

**CRITICAL FACTORS CAUSING DELAY IN CONSTRUCTION PERIOD  
OF BUILT OPERATE & TRANSFER (BOT) INFRASTRUCTURE  
PROJECTS IN PAKISTAN**

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PROJECTS IN PAKISTAN**

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has been accepted towards the partial fulfillment

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### THESIS ACCEPTANCE CERTIFICATE

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*This thesis is dedicated to my lovely family and honorable teachers!*

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## **ABSTRACT**

The development of infrastructures in Pakistan is very essential because it provides the basic need to the nation. From last decade, number of infrastructures projects have been launched by the Government but due to delay in timely completion of the projects, public is unable to utilize the complete benefits of Built Operate & Transfer (BOT) basis projects. This study focuses on identifying the critical delaying factors causing delay in construction period of BOT infrastructures projects in Pakistan and provide various mitigation measures to overcome them effectively. This study also helps in dealing with “effects of delay” which occurred due to certain delaying factors. Thirty-six critical delaying factors were identified from extensive literature study. Using a preliminary questionnaire survey, initially 45 responses are received. By data analysis fifteen delaying factors are shortlisted and twelve “Effects of Delay” are also finalized after content analysis. Thirty semi structure interviews are conducted from field experts for finding mitigation measures for these critical delaying factors and better deal with the delaying effects. Good planning, essential collaboration, cooperation in TORs handling, better communication and information sharing among all stakeholders should be promoted and strengthen at every stage of the execution for timely completion of the project.

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## **LIST OF ABBREVIATIONS**

PPP	=	Public Private Partnership
BOT	=	Build-Operate-Transfer
EPC	=	Engineering, Procurement & Construction
TORs	=	Term of References
IE	=	Independent Engineer
QC	=	Quality Control
QA	=	Quality Assurance
MS	=	Microsoft
GDP	=	Gross Domestic Product
PFI	=	Private Finance Initiative
SBP	=	State Bank of Pakistan

## **INTRODUCTION**

### **1.1. General**

Construction is an essential element for the development of any under-developed and developing country and it is also among the important factors that provides necessary ingredients for the better development of any country. In Pakistan, it has 9.13 growth rate and 0.25 percent share in total Gross Domestic Product (GDP) during the FY 2017-2018 and it has been decreased by 7.57 percent as compared to FY 2016-2017 (Finance Division Government of Pakistan, 2018).

Usually, infrastructure projects consist of following two main categories: -

- i. Economical Infrastructure Projects
- ii. Social Infrastructure Projects

(Ng and Loosemore, 2007) explained that typically, “economical infrastructure” projects include flyovers / bridges, highway, drainage systems, sewerage treatment plants and telecommunications network system, rail and air transport facilities, etc. Whereas, social infrastructure consists of education plan, prison, health, tourism and recreational facilities. Development of economic infrastructures have considered very important for any civilization and its development required very large investment (Naidu, 2008).

(Nagesha and Gayithri, 2014) studied that separation among demand and availability of infrastructure is rapidly increasing for developing countries mainly due to insufficient investment of governments both at the federal and provincial level over the long period of time owing to the present high rise building demand caused by globalization, urbanization and population growth. It has been revealed that to carryout infrastructure development of any

country there several type of project delivery methods are selected by the parties which involved in the construction (Ruparathna and Hewage, 2015).

The delivery method is the formal process under which a construction sector project is properly designed and executed for construction to full filling the client / owner requirements in accordance with project work scope definition, organization of design experts, contractors and different consultancy experts, sequencing of design and construction management & operations, implementation of design and construction, and closeout and start-up (Touran et al., 2009). Failure to select proper delivery method causes delay, cost over runs and compromise on the quality works of the projects (Lædre et al., 2006). There are basically two main types of project delivery methods:

- i. Traditional Delivery Method
- ii. Non-Traditional Delivery Method

The traditional project delivery method consists of owner, consultant and the contractor. The clients do separately legal agreements with contractor and consultant, while communication and coordination carried out between all these primary stakeholders until completion of project (Touran et al., 2009).

Non-Traditional project delivery methods include the following:

- Design and Construct Method
- Construction Management and Project Management Method
- In House Development Method
- Concessional or Private Funding Initiatives (PFI) Method

The Nontraditional method is different from the traditional method. It deviates from the traditional contractual arrangement involving the client, consultant and the contractor in order to favor more efficient management of each stage of the project lifecycle (Touran et al., 2009). PFI was first introduced in UK in 1992 (Al-Sharif and Kaka, 2004) and in this method obligations for procurement of services from the public entity to the private sector is shifted. The focus of this research is on concessional agreement methods. The commonly used forms of PFI are outsourcing or contracting out, such as Build-Operate-Transfer (BOT) (Alshawi, 2009). There are different types of project delivery methods in Public Private Partnerships, but BOT is a most common mode of public-private partnerships (PPP), because by adopting it, the chances increases for the commencement construction works through private investment and brings the development in related sector (Yang et al., 2010). In simple manner, this is achieved vide a concession agreement which includes by host government granting a license or concession to a private consortium i.e., concessionaire, promoter and sponsor which established a single purpose entity known as a Special Purpose Vehicle (SPV) using special contracts to the concession, for finances, design & build, operate and maintain an infrastructure project for complete concession period typically 20 to 25 years including construction period of 1.5 to 3 years (Ng and Loosemore, 2007). It has been experienced that even after the successful selection of a promotor and subsequent advancement in built and operate phases, projects may incur delay in construction phase (Yang et al., 2010). Delay are commons in construction projects but construction companies itself may not be in position to identifies the genuine reasons for delay in construction period (Aziz and Abdel-Hakam, 2016, Budayan, 2019). Due to delay in project implementation, people of the country have to wait to get the benefits from the services (Singh, 2010).

(Khan et al., 2016) studied that in construction sector production and design process is more complex and there is need to improve the management information flow to enhance the

productivity so that project can be completed within time frame. (Owolabi et al., 2014) studied that due to failure to achieve project completion with in time, budgeted cost and specified quality result as per construction standards in various unexpected negative effects on the projects.

## **1.2. Problem Statement**

Pakistan's economy has experienced boom and bust cycles. Recently, due to low growth in revenues government is facing financial burden / limitations and constraints for the development of infrastructure projects (Finance Division Government of Pakistan, 2018). To overcome the difficulties in arrangement of finances the delivery and operation of public facilities, government latched BOT concept in Pakistan (Mubin and Ghaffar, 2016). By putting money in a BOT project, private limited company first objective is to achieve a huge return on their investment in generating sufficient future cash flows to cover initial invested money and financial dues, thereby providing sufficient profit to again invest in future projects and pay shareholder dividends on time (Ng and Loosemore, 2007). Delays in construction duration / period may instigates the cost overruns and negative impact on overall financial model / cash flow of the project company & the relationships of client, financiers, sponsor, concessionaire and consultants (Feyzbakhsh et al., 2018, Owolabi et al., 2014). Due to delay, loss of revenue collection to the project company, delay in payment to financiers & promoters on account of debt installment, delay in business development or commercial activity which may leads the project or stakeholders towards mistrust, arbitration, litigation and termination of contract (Owolabi et al., 2014). Due to certain delaying factors, both (Public & Private) sectors are unable to utilize the complete benefits of BOT projects.

## **1.3. Level of Research Already Carried Out on the Proposed Topic**

(Mubin and Ghaffar, 2016) thoroughly studied the applicability of BOT projects in Pakistan and develop procedural model and proposed risk management model to manage associated the risks



to the project faced by parties during project execution. (Babatunde et al., 2017) study revealed the 22 delaying factors specifically for land acquisition process and group them into 4x important factors which names are as under :-

- i. Resettlement issues with highly political interference
- ii. Non-availability of land
- iii. Weak planning organization / institutions
- iv. Rehabilitation issues due to extensive legal delays

(Budayan, 2019) evaluated the delay causes by conducting a workshop using analytical hierarchical process (AHP). (Vu et al., 2015) discussed the financial factors causing delay on schedule by using exploratory factor analysis and questionnaire survey. By conducted a review study especially on delays of projects in developing countries during planning and construction stages of the project. It has been found that the delays and cost overruns are interconnected in construction projects on the very early stages of the project (Mohammed and Isah, 2012).

(Yang et al., 2010) studied that in BOT construction project large numbers of complicated problems would slow down their implementation speed in each stage and even that diminish the partial interests of private sector entities. (Yates, 1993) studied about construction delays, the study help to prepare a decision support system for construction delay analysis which is called (DAS). The main categories of delays in DAS according to the study are includes engineering techniques, management, material and equipment, external delays event, owner, suppliers & subcontractors, and adverse weather condition.

Hence, discussed the above research works it can be noticed that work is mostly carried out on factors causing delay for implementation of BOT projects and on traditional methods in which

project duration is affected by different unforeseeable events. Dearth of studies is conducted specifically for BOT projects to identify the reasons due to which projects are being delayed and public & private sectors are not in position to obtain complete benefits from these projects. This research will highlight the main factors which are causing the delay in construction period and refraining public and private sectors to get the benefits.

#### **1.4. Reasons/Justification for Selection of Topic**

The government of Pakistan (GOP) is facing fiscal impediments for sustainable economic and social development, however, there is requirement for provisions of infrastructural development in the country. The amount of investment can hardly materialized while the projects which are already started are facing delay in its completion due to unforeseen reasons. Private investors facing fiscal loss and end-users (Public) have to wait longer to get the advantages from these services. (Mubin and Ghaffar, 2016) identified that since in last two decades, Pakistan has experienced mixed results of success and failure related with BOT construction projects in its completion. Therefore, there is a special requirement to understand the main factors which are involved towards the delay in timely completion of the projects. This study aims to identify critical factors causing delay in construction period of BOT infrastructure projects and finding recommendations regarding mitigation the effect of these critical factors.

#### **1.5. Objectives**

- To identify the critical factors causing delay in construction period of BOT infrastructure projects
- To investigate the effects of delay in BOT infrastructure project
- To give recommendations to minimize the effect of critical factors causing delay in project

## **1.6. Relevance to National Needs**

Project which is executed under Public Private Partnership have high probability to stick within allotted budget than the projects which are procured traditionally (Grimsey and Lewis, 2005). By putting money into BOT projects, private sectors needed to obtained a sufficient return on their investments and obtaining an enough future cash flows in the form of income to recoup initial invested capital costs and other financial payments, hereby providing enough net profit value to invest in upcoming future projects and pay back to shareholder's markup and dividends. But, in Pakistan most of the public sector BOT projects counter the time delays in its completion timeframe due to which loss of revenue collection to the private investors, delay in re-payment to financiers, promoters, sponsor on account of debt and equity installment which may leads the shareholders to under financial crunch. This study will provide the guidelines to eliminate the delaying factors which are causing the financial loss to shareholders, so that maximum benefits can be obtained.

## **1.7. Advantages**

The main advantages of this research will be as given below;

- Reduce the development and infrastructure budget from the governments and transfer of risk to concession company
- Minimize the effect of factors causing delayed in timely completion of project and increases the chances that project will be completed within time & budget
- Give guidelines to private company to focus on it define scope and receive maximum profit

- Timely payment of all dividends between shareholders
- End-user (Public) can avail the services, at earliest.

## LITERATURE REVIEW

### 2.1. Introduction

This chapter discuss the definition of Infrastructure, BOT & Delay and gives overview of the applicability of the BOT projects and schedule delay in its construction phase for public infrastructure development. Detailed literature will be discussed covering the critical factors that caused delayed in construction period of the projects. The last part will describe the identified critical delaying factors extracted from the research articles published in different journals.

### 2.2. Public Infrastructure

There are two types infrastructure projects (i) social infrastructure and (ii) economic / public infrastructure. First, social infrastructure consists of education, prisons, health, tourism and recreational facilities and facilities which are indispensable for the proper functioning of the economy and society of a country are commonly known as economic infrastructure or public infrastructure (Ng and Loosemore, 2007). Social activity, similar with “economic” and “social” infrastructure, that also includes the secondary functions, such as public-sector offices and accommodations. (Argy et al., 1999) stated that public infrastructure has both “hard” and “soft” facets given in Table 2.1.

**Table 2.1 (Classification of Infrastructure by Type)**

Type	Hard	Soft
<b>Economic</b>	Ports, Motorways, Airports Bridges & Flyovers, Telecommunication Power	Technology software transfer, Vocational training programmes, R & D facilities, Financial institutions, Export assistance
<b>Social</b>	Hospitals for treatment, Water supply system, Prisons, Housing, Sewerage system and Child Care Schools, Aged care homes	Social security programmes, Community services, Environmental agencies

### 2.3. Built Operate & Transfer (BOT)

Built Operate & Transfer is the type of PPP contract under which private investment is utilized to undertake the infrastructure development and that has been historically the preserve of the public sector (UNIDO 1996). The BOT modality is refer as given: -

- **Build** – A private party agreed upon a concession agreement with the government sector to build an infrastructure facility.
- **Operate** – In this stage, the Concessionaire / private company takes over operations and maintenance of the infrastructure facility for mutually agreed concession timeframe as per concession contract and recovers their invested money through charges / tolls levies.
- **Transfer** – After the expiration of concession timelines the private sector transfer the complete possession and operations of the said facility to the government department or relevant state authority

BOT is a type of project delivery, where a private company enter a concession from the private or public division for finances, architect and design, build / construct, operate and maintenance a facility for a specified period, usually 20 or 30 years which is known as concession period. This specified period consists of construction period & operational period. After the concession period expires, possession is transferred back to the granting unit.

### 2.4. Build Operate and Transfer (BOT) Delivery System in Pakistan

(Kumaraswamy and Zhang, 2001) spotlight that BOT project delivery system has produced different efficient ways to exploit private company finances, technology transfer, management expertise and abilities for the construction of the infrastructures projects. However, large number of countries lack BOT experience and familiarity. The BOT method is being worked in good

manner specially in Hong Kong, with reference to the five (5) toll tunnels. Host governments mostly offer guarantees in build operate transfer infrastructure projects to catch the attention of private investors.

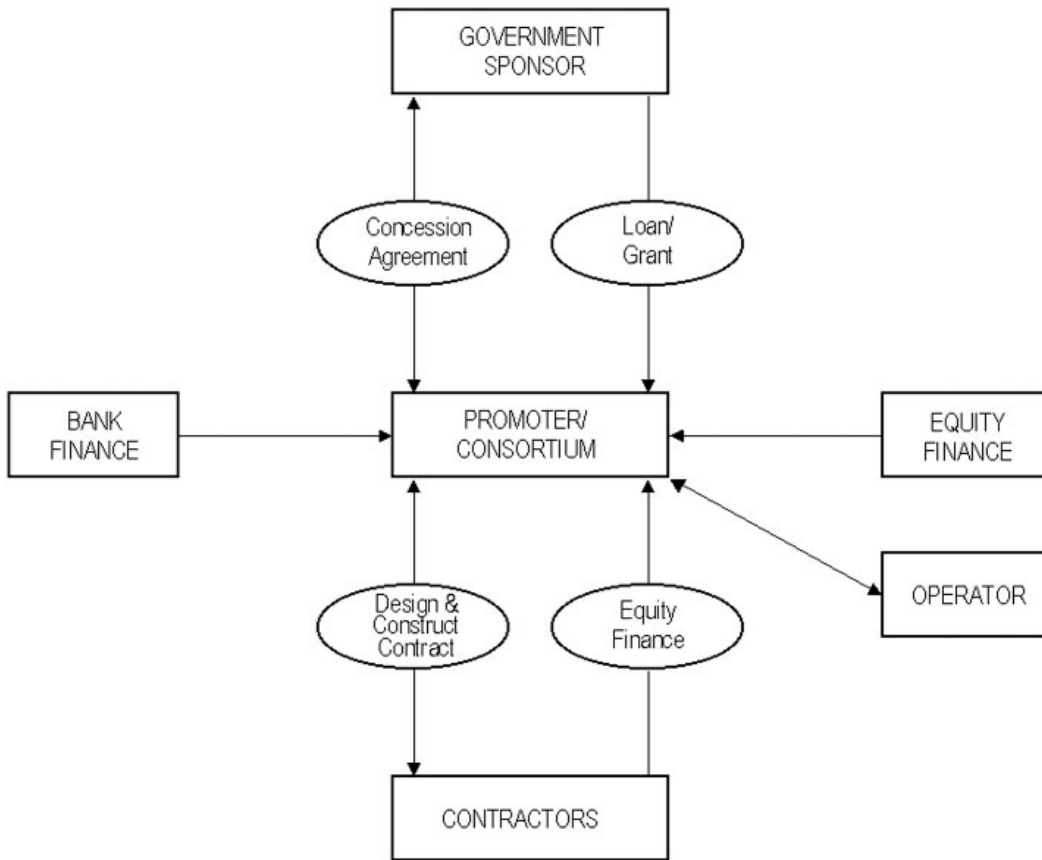
In Pakistan, development of infrastructure with growing population is need of the hour. Development of infrastructure at national level requires large financial resources involving use of public finances and foreign investments in parallel to other important social sector works. The government is unable to meet development targets due to its insufficient financial resources. It is therefore mandatory for Pakistan's government, to implement an indirect approach i.e., BOT (Khan et al., 2008).The first priority always remained questionable for the initiation of each government sponsored infrastructure development project specifically in Pakistan. BOT is suitable option for funding in the infrastructure projects and give raise to economic development of the country without direct consumption of government's financial assets and resources. In private sector companies the sponsor who have land resources but no investment to make the adequate development on these lands, BOT can be an alternate. The BOT projects have the prospective to facilitate the government and as well as private sector with equal effectiveness (Khan et.al 2008).

Pakistan is going though worst economic slump therefore funding for infra structure development program is becoming inadequate, so there is prospect to involve private sector in infra structure development facilities such as road, railways, bridges, power plant, waters treatment plant etc. There are also serious issues associated with expansion of the current infra structure in areas such as electricity, housing, healthcare and education. In this situation, by increasing the private companies' participation to BOT projects in development of medium to large scaled infrastructures facilities or projects with minimize the financial burden on the government bodies. In addition, in last decades due to rapid increase in the population growth, it has been necessitated that the new construction facilities as well as rehabilitation and maintenance of existing projects should be carried out at priority.

Keeping in mind the recent construction developments in the world, Government of Pakistan is also encouraging private companies to take part in establishment of the facilities such as highway, motorway, expressways, railways, flyovers / bridges, local roads, airports power plants, water supply, ports etc. The Government of Pakistan is trying to attract private companies for large scaled investment projects due to its financial limitations. Pakistan is a developing country and the government rarely has the enough finances to meet development challenges and have financial constraints to carry out the infra-structure development projects. BOT is an alternate option to serve the government and to finance such projects without direct utilization of government budget. But unfortunately, this concept has not gained much popularity in Pakistan and somehow few projects which are imitated by the Government are facing delay in its completion.

A typical organizational structure of BOT project is shown below in Figure 2.1 as described by (Uher and Davenport, 2009)





**Figure 2.1 (Organizational Structure of a BOT Method of Project Delivery)**

## **2.5. Delay / Schedule Delay**

The schedule delay is the “time overrun” (required additional time) either beyond stipulated project completion date agreed in a contract agreement, and date that the parties agreed upon for delivery of a completed project (Aziz and Abdel-Hakam, 2016).

(Menesi, 2007) distinguished the delay types into two different types pertaining to liabilities as given below:

### **1. Excusable Delays**

- Compensate able (Owner) and
- Non-Compensate able

### **2. In-excusable Delays**

It has been experienced that time required for construction of infra project and subsequently its performance have usually an importance consideration for both the project’s sponsor (Owner) and the project’s Concessionaire. So far, it is almost common that construction projects are to delay due to different delaying factors beyond the control of the both parties. Delays may be due to reason by the owner (compensable delay), by the contractor (non-excusable delay), by acts of God, or any third party (excusable delay), or different kinds of delays that would happen subsequently (Kraiem et al., 1987).

## 2.6. Critical Delaying Factors

Initially, extensive research articles published in different journals were studied between years 2010 – 2020 were analyzed and 60 most critical factors were identified from these papers. After merging the similar factors, only 36 factors were chosen for further research process.

**Table 2.2 (Critical Delaying Factor)**

<b>Sr #</b>	<b>Critical Delaying Factor</b>	<b>References</b>
1	Uncompleted Client Furnish Items	(Yang et al., 2010),(Gonzalez et al., 2014)
2	Change in Policies and Regulations	(Sepasgozar et al., 2019), (Owolabi et al., 2020, Vu et al., 2015),(Chan et al., 2015, Budayan, 2019),(Hwang et al., 2013)
3	Un-necessary demand of Client	(Yang et al., 2010),(Budayan, 2019),(Gonzalez et al., 2014),(Gündüz et al., 2013),(Rauzana and Engineering, 2016)
4	Protection of geological and historical objects	(Ke et al., 2010)
5	Deficiency in Design	(Yang et al., 2010),(Babatunde et al., 2017),(Budayan, 2019),(Gonzalez et al., 2014), (Akinsiku and Akinsulire, 2012),(Gonzalez et al., 2014),(Rauzana and Engineering, 2016), (Hwang et al., 2013),(Ke et al., 2010), (Mahamid et al., 2012), (Owolabi et al., 2014)
6	Fluctuation on Resource Price	(Mahamid et al., 2012), (Chan et al., 2015), (Budayan, 2019), (Yang et al., 2010)
7	Attitude of sub-contractors or suppliers	(Chou and Pramudawardhani, 2015), (Hwang et al., 2013), (Ke et al., 2010), (Gündüz et al.,

		2013), (Owolabi et al., 2014, Vu et al., 2015), (Aziz and Abdel-Hakam, 2016), (Gündüz et al., 2013)
8	Availability of Equipment	(Yang et al., 2010), (Gonzalez et al., 2014), (Rauzana and Engineering, 2016), (Mahamid et al., 2012), (Aziz and Abdel-Hakam, 2016, Owolabi et al., 2014),(Chan et al., 2015)
9	Shortage of Material	(Budayan, 2019), (Gonzalez et al., 2014), (Yang et al., 2010), (Rauzana and Engineering, 2016), (Chou and Pramudawardhani, 2015), (Hwang et al., 2013), (Ke et al., 2010), (Mahamid et al., 2012, Aziz and Abdel-Hakam, 2016), (Chan et al., 2015), (Gündüz et al., 2013, Owolabi et al., 2020)
10	Change Order / Variation Order	(Yang et al., 2010), (Budayan, 2019), (Sepasgozar et al., 2019), (Hwang et al., 2013), (Mahamid et al., 2012), (Aziz and Abdel-Hakam, 2016, Gündüz et al., 2013)
11	Poor Planning & Management by Project Team	(Gonzalez et al., 2014), (Abdul-Aziz and Kassim, 2011),(Aziz and Abdel-Hakam, 2016), (Gündüz et al., 2013), (Budayan, 2019), (Mahamid et al., 2012), (Chan et al., 2015), (Gündüz et al., 2013),
12	Delay in construction schedule	(Yang et al., 2010), (Chou and Pramudawardhani, 2015), (Mahamid et al.,

		2012), (Hwang et al., 2013), (Gündüz et al., 2013), (Aziz and Abdel-Hakam, 2016), (Budayan, 2019)
13	Inflexibility of Consultant	(Mahamid et al., 2012)
14	Inadequate Site Safety & Security Measures	(Aziz and Abdel-Hakam, 2016), (Rauzana and Engineering, 2016), (Chou and Pramudawardhani, 2015), (Hwang et al., 2013, Ke et al., 2010), (Owolabi et al., 2020)
15	Financial Deficit / Availability of Finance	(Yang et al., 2010), (Budayan, 2019), (Sepasgozar et al., 2019), (Aziz and Abdel-Hakam, 2016), (Chan et al., 2015), (Vu et al., 2015), (Ke et al., 2010, Hwang et al., 2013), (Rauzana and Engineering, 2016),
16	Construction Cost overrun	(Yang et al., 2010), (Budayan, 2019), (Sepasgozar et al., 2019) (Aziz and Abdel-Hakam, 2016), (Chan et al., 2015)
17	Political influence	(Hwang et al., 2013), (Mahamid et al., 2012), (Chan et al., 2015)
18	Lack of communication and coordination between parties	(Hwang et al., 2013), (Chou and Pramudawardhani, 2015, Aziz and Abdel-Hakam, 2016), (Chan et al., 2015),
19	Corruption & Bribery	(Hwang et al., 2013), (Chan et al., 2015)

20	Unstable Economic Growth (inflation)	(Vu et al., 2015), (Rauzana and Engineering, 2016), (Hwang et al., 2013), (Ke et al., 2010), (Budayan, 2019), (Owolabi et al., 2020),(Mahamid et al., 2012), (Owolabi et al., 2014)
21	Availability of Land / Possession of Site	(Babatunde and Perera, 2017), (Sepasgozar et al., 2019), (Ke et al., 2010), (Mahamid et al., 2012), (Chan et al., 2015), (Hwang et al., 2013), (Gündüz et al., 2013),(Owolabi et al., 2020)
22	Litigation (Public Opposition)	(Babatunde et al., 2017), (Aziz and Abdel-Hakam, 2016), (Owolabi et al., 2014), (Mahamid et al., 2012), (Chan et al., 2015)
23	Inexperience Labor	(Gonzalez et al., 2014), (Rauzana and Engineering, 2016), (Chou and Pramudawardhani, 2015), (Ke et al., 2010), (Mahamid et al., 2012), (Aziz and Abdel-Hakam, 2016)
24	Trivial Administrative Procedure	(Budayan, 2019)
25	Preparation and approval of shop drawings	(Aziz and Abdel-Hakam, 2016), (Abdul-Aziz and Kassim, 2011)
26	Unexpected increased quantity	(Budayan, 2019)
27	Failed Examination & Inspection	(Budayan, 2019, Mahamid et al., 2012), (Gündüz et al., 2013)
28	Unproven engineering techniques &	(Hwang et al., 2013), (Mahamid et al., 2012),

	methods	(Aziz and Abdel-Hakam, 2016), (Owolabi et al., 2020)
29	Adverse Weather conditions	(Gonzalez et al., 2014), (Rauzana and Engineering, 2016), (Hwang et al., 2013), (Ke et al., 2010), (Mahamid et al., 2012), (Aziz and Abdel-Hakam, 2016), (Chan et al., 2015, Owolabi et al., 2014)
30	Social Culture Rights	(Rauzana and Engineering, 2016), (Hwang et al., 2013), (Mahamid et al., 2012), (Chan et al., 2015),
31	Force Majeure Event	(Chan et al., 2015), (Hwang et al., 2013), (Mahamid et al., 2012), (Owolabi et al., 2020)
32	Obtaining Permits / NOC	(Hwang et al., 2013), (Aziz and Abdel-Hakam, 2016), (Chan et al., 2015), (Owolabi et al., 2020)
33	Inadequate experience by Concessionaire	(Hwang et al., 2013), (Chan et al., 2015), (Gündüz et al., 2013)
34	Unforeseeable Ground Conditions / Geological Conditions	(Hwang et al., 2013), (Ke et al., 2010), (Mahamid et al., 2012), (Chan et al., 2015), (Gündüz et al., 2013)
35	Delay in decision making by client	(Mahamid et al., 2012), (Aziz and Abdel-Hakam, 2016), (Gündüz et al., 2013)
36	Delay in Commencement	(Mahamid et al., 2012), (Owolabi et al., 2014)

## 2.7. Effects of Delay

Number of critical delaying factors caused the overall delay in the construction duration of the project such as few may be within Concessionaire's obligations and few are within Client's side. It is very hard for researchers to define separately due to over-lapping nature of the delaying events that which party or parties are accountable and what are solid elements of the delay causes (Haseeb et al., 2011). Followings are the major delay effects which are identified in construction industry of Pakistan:



Figure 2.2 (Effects of Delay)

Table 2.3 (Effects of Delay)

Sr #	Effects of Delay	References
1	Cost overruns	(Haseeb et al., 2011), (Aibinu and Jagboro, 2002), (Sunjka and Jacob, 2013),



		(Sambasivan and Soon, 2007), (Bekr, 2018), (Owolabi et al., 2014), (Motaleb and Kishk, 2010), (Mahamid et al., 2012), (Akinsiku and Akinsulire, 2012)
2	Extension of Time / Time Overrun	(Haseeb et al., 2011), (Aibinu and Jagboro, 2002), (Sunjka and Jacob, 2013), (Sambasivan and Soon, 2007), (Bekr, 2018), (Owolabi et al., 2014), (Motaleb and Kishk, 2010), (Mahamid et al., 2012), (Akinsiku and Akinsulire, 2012)
3	Dispute between parties	(Haseeb et al., 2011)
4	Negotiations / Arbitration	(Haseeb et al., 2011), (Sunjka and Jacob, 2013), (Sambasivan and Soon, 2007), (Bekr, 2018), (Owolabi et al., 2014), (Motaleb and Kishk, 2010), (Mahamid et al., 2012), (Akinsiku and Akinsulire, 2012)
5	Late return of income and profit	(Owolabi et al., 2014), (Pourrostam et al., 2012), (Akinsiku and Akinsulire, 2012)
6	Litigation (Lawsuits)	(Haseeb et al., 2011), (Aibinu and Jagboro, 2002), (Sunjka and Jacob, 2013), (Sambasivan and Soon, 2007), (Bekr, 2018), (Owolabi et al., 2014), (Motaleb and Kishk, 2010), (Mahamid et al., 2012), (Akinsiku and Akinsulire, 2012)
7	Abandonment	(Haseeb et al., 2011), (Aibinu and Jagboro,

		2002), (Sunjka and Jacob, 2013), (Sambasivan and Soon, 2007), (Bekr, 2018), (Owolabi et al., 2014), (Motaleb and Kishk, 2010), (Mahamid et al., 2012), (Akinsiku and Akinsulire, 2012)
8	Negative Social Impact	(Sunjka and Jacob, 2013), (Pourrostam et al., 2012)
9	Incremental Cost due to claims	(Sunjka and Jacob, 2013)
10	Bankruptcy of any stakeholder	(Owolabi et al., 2014),(Mubin and Ghaffar, 2016)
11	Additional insurance charges and taxes	(Akinsiku and Akinsulire, 2012)
12	Poor Quality	(Sunjka and Jacob, 2013)

## **RESEARCH METHODOLOGY**

### **3.1 Introduction**

In this section discussed about the detailed research methodology formulized for this study to achieve the set forth objectives, as discussed in chapter 1. Research methodology defines that how research is to be followed on each stage to achieve the objectives of the research (Leiva et al., 2017). For this study the research data is mainly collected through extensive literature review and questionnaire survey. After data collection, a detail analysis of the data was done. In fourth phases the research was completed and as described in research design heading.

### **3.2 Research Design**

In the first phase of the research, as shown in Figure 3.1 after development of research proposal, pertinent literature was reviewed to understand and identified the critical factor causing delay in construction period of projects. In addition, effects of delay were also extracted from different research articles. These delay factors were identified from literature review and previous studies published in different papers. The [www.google.com](http://www.google.com) and research gate as a search tool were used as a primary source for literature review.

In second phase, an inquiry form inform of questionnaire was developed and circulated to field professionals and related peoples by online. In third phase the data collected from questionnaire survey was analyzed by using MS excel.

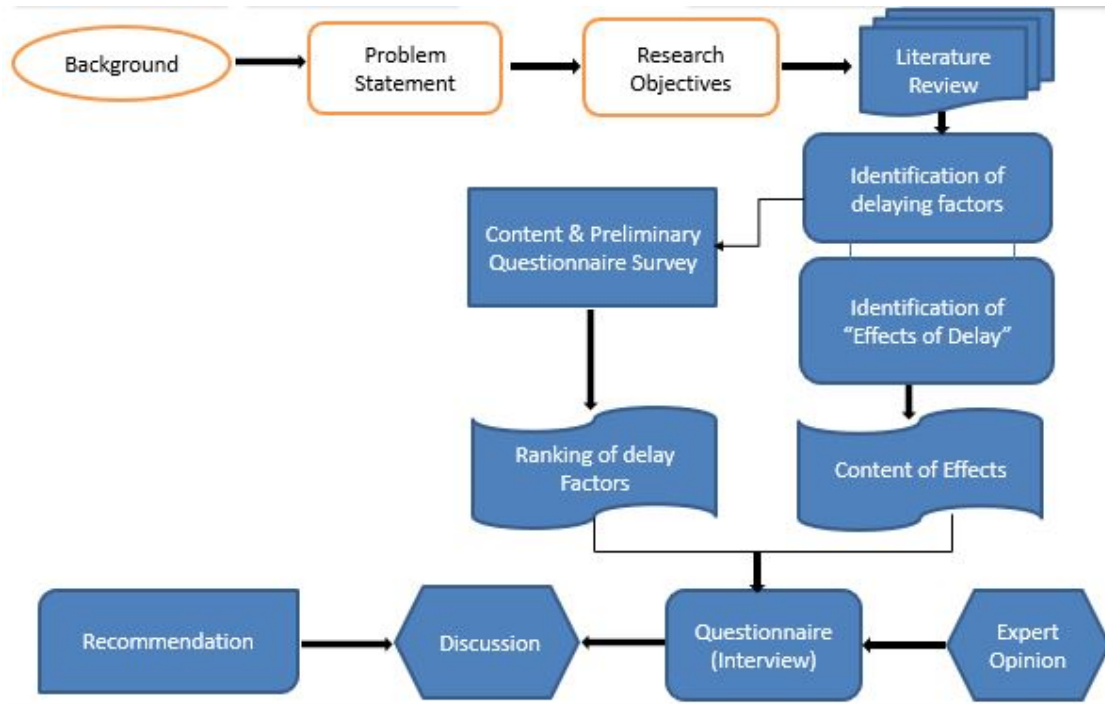


Figure 3.2 (Flow Chart for Research Methodology)

### 3.3 Questionnaire

Extensive pertinent literature reviewed relevant to topic and a questionnaire was developed. Sum of total 36 critical delaying factors were acknowledged, and a questionnaire survey was circulated to field expert. The questionnaire form consisted of two important portions. First portion focused on obtaining personnel information of the respondents. While in the second portion respondents were asked to rank the critical delaying, the factors using on a Likert scale from 1 to 5. Where 1 represented very low impact and 5 represented very high impact. Annexure 1 contains the questionnaire survey used for the study.

### **3.4 Data Analysis**

Below statistical tests/techniques were used for analysis of collected data.

#### **3.4.1 Reliability Test**

Cronbach's coefficient alpha method is adopted to check the reliability of collected data on Likert scale. The collected data is reliable if the value of Cronbach's alpha is greater than 0.7 and if the value is greater than 0.9, the collected data is highly consistent (Li, 2007). Moreover, If the value of Cronbach's alpha is 0.977 the collected data is considered as highly consistent for further analysis.

#### **3.4.2 Kruskal Wallis Test or one-way ANOVA**

This test is useful to know that three (3) or more independent groups have same perception or not regarding the variables. If the data is non-parametric in nature than Kruskal Wallis test is applied and if the data is parametric in nature than One-way ANOVA is applied. The results of the analyzed data are tested against the significance level of 0.05. Value of significance equal and greater than 0.05 is considered that all the respondents have same perception and vice versa.

### **3.5 Interviews**

Interviews enable detailed discussion on the subject topic with the respondent (Arksey and Knight, 1999). Interviews can be categorized as structured, semi-structured and unstructured. For evaluating the remedy for delaying factors and effects of delay, recommendations measures in Built Operate & Transfer infrastructures projects of Pakistan, mixed interviews were conducted in a very comfortable environment to enable the respondents to speak freely and in detail in order

to extract maximum information. Although discussion was controlled to remain topic centered in order to have fruitful interview in permissible time of one-hour maximum.

Questions in the interviews were purely related to respondent's view of delaying factors and effects of delay for BOT infrastructures projects in Pakistan and their recommendation for mitigation of these factors and better dealing with its effect after their occurrence.

### **3.6 Sample Selection and Size**

As the matter of the fact, change comes from top. Taking this fact into consideration interviews were conducted only from senior management of the Pakistan's construction firms. The client, concessionaries, EPC developer, contractors and consultants' firm of Islamabad, Lahore and Karachi were interviewed. Due to epidemic disease of COVID-19 spread, for the firms of Karachi and Islamabad, telephonic interviews were conducted, but in Lahore, firms were personally visited by adopting all health and safety measures. According to Alan Bryman of University of Leicester, for an interview based qualitative study 20-30 interviews are sufficient for sample size (Bryman, 2006).

### **3.7 Data Analysis**

Data was analyzed using the techniques of Content Analysis. Content analysis is analyzing visual, written or oral communication (Cole, 1988). During content analysis, the main idea and keywords spoken by the interviewees were considered as the primary content.

### **3.8 Summary**

This chapter discussed in detail about research methodology adopted for the study. Questionnaire development, sample size of population and statistical analysis of data were described comprehensively. The findings and results of the analyzed data is described in the subsequent chapter.

## **DATA ANALYSIS AND RESULTS**

### **4.1 Introduction**

In this chapter the data analysis and the results are discussed. The objectives of this research, as set forth in the beginning, the identification of critical delaying factors and their remedy to minimize the effects of delay for BOT projects in Pakistan.

The questionnaire survey was floated to rank the delaying factors which caused the delay in timely completion of BOT infrastructures projects. This study aims to give recommendation to minimize the impact of delaying factors and better deal the effects of delay if occurred.

### **4.2 Characteristics of Respondents**

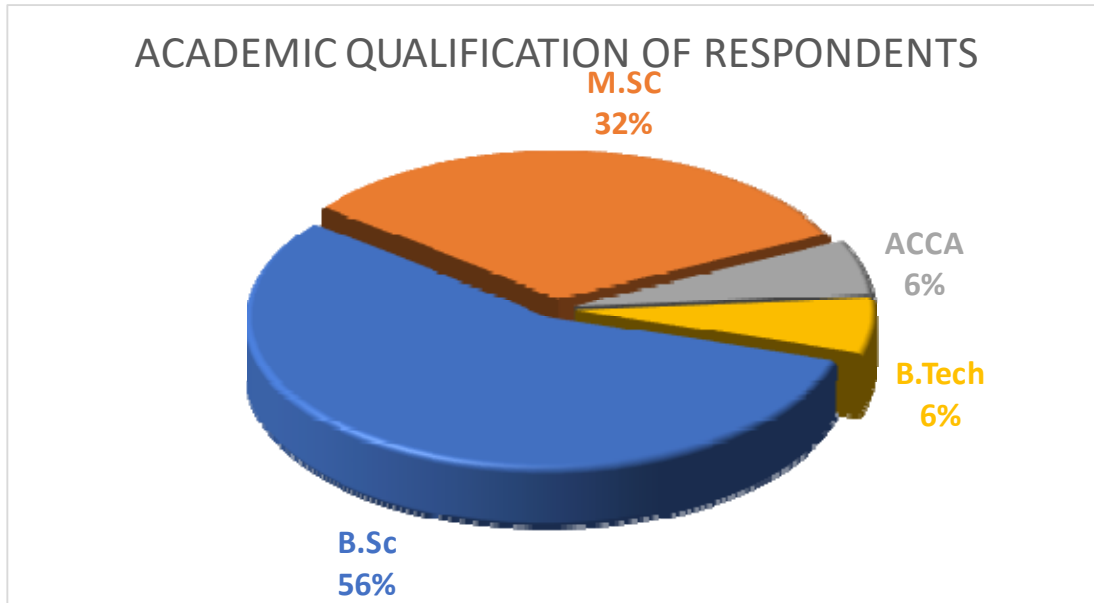
The questionnaire was circulated by using the google form among client, EPC developer, contractor, consultant, Financers and other related construction professionals. A total of 45 responses were obtained. After detailed scrutiny 34 responses were finalize in line with a suitable mix of different sub-sector experts with various types of qualification, associated organizations and nature of experiences. The details of the respondents are as follows.

#### **4.2.1 Academic Qualifications**

Responses were made by construction professionals having different academic backgrounds.

Figure 4.1 explains the respondents' highest academic qualification: Construction professionals having professional engineering degree were 56%, with further masters were 32%. The construction professionals at senior positions but with B. Tech in Civil Engineering 6% and 6 % of ACCA. Financers were also approach because financers inject their money in BOT projects in form of debt to Sponsor or Concessionaire.





**Figure 4.1 (Academic Qualifications of Respondents)**

#### **4.2.2 Professional Experience**

The respondents had varying years of professional experience. Figure 4.2 demonstrates that 47% of respondents carried up to 5 years of experiences, while the next majority 38% had between 6-10 years of experience. Moreover, 3% respondents had 11-15 years, 9% respondents had 16-20 years, and 3% respondents had more than 20 years of professional experience in the construction industry.



**Figure 4.2 (Professional Experience)**

### 4.2.3 Type of Organizational

Another classification considered for the 34 respondents was their organization's role in the construction industry. Figure 4.3 shows that 20% respondents belong to client organizations, 9% to consultant, and 65% to EPC Developer / contractor and 6% to Financers organizations.

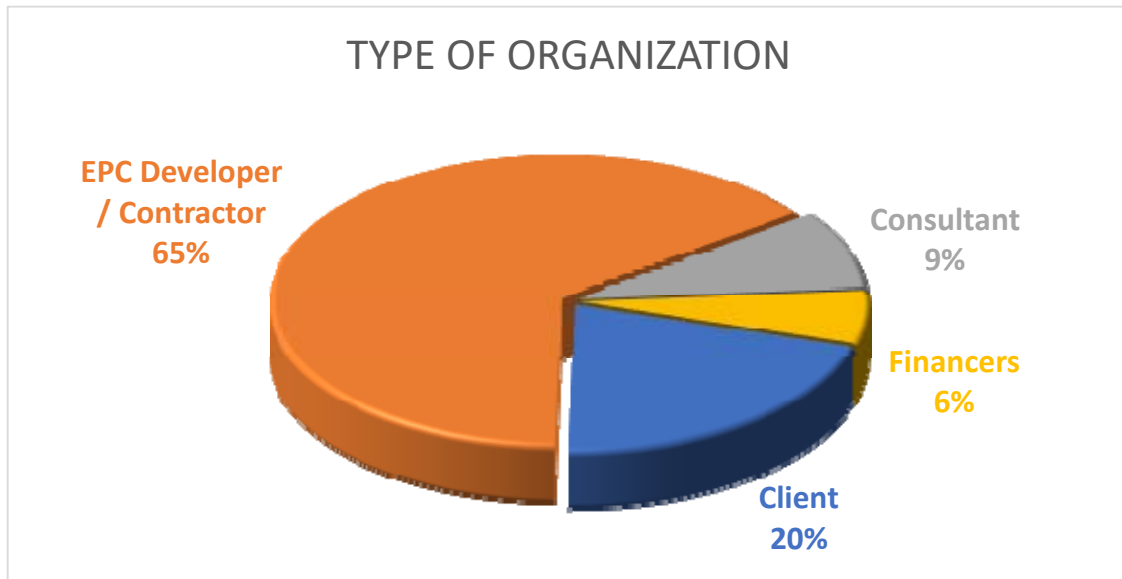


Figure 4.3 (Type of Organization)

## 4.3 Statistical Analysis

For statistically analysis, reliability test was conducted, detail is given below:

### 4.3.1 Reliability Analysis

(Taherdoost, 2016) have also explained reliability as a data tested to study any specific topic at different times and across several types of samples and populations, if gives similar results, then questionnaire is a reliable option.

Cronbach's Alpha for continuous data Likert-scale type items is frequently used method (Hinton et.al 2004 and Leech et.al 2005). (Taherdoost, 2016) determined that Cronbach Alpha value vary from 0 (un-reliable) to 1 (reliable) with 0.75 being considered the most reliable value. They have also provided a guideline to test the reliability of any data as shown in the Table 4.1.

**Table 4.1 (Reliability Data)**

<b>a</b>	0.9 & above	Excellent (Reliable)	<b>b</b>	0.7 to 0.9	High (Reliable)
<b>c</b>	0.5 to 0.7	Moderate (Reliable)	<b>d</b>	0.5 & below	Low (Reliable)

Cronbach's alpha method is used to identify the reliability of the collected data on Likert scale.

The Cronbach's alpha value is 0.928, so the data has excellent reliability as shown in table 4.2.

**Table 4.2 (Reliability Statistics)**

<b>Reliability Statistics</b>	
Cronbach's alpha	N of Items
0.928	36

### **4.3.2 Comparison of Literature Review Data and Field Data**

Further analysis decision based on purely literature review data or purely on field data results maybe criticized. Therefore, it was required to compare the two streams of results. These two streams were compared using the following different options.

- a. 20 / 80 ratio i.e. 20% to literature review 80% weightage to filed data
- b. 30 / 70 ratio i.e. 30% to literature review 70% weightage to filed data
- c. 40 / 60 ratio i.e. 40% to literature review 60% weightage to filed data
- d. 50 / 50 ratio i.e. 50% to literature review 50% weightage to filed data

For each above option, following analytical results were calculated with the help of excel sheet formulas.

- a. Literature Score
- b. Industry Score
- c. Normalized Total Score

d. Cumulative Normalize Score

e. Rank

Results of all these four different weightings options are tabulated in Table 4.3 to see the variance in each weighted option.

**Table 4.3 (Literature & Field Data Ratio)**

<b>Sr #</b>	<b>20/80 ratio</b>	<b>30/70 ratio</b>	<b>40/60 ratio</b>	<b>50/50 ratio</b>
1	30	31	32	31
2	4	3	3	2
3	21	21	21	21
4	35	35	35	34
5	3	5	8	8
6	16	16	17	16
7	19	19	19	18
8	17	15	16	15
9	6	7	6	6
10	9	10	11	12
11	5	6	9	9
12	8	8	7	7
13	29	30	31	32
14	31	29	27	23
15	1	1	1	1
16	10	11	12	13
17	14	14	14	14
18	20	22	22	22
19	32	32	30	29
20	13	9	5	4
21	2	2	2	3
22	12	12	10	10
23	23	18	13	11
24	33	33	34	35
25	34	34	33	33
26	24	27	28	28
27	26	26	26	26
28	27	25	24	25
29	7	4	4	5
30	36	36	36	36
31	25	24	23	24
32	15	17	18	19
33	18	20	20	20
34	28	28	29	30
35	11	13	15	17
36	22	23	25	27

### 4.3.3 Conclude Top Rank Factors

40 / 60 ratio was selected for shortlisting these factors, so that expert opinion be determined for remedy measures of the shortlisted factors. Top 15 factors were shortlisted on the basis of 50 percent combined cumulative normalized score (Scheirer et al., 2010). 15x delaying factors which are shortlisted are tabulated below (Table 4.4):

**Table 4.4 (Top Ranked Factors)**

<b>Factor</b>	<b>Normalized Score</b>	<b>Cumulative Score</b>	<b>Rank</b>
Financial Deficit / Availability of Finance	0.042	0.042	1
Availability of Land / Possession of Site	0.035	0.077	2
Change in Policies and Regulations	0.035	0.112	3
Adverse Weather conditions	0.034	0.146	4
Shortage of Material	0.033	0.179	5
Deficiency in Design	0.033	0.212	6
Delay in construction schedule	0.033	0.245	7
Poor Planning & Management by Project Team	0.033	0.278	8
Unstable Economic Growth (inflation)	0.033	0.311	8
Change Order / Variation Order	0.031	0.342	10
Litigation (Public Opposition)	0.031	0.373	11
Construction Cost overrun	0.031	0.404	12
Delay in decision making by client	0.030	0.434	13
Political influence	0.029	0.463	14
Availability of Equipment	0.029	0.492	15

#### 4.4 Interviews

This section aims to explore the findings of interviews done in order to find the critical delaying factors and effects of delay for BOT infrastructures projects and with their relevant mitigation measures for timely completion of the project. The interviews were conducted with total of 30 personnel, 10x personnel were contacted one to one and 20x personnel were contacted on telephonic device from all over the Pakistan comprising of client/public sector authorities, concessionaries and contractors. These professionals were serving at the senior management and middle management positions in private, semi government and government agencies.

Widespread interviews were conducted in order to get authentic information about the mitigation measures of critical delaying factors and effects of delay for BOT projects in Pakistan. Interviewees were given a topic not the questions to speak openly, afterwards technique of content analysis was used at both descriptive and interpretative levels.

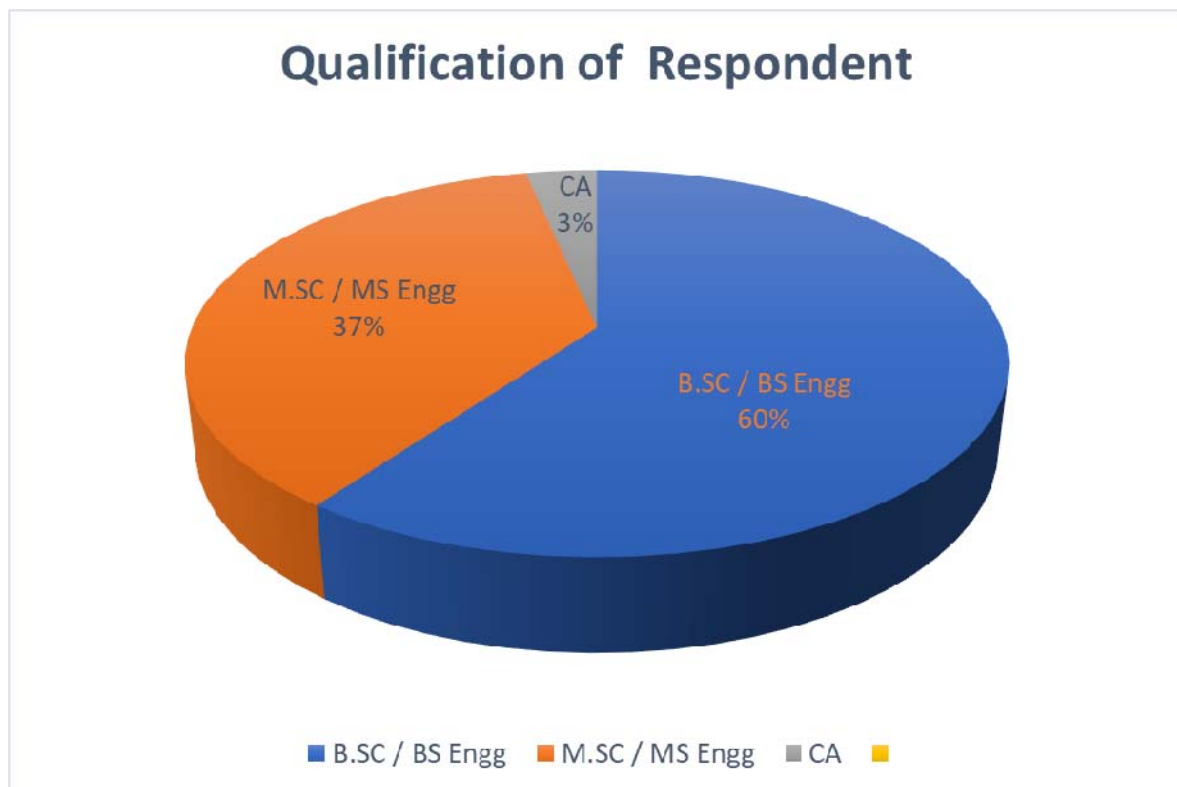
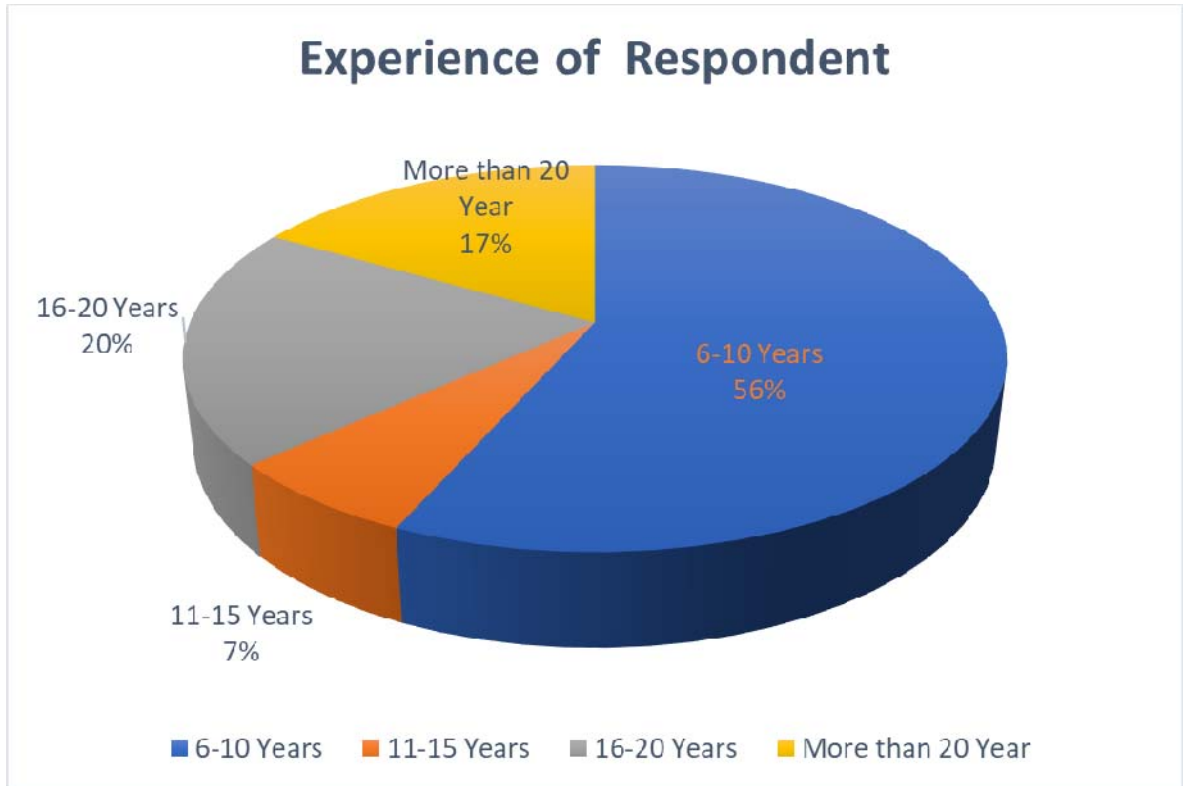


Figure 4.4 (Qualification of Respondent)



**Figure 4.5 (Experience of Respondent)**

#### **4.4.1 Critical Delaying Factors**

The reported delaying factors and that were identified from the interviews are discussed below in detail.

