FACTORS CAUSING DELAYS AND THEIR MITIGATION MEASURES IN BUILDING CONSTRUCTION PROJECTS OF PAKISTAN

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ABSTRACT

The construction industry is a crucial indicator of a country's GDP. However, like other industries, it faces various challenges such as delay, cost overrun, and low-quality standards. Among these, the delay is identified as a significant contributor to project failure, cost overrun, and low-quality standards. Building construction projects in Pakistan are adversely affected by delays. Therefore, this study aims to identify the common factors of construction delays globally, critical factors of delay in building construction projects in Pakistan, and the measures to control these factors. To achieve these objectives, a literature review was conducted, which resulted in the identification of 45 common factors of delay in the construction industry worldwide. Using a structured questionnaire and the average index method, 11 critical factors of delay were identified in building construction projects in Pakistan. Moreover, a semistructured questionnaire was used to determine 44 possible mitigation measures, which were analysed using SPSS's frequency analysis method. Additionally, the Pearson correlation technique was utilized to identify the relationship between critical delay factors and mitigation measures. The findings of this study will benefit stakeholders in building construction projects in Pakistan. They can identify and control the critical factors that can cause delays in building construction projects by incorporating the recommended mitigation measures and understanding the relationship between critical delay factors and mitigation measures.



ABSTRAK

Industri pembinaan adalah penunjuk penting KDNK sesebuah negara. Walau bagaimanapun, seperti industri lain, ia menghadapi pelbagai cabaran seperti kelewatan, kos berlebihan dan standard kualiti rendah. Antaranya, kelewatan dikenal pasti sebagai penyumbang penting kepada kegagalan projek, kos lebihan dan standard kualiti rendah. Projek pembinaan bangunan di Pakistan terjejas teruk akibat kelewatan. Oleh itu, kajian ini bertujuan untuk mengenal pasti faktor biasa kelewatan pembinaan secara global, faktor kritikal kelewatan dalam projek pembinaan bangunan di Pakistan, dan langkah-langkah untuk mengawal faktor-faktor ini. Untuk mencapai objektif ini, kajian literatur telah dijalankan, yang menghasilkan pengenalpastian 45 faktor kelewatan biasa dalam industri pembinaan di seluruh dunia. Menggunakan soal selidik berstruktur dan kaedah indeks purata, 11 faktor kritikal kelewatan telah dikenal pasti dalam projek pembinaan bangunan di Pakistan. Selain itu, soal selidik separa berstruktur telah digunakan untuk menentukan 44 kemungkinan langkah mitigasi, yang dianalisis menggunakan kaedah analisis frekuensi SPSS. Selain itu, teknik korelasi Pearson digunakan untuk mengenal pasti hubungan antara faktor kelewatan kritikal dan langkah mitigasi. Dapatan kajian ini akan memberi manfaat kepada pihak berkepentingan dalam projek pembinaan bangunan di Pakistan. Mereka boleh mengenal pasti dan mengawal faktor kritikal yang boleh menyebabkan kelewatan dalam projek pembinaan bangunan dengan memasukkan langkah-langkah mitigasi yang disyorkan dan memahami hubungan antara faktor kelewatan kritikal dan langkah mitigasi.



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LIST OF SYMBOLES AND ABBREVIATIONS Average Index Critical Factor

| AI | - | Average Index |
|------|---|--------------------------------------|
| CF | - | Critical Factor |
| CPEC | - | China-Pakistan Economic Corridore |
| CFM1 | - | Critical Factor Mitigation 1 |
| CFM2 | ō | Critical Factor Mitigation 2 |
| CFM3 | | Critical Factor Mitigation 3 |
| CFM4 | - | Critical Factor Mitigation 4 |
| GDP | - | Gross Domestic Product |
| Ν | - | Number of Items |
| PCRA | - | Pakistan Credit Rating Agency |
| PMCC | - | Product Moment Correlation Method |
| S.S | - | Sample Size |
| SPSS | - | Statical Package for Social Sciences |
| | | |



CHAPTER 1

INTRODUCTION

1.1 Background

The construction industry is an important sector that contributes to the country's economic growth in a positive direction (Perera *et al.*, 2020). Moreover, this industry has improved the living standard of the people by providing basic amenities like hospitals, infrastructure, buildings, roads, and others (Perera *et al.*, 2020). Therefore, all types of construction projects must be completed within the approved time for constructive economic growth and improvement of the people's living standards.



The global construction industry is a vast and complex sector that includes various activities related to designing, constructing, and maintaining buildings, infrastructure, and other structures. The construction industry plays a crucial role in the development of modern society by creating the physical environments in which we live, work, and play.

The construction industry significantly contributes to the global economy, with a market size of approximately \$10 trillion. It employs millions worldwide, providing jobs in various fields, including architecture, engineering, project management, and skilled trades such as carpentry, plumbing, and electrical work.

The global construction industry faces challenges, including time overruns, increasing pressure to adopt sustainable building practices and the rising cost of materials and labor. Nonetheless, the sector remains a critical driver of economic growth and development, and it is likely to continue to play an essential role in shaping the world around us.

The construction industry is one of the largest industries, engaging roughly 190 million people globally (Jones & Comfort, 2018). The construction industry of the

United Kingdom contributed almost £103 billion in 2014-2015. This industry has engaged nearly 13% of the total labor. In total, 2.1 million of the population were involved in this industry (Rhodes, 2015). It was reported that Canada's construction industry contributed 11.3 % of the total gross domestic product in 2017-2018. The construction industry of Qatar has contributed to more than 10% of the entire economy of the country (Wei *et al.*, 2020). The construction industry of Asia has estimated to be around 4 USD trillion in 2017, and it is also growing by about 5% annually. Though China is known as Asia's most significant construction industry, it is expected to grow by 5% yearly from 2020 onward. China has launched the one belt road, known as a key infrastructure in the development of Asia and contains large projects such as CPEC (China-Pakistan Economic Corridor). This project has worth more than USD 60 billion, and the main aim of this project is to promote the development of infrastructure in Pakistan (Ali *et al.*, 2020).

The construction sector of Pakistan faces challenges like shortage of funds, delay in approval, improper management, poor planning, and client interest in the project (Sohu *et al.*, 2016). In Pakistan, Projects also face cost overruns, delays, and critical issues in project management (Haseeb *et al.*, 2011). Due to the variety of challenges faced by the construction industry, more than 85% of construction projects are delayed, which gives a negative perception among the industry's stakeholders (Rashid *et al.*, 2020).

The study conducted by Sheikh *et al.*, (2020) found that around 70% of construction projects are delayed. The study performed by Shahid *et al.*, (2015) concluded that delays observed in residential building construction projects are due to corruption, non-availability of funds, Price increase in materials, and improper planning. These are some causes that affect the project's delivery time.

Another research conducted by Haseeb *et al.*, (2011) mentioned thirty-seven (37) factors that cause delay and their effects on the success and completion of the project and grouped into seven (7) groups. The most common factor of uncertainty is a natural disaster in Pakistan like flood and earthquake, and some others like financial and payment problems, improper planning, poor site management, insufficient experience, and shortage of materials and equipment. They covered the delay factors and causes of delay and some suggestions for reducing these delays in large construction projects in Pakistan.



Pakistan is a financially unstable country and the construction industry of Pakistan plays a crucial role in its up-gradation and economic development (Khan & Umar, 2020). This study is focused on identifying the critical factors of delay and determining mitigation measures for the delay factors in building construction projects in Pakistan, along with the relationship between the critical factors and the mitigation measure.

Many studies have been carried out to identify the factors of delay in construction projects in Pakistan. Still, there is a gap in the study to find critical delay factors in the building construction industry, suggesting controlling measures for each established factor that causes a delay in building construction projects in Pakistan and the relationship of critical delay factors with the proposed mitigation measures.

1.2 Problem statement

The construction industry can contribute to any country's socio-economic development if managed within the constraints of the construction project. The ideal criteria for profitable projects are related to the project's timely completion, which will result in financial and economic development. The construction industry is facing many challenges like delay, cost overrun, and quality with related risks (Abioye *et al.*, 2021). It has been observed that delay is the most severe challenge among all these challenges (Opoku *et al.*, 2021). The project is known as successful when it is completed within the given timeline (Shaikh *et al.*, 2020).

The construction industry of Pakