0	1
2	Suspension of work	64.00	2	Quality assurance	90.0	1
3	Unclear and inadequate details in drawings	64.00	2	Poor site management and supervision	88.0	2
4	Low financial capability of construction	64.00	2	Inadequate contractor experience	86.0	3
5	Strikes	64.00	2	Low financial capabilities of firm	86.0	3
6	Delay in finance and payments of completed work by owner	62.00	3	Improper project feasibility study	86.0	3
7				Fluctuation in cost/currency	86.0	3



**Table 7: Contractor's Feedback**

S #	Attributes	FI%	Rank	Attributes	SI%	Rank
1	Delay in getting work permit from local authorities	73.3	1	Effect of subsurface condition	93.3	1
2	Bureaucracy	71.1	2	Rework due to error during construction	93.3	1
3	Delay in finance and payments of completed work by owner	68.9	3	Owner interference	91.1	2
4	Slow permit by Govt	68.9	3	Inadequate contractor experience	91.1	2
5	Slow decision making	68.9	3	Improper project feasibility study	91.1	2
6				Shortage of labor	88.87	3
7				Environmental restriction	88.87	3

**Table 8: Project Manager's Feedback**

S #	Attributes	FI %	Rank	Attributes	SI %	Rank
1	Unclear and inadequate details in drawings	63.3	1	Poor site management and supervision	97.0	1
2	Least use of high tech tools/equipment	63.3	1	Problem with neighbors	97.0	1
3	Unqualified workforce	60.0	2	Owner interference	96.6	2
4	Equipment availability and failure stands	60.0	2	Inadequate experience of consultant	96.6	2
5	Problem with neighbors stands	56.7	3	War and terrorism	96.6	2
6				Law & order situation	96.6	2
7				Fluctuation in cost/currency	94.3	3

For prioritizing delay causes groups median and percentage values seven delay groups for Severity index and frequency index are in table 9. They are classified according to its percentages as Very High (V H), High (H), Low (Low) and Very Low (V L).

**Table 9: Median and percentage of SI & FI**

Delay Group	Severity Index			Frequency Index		
	Median	%	Degree	Median	%	Degree
Owner Related	39.00	18.48	V.H	28.00	19.17	V.H
Consultant Related	23.00	10.90	L	17.00	11.64	L
Contractor Related	36.00	17.06	H	24.00	16.43	H
Material Related	12.00	5.68	V.L	7.00	4.79	V.L
L & E Related	24.00	11.37	L	16.00	10.95	L
Project Related	28.00	13.27	H	19.00	13.01	H
External Related	49.00	23.22	V.H	35.00	23.97	V.H
Total	<b>211.00</b>	<b>100.000</b>		<b>146.00</b>	<b>100.000</b>	

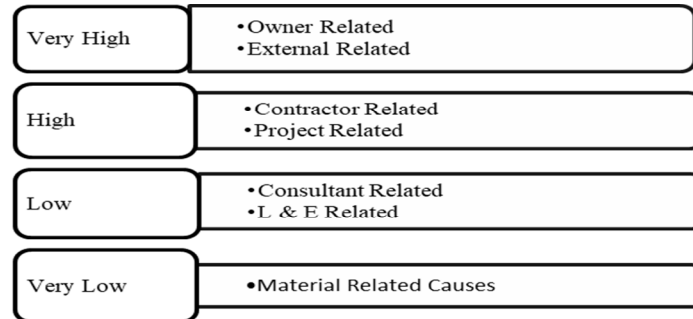
In table 10 class boundaries for median and percentage of severity index and frequency index are shown. The upper boundary of each class interval is exclusive in that group.

**Table 10: Class Intervals for median and percentage of SI & FI**

Class Intervals For SI	CI	Degree	Class Intervals for FI	CI	Degree
	0-5.8	Very Low		0-6	Very Low
	5.8-11.6	Low		6-12	Low
	11.6-17.4	High		12-18	High
	17.4-23.2	Very High		18-24	Very High

For achieving fourth objective results are shown it figure 2. Impact of owner related and external related

delay causes group is very high over project schedule delay. Management of construction project in Pakistan must pay proper attention for minimizing the impact of owner as well as external related delay causes. Impact of contractor and project related delay causes group over project schedule delay is high. Consultant related, labor & equipment related delay causes have low impact over Schedule delay. Material related delay group impact over schedule delay is very low.



**Figure 2: Prioritization Roadmap for SI & FI**

## 5. Recommendations

The following recommendations might help in minimizing schedule delay from construction projects in Pakistan. For Owners

- Owner should take decision quickly or we can say owner must take decisions on time regarding different matters.
- Owner should ensure sufficient and timely availability of funds to finance the project.
- Owner should ensure the proper feasibility study. Because it is conducted in start of the projects. Project cannot afford late or wrong feasibility study.
- Owner must be careful in interfering project. His interference must not cause in suspension or work.
- Getting required approvals from relevant federal as well as local authorities' for starting the project.
- Assigning experienced and financially sound contractors for project execution.

For Contractors

- Experience sub contractor and development of a system which must monitor and evaluate the progress of the project on regular basis
- For Consultant
- Consultant quick reply to the contractor queries and development of a system which will evaluate and control the variation orders initiated by owners.
- For Government of Pakistan
- Pakistan being a developing country can really improve its economic growth by introducing improved rules and regulation in the country.
- Introduction of an automatic, quick and efficient system of getting work permission at federal as well as local level can be very helpful in completing construction project successfully.

## 5.1 Conclusion

This research analyzed the causes of delay in construction industry of Pakistan. The feedback of experts related to construction industry was obtained through questionnaire surveys and interviews. Three (3) descriptive statistics tools severity index, frequency index and relative importance index were used for ranking the schedule delay causes. For each index top ten (10) delay causes in construction industry has been provided. Study use median and percentage for finding level of significance for seven (7) delay groups. These levels were Very Low, Low, High and Very High. Study discussed the results. Finally recommendations have been made for all the parties involved in contraction projects so that they can plan how to neglect or minimize the impact of these delay causes in their projects.

## References

- Alaghbari, W. E., Razali A. Kadir, M., Salim, A., & Ernawati. (2007). The significant factors causing delay of building construction projects in Malaysia. *Engineering, Construction and Architectural Management*, 14(2), 192-206.
- Akinsiku, O. E., & Akinsulire, A.(2012). Stakeholders Perception of the Causes and Effects of Construction Delays on Project Delivery. *Journal of Construction Engineering and Project Management*, 2(4), 25-31.
- Ashwini A.S.,& Rahul.S.P.(2014).Identification of critical construction delay factors. *International Journal of Latest Trends in Engineering and Technology*, Vol. (3), 256-261.
- Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International journal of*

- project management, 24(4), 349-357.
- Assaf, S. A., Al-Khalil, M., & Al-Hazmi, M. (1995). Causes of delay in large building construction projects. *Journal of management in engineering*, 11(2), 45-50.
- Aziz, R. F. (2013). Ranking of delay factors in construction projects after Egyptian revolution. *Alexandria Engineering Journal*, 52(3), 387-406.
- Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, S. (2012). Analyzing factors affecting delays in Indian construction projects. *International Journal of Project Management*, 30(4), 479-489.
- Gardezi, S. S. S., Manarvi, I. A., & Gardezi, S. J. S. (2014). Time Extension Factors in Construction Industry of Pakistan. *Procedia Engineering*, 77, 196-204.
- Gunduz, M., Nielsen, Y., & Özdemir, M. (2012). Quantification of delay factors using the relative importance index method for construction projects in Turkey. *Journal of Management in Engineering*, 29(2), 133-139.
- Haseeb, M., Bibi, A., & Rabbani, W. (2011). Problems of projects and effects of delays in the construction industry of Pakistan. *Australian Journal of Business and Management Research*, 1(5), 41-50.
- Kerzner, H. R. (2014). *Project Recovery: Case Studies and Techniques for Overcoming Project Failure*. John Wiley & Sons.
- Long, N. D., Ogunlana, S., Quang, T., & Lam, K. C. (2004). Large construction projects in developing countries: a case study from Vietnam. *International Journal of project management*, 22(7), 553-561.
- Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of advanced research*, 5(1), 49-55.
- Mazzarol, T., Norman Soutar, G., & Sim Yaw Seng, M. (2003). The third wave: future trends in international education. *International Journal of Educational Management*, 17(3), 90-99.
- Memon, A. H., Abdul Rahman, I., Abdullah, M. R., & Abdu Azis, A. A. (2011). Factors affecting construction cost in Mara large construction project: perspective of project management consultant. *International Journal of Sustainable Construction Engineering and Technology*, 1(2), 41-54
- Memon, A. H., Rahman, I. A., Abdullah, M. R., & Azis, A. A. A. (2014). Factors affecting construction cost performance in project management projects: Case of MARA large projects. *International Journal of Civil Engineering and Built Environment*, 1(1).
- Meng, X. (2012). The effect of relationship management on project performance in construction. *International journal of project management*, 30(2), 188-198.
- Mok, K. Y., Shen, G. Q., & Yang, J. (2015). Stakeholder management studies in mega construction projects: A review and future directions. *International Journal of Project Management*, 33(2), 446-457.
- Navon, R. (2005). Automated project performance control of construction projects. *Automation in Construction*, 14(4), 467-476.
- Nawaz, T., Ikram, A. A., & Qureshi, A. A. (2013). Causes of Schedule Overruns in Pakistani Construction Industry. *Journal of Mechanical and Civil Engineering*, 5(4), 01-11.
- Oisen, RP, Can project management be defined? *Project Management Quarterly*, 1971, 2(1), 12-14.
- Owolabi James, D., Amusan Lekan, M., Oloke, C. O., Olusanya, O., & Tunji-Olayeni, P. causes and effect of delay on project construction delivery time. *International journal of education and research*, 197-208.
- Rahsid, Y., ul Haq, S., & Aslam, M. S. (2013). Causes of Delay in Construction Projects of Punjab-Pakistan: An Empirical Study. *Journal of Basic and Applied Scientific Research*, 3(10), 87-96.
- Ravisankar, K. L., Kumar, D. S. A., & Krishnamoorthy, V. (2014). Study on the quantification of delay factors in construction industry. *International Journal of Emerging Technology and Advanced Engineering (IJETA)*, 4(1).
- Wright, JN, Time and budget: the twin imperatives of a project sponsor. *International Journal of Project Management*, 1997, 15(3), 181-186.
- Yang, J. B., & Kao, C. K. (2012). Critical path effect based delay analysis method for construction projects. *International Journal of Project Management*, 30(3), 385-397