##### **4.4.1.1 Financial Deficit / Availability of Finance**

The arrangement of funds should be completed before achieving the Financial Close of the project. During the construction phase of the project, it is essential for Concessionaire or EPC Developer to pay the liabilities of the sub-contractors and suppliers well before time, so that pace of work cannot be compromised. Moreover, if financial problem regarding delay in receiving debt from lenders and share / loan of Client is not available than Concessionaire should first inject its equity or Sponsor’s share.

#### **4.4.1.2 Availability of Land / Possession of Site**

It was reported that possession of complete site free from all encumbrance is the major delaying factor for the project. Major part of the project faces delays due to non-removal of public utilities and land acquisition because it takes lot of time. To minimize this client continuous provision and commitment is very much necessary, with help of local governments, and District administration the Land acquisition issues should be resolved before the start of project.

#### **4.4.1.3 Change in Policies and Regulations**

The change in policies and regulations due to Government action takes positive and negative impact on the project but in delay scenario it takes the project negative effect. To avoid any high impact on the project contingencies amount and flexibility in contract clauses are suggested.

#### **4.4.1.4 Adverse Weather Conditions**

Good planning is very important for timely completion of the project to avoid any delay due to adverse weather conditions it is suggested that realistic data pertaining to respective project location for last 20 to 25 years should be studied and same be considered during the preparation of work implementation programme.

#### **4.4.1.5 Shortage of Material**

It is observed that due to mismanagement of the project team shortage of material is occurred. Type and exact quantity of the material with required characteristics be identified before the commencement of the works. After that detailed procurement plan, be prepared and enough space for storage of material be established.

It is suggested that the material which is being imported should be procured well before time so that delay can be avoided.



#### **4.4.1.6 Deficiency in Design**

Design portion was discussed in detail with experts and it has been noticed that in BOT projects mostly design responsibility is at the end of Concessionaire. An experience team of design experts should be deployed at site who can regularly monitor the execution activities of the project and in case of any design issue same can be resolved within specified time frame without delaying the construction activities. In addition, same design should be reviewed and vetted by the 3<sup>rd</sup> party so that any missing anomalies in design can be identified within time.

#### **4.4.1.7 Delay in Construction Schedule**

The advance software for like Primavera be used, in planning stage all major delaying risk should be considered and regular monitoring and control the baseline on fortnight basis. In case of any change in baseline same should be revised and communicated to all stakeholders.

#### **4.4.1.8 Poor Planning & Management by Project Team**

The experienced personnel should be employed those have similar projects exposure in their professional job tenure. During the construction phase of the projects training workshops and short courses should be conducted to boost up the professional team knowledge. In addition, benefits to employees should also be given so that their morale can be kept at optimum level which will increase their capacity.

#### **4.4.1.9 Unstable Economic Growth (Inflation)**

In BOT projects typically, already escalation in construction cost is given. In case of due to any force majeure event like COVID-19 disease, Concessionaire should inject its equity to support the project in early stage. Moreover, it is suggested that special management reserve or

contingencies allowance should be considered in financial model of the project before the finalization of the of Equity Funding arrangement.

#### **4.4.1.10 Change Order / Variation Order**

It is revealed that initial project documents should be studied thoroughly especially the tender drawings. In BOT projects the design responsibility is on the Concessionaire end and he should prepare the drawings in accordance with best engineering practices so that minimum requirement arises for change in design. However, if client demands any additional works and issue the Variation Order than Concessionaire or EPC developer should deployed separate team to deal the VO as new contract.

#### **4.4.1.11 Litigation (Public Opposition)**

Mostly litigation cases are due to non-resolution of the public concerns related to their property and access to their site. First step is that issues for especially public community should be addressed upto possible action. In second step, Concessionaire should approach the client for compensation if the problem pertains to client.

#### **4.4.1.12 Construction Cost Overrun**

Financial planning for BOT projects should be adequate during the construction phase of the project because if delayed occurred it leads the project towards loss of revenue to the Concessionaire. It is recommended that the Cost overruns during construction period mostly borne by EPC developer and Sponsor of Concessionaire. In this case, sponsor should give additional loan to the project which will be reimbursed by Concessionaire on later stage along-with mutually agreed upon markup values. Thereafter, it should be tried that no further change in design is entertained.

#### **4.4.1.13 Delay in Decision Making by Client**

To mitigate this factor, it is submitted that regular meetings with Client should be conducted by the Concessionaire and Independent Engineer (IE) of the project. Proper coordination and communication are very important to expedite decision maker process. This is IE responsibility to act appropriate and reasonably for fair decision by the Client.

#### **4.4.1.14 Political Influence**

In BOT projects, upto some extent political influence has been faced by experts. The best solution is that higher authority of the Concessionaire and Client should deal with it by amicably. Moreover, political awareness at national level be carried out with the help of Pakistan Engineering Council.

#### **4.4.1.15 Availability of Equipment**

It is submitted that in start of the project proper machinery and equipment histogram be prepared. Equipment should be managed in accordance that before the execution of the work, equipment should be present at site with its maximum efficiency. In case of import of new equipment, project management should procure it at early stage of the project.

#### **4.4.2 Effects of Delay**

The reported effects of delay that were identified from the interviews are discussed below in detail.

##### **4.4.2.1 Extension of Time**

Due to certain delaying factors which are beyond the control of primary stakeholders are the major reason of delay and subsequently project needs additional time for its completion. Common problems which leads the project to time overrun phase should be identified and need to be mitigate. Realistic additional time requirement should be calculated for remaining works and accordingly extension of time should be applied by the Concessionaire with deployment of adequate resources.

##### **4.4.2.2 Cost Overrun**

The cost overrun instigate the negative impact on the project, if the cost overrun occurred than Concessionaire or EPC developer (Sponsor) should inject their additional amount in the form of equity and loan.

Moreover, Concessionaire can approach to different finances agencies for provision of loan which will be pay back to them with principle plus interest amount.

##### **4.4.2.3 Dispute Between Parties**

Due to non-clarity in the Terms of References (TOR) of stakeholders, issue arises and resultantly project suffers delay and other technical issues. It is suggested that to better deal this situation the parties should consult with 3<sup>rd</sup> party and table talk should be carried out for better stakeholder's management. In addition, Concession Agreement should be clear and fair from any ambiguity.

#### **4.4.2.4 Negotiations / Arbitration**

It is suggested that for positive negotiations each stakeholder have completed the record of documentation pertaining to current issue because in negotiations only detailed correspondence leads the stakeholders for conclusion on one point. It is recommended that stakeholders should be flexible during negotiations and arbitration process.

#### **4.4.2.5 Litigation (Lawsuits)**

It is observed that due to litigation between parties' project suffers a lot of delay, and ultimately project cost is increased. The best solution for this is that parties should do table talk and try to settle the matter out of court.

#### **4.4.2.6 Abandonment**

This effect caused cost overrun to the project and negative impact on the society. The better option is that parties should proceed as per CA clauses and amicably solution should be adopted.

#### **4.4.2.7 Poor Quality**

As the project is completed but quality is compromised. In this regards, remedial measures for maintenance of the project should be initiated on urgent basis keeping in view the safety of the project users and environment. Experienced quality control team should ensure that all the works are being executed as per construction performance standards and best engineering practices.

#### **4.4.2.8 Negative Social Impact**

Due to delay, one of major effect is that population which is living nearby project area faces a lot of problems. This caused negative impact on their sociology and lifestyle. It is recommended that it should be trying to complete the project in different phases or section, if any phase or section is completed same should be opened for utilization of the public benefits.

#### **4.4.2.9 Incremental Cost Due to Claims**

This effect influences the project in the form of additional cost which may be paid by Concessionaire and Client to each other. It is suggested that Independent Engineer (IE) should scrutinize the claim fairly and other party be notified as per contract to pay the liability to affected party on account of claims.

#### **4.4.2.10 Late Return of Income and Profit**

Concessionaire faces financial problem due to delay in completion of the project and subsequently late return of income and profit. It is recommended that Concessionaire should explore the business opportunities in project area so that upto some extent the losses can be recovered from these businesses. In this regard, it is submitted that complete business plan be initiated for potential investors which are interested in doing business in your project area.

#### **4.4.2.11 Bankruptcy of Any Stakeholder**

The bankruptcy of stakeholders indicates the financial losses to the project. If the stakeholder faces financial problem than Government should support as bailout package to the stakeholder for better interest of the project. If it is not possible than new contract should be done with potential stakeholder.

#### **4.4.2.12 Additional Insurance Charges and Taxes**

In BOT projects, it's Concessionaire obligation to get insurance for all machinery, manpower and other assets for construction as well as operation period. It is submitted that backup plan for payment on account of insurances and taxes be prepared in early stage of the project.

#### **4.5 SUMMARY**

Chapter describes various tests and procedures adopted for data analysis in detail in which normality, reliability and data was checked through MS excel. Chapter also highlights the ranking of delaying factors and its effects. The detailed discussion on these factors and effects were also represented in paragraph form. For ease of apprehension, the complex statistics of the surveyed data has been represented through various pie charts etc. in the chapter for better understanding.

## RESULTS & RECOMMENDATIONS

### 5.1 Introduction

This chapter includes findings, limitation and recommendations of the study.

### 5.2 Identified Critical Delaying Factors

The list of identified critical factors causing delay in construction period of BOT infrastructure projects is tabulated as under:

**Table 5.1 (Critical Delaying Factors)**

Sr #	Critical Delaying Factor
1	Uncompleted Client Furnish Items
2	Change in Policies and Regulations
3	Un-necessary demand of Client
4	Protection of geological and historical objects
5	Deficiency in Design
6	Fluctuation on Resource Price
7	Attitude of sub-contractors or suppliers
8	Availability of Equipment
9	Shortage of Material
10	Change Order / Variation Order
11	Poor Planning & Management by Project Team
12	Delay in construction schedule
13	Inflexibility of Consultant
14	Inadequate Site Safety & Security Measures
15	Financial Deficit / Availability of Finance



16	Construction Cost overrun
17	Political influence
18	Lack of communication and coordination between parties
19	Corruption & Bribery
20	Unstable Economic Growth (inflation)
21	Availability of Land / Possession of Site
22	Litigation (Public Opposition)
23	Inexperience Labor
24	Trivial Administrative Procedure
25	Preparation and approval of shop drawings
26	Unexpected increased quantity
27	Failed Examination & Inspection
28	Unproven engineering techniques & methods
29	Adverse Weather conditions
30	Social Culture Rights
31	Force Majeure Event
32	Obtaining Permits / NOC
33	Inadequate experience by Concessionaire
34	Unforeseeable Ground Conditions / Geological Conditions
35	Delay in decision making by client
36	Delay in Commencement

After statistical analysis of the collected data, the top ranked critical factors are as follows:

**Table 5.2 (Shortlisted Factors)**

<b>Shortlisted Critical Factors</b>	<b>Rank</b>
Financial Deficit / Availability of Finance	1
Availability of Land / Possession of Site	2
Change in Policies and Regulations	3
Adverse Weather conditions	4
Shortage of Material	5
Deficiency in Design	6
Delay in construction schedule	7
Poor Planning & Management by Project Team	8
Unstable Economic Growth (inflation)	9
Change Order / Variation Order	10
Litigation (Public Opposition)	11
Construction Cost overrun	12
Delay in decision making by client	13
Political influence	14
Availability of Equipment	15

### 5.3 Identified “Effects of Delay”

The list of identified effects of delay for BOT infrastructure projects is tabulated as under:

**Table 5.3 (Effects of Delay)**

<b>Sr #</b>	<b>Effects of Delay</b>
1	Cost overruns
2	Extension of Time / Time Overrun
3	Dispute between parties
4	Negotiations / Arbitration
5	Late return of income and profit
6	Litigation (Lawsuits)
7	Abandonment
8	Negative Social Impact
9	Incremental Cost due to claims
10	Bankruptcy of any stakeholder
11	Additional insurance charges and taxes
12	Poor Quality

On the basis of results and information gathered through survey, interviews were conducted from the senior management, to find out that like other construction industries what possible delaying factors faces by our construction industry for BOT projects and how we can cope with these problems in order to successfully completion of the projects within time and cost in Pakistan.

Majority of the interviewees are of the view that financial arrangement problem for BOT projects is not major issues if the Concessionaire inject its equity and loan within time, land acquisition problems, removal of public utilities and deficiency in design are major issues in Pakistan. According to them, successful completion of the projects Client support and better planning, management and coordination of project team with all internal stakeholders be ensured at every cycle of the project.

#### **5.4 Research Limitations**

The limitations of the study are enumerated below:

- This study has focused on construction period that is only for 2 ~ 3 years
- Study is conducted for BOT infrastructures projects in Pakistan

#### **5.5 Recommendations**

Recommendations for minimize the impact of critical delaying factors and better deal the “effects of delay” for successful completion of BOT infrastructures projects within stipulated timeframe is represented below:

- Financial arrangement during the construction phase of the project is very necessary from the Concessionaire end.
- Client support and commitment is very much necessary, with help of local governments and district administration the for timely possession of site free from all encumbrances and utilities removal / relocation issues should be resolved in early stage of the project.

- Expert designer should be hired by the Concessionaire / EPC developer and their team members be deployed at site for early identification and resolution of drawings issues. Pakistan Engineering Council should conduct seminars and workshops for guidelines for those who are designing mega projects to boost up their knowledge as per international standards.
- TORs between parties should clear in Concession Agreement.
- Essential collaboration, cooperation within stakeholders, proper communication and information sharing among different stakeholders should be encouraged and strengthen at every stage of the project.
- Commitment of politicians in timely completion of projects would play vital role.
- Research and development should be promoted

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# Critical Factors Causing Delay in Construction Period of Built Operate & Transfer (BOT) Infrastructure Projects in Pakistan

This survey is being carried out as part of MS research titled "Critical Factors Causing Delay in Construction Period of Built Operate & Transfer (BOT) Infrastructure Projects in Pakistan". The purpose of this research is to identify the factors causing delay in especially in construction period / construction phase of the project and to investigate it's effect on the project. This survey will help to identify the most critical factors causing delay to the project so that the most efficient remedies / recommendations may be identified to better deal with these factors.

Your contribution towards this research will be highly appreciated. Please be assured that the data will only be used for study purpose and no personal information will be disclosed at any forum/level. Please click next to continue and complete the survey and remember to click submit at the end. In case of any inquiry, please feel free to contact.

Regards,  
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**\*Required**

## Personal Information

1. Respondent Name \*

---

2. Organization / Company / Institution \*

---

3. Please indicate your organization type "Mark only one". \*

*Mark only one oval.*

- Client
- Consultant
- Contractor
- Financier
- Sub-Contractors / Suppliers
- Other: \_\_\_\_\_

4. Position / Designation \*

\_\_\_\_\_

5. Please indicate your academic qualification \*

*Mark only one oval.*

- B.Tech / BS. Tech
- B.Sc/ B. Engg/ BS / BBA
- M.Sc/MS
- M.Tech/ Ms.Tech
- PhD/ D.Engg
- Other: \_\_\_\_\_

6. Please indicate your professional experience \*

*Mark only one oval.*

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 years
- More than 20 years
- Other: \_\_\_\_\_

Development  
of Survey

Research papers published in top journals were studied to extract different critical factors which are causing delay in construction period of the project. The common factors mentioned in these papers are presented in this survey to determine experts' opinion on their importance and validity.

Respondents are required to choose one option about the impact of these critical factors on the project duration (construction phase) based on their professional experiences and knowledge.

7. What is the effect / impact of delay by following factors on the construction period of BOT infrastructure projects in Pakistan? \*

Mark only one oval per row.

	Very Low	Low	Moderate	High	Very High
Uncompleted Client Furnish Items	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Change in Policies and Regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Un-necessary demand of Client	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protection of geological and historical objects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Deficiency in Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fluctuation on Resource Price	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attitude of sub-contractors or suppliers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Availability of Equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shortage of Material	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Change Order / Variation Order	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor Planning & Management by Project Team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delay in construction schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inflexibility of Consultant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inadequate Site Safety & Security Measures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial Deficit / Availability of Finance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction Cost overrun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Political influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of communication and	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

coordination between parties

Corruption & Bribery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unstable Economic Growth (inflation)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Availability of Land / Possession of Site	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Litigation / Public Opposition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inexperience Labor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trivial Administrative Procedure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preparation and approval of shop drawings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unexpected increased quantity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Failed Examination & Inspection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unproven engineering techniques & methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adverse Weather conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social Culture Rights	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Force Majeure Event	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Obtaining Permits / NOC	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inadequate experience by Concessionaire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unforeseeable Ground Conditions / Geological Conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delay in decision making by client	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delay in Commencement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Any other critical factor(s) relevant to the delay in construction period (Optional)

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9. Remarks (Optional)

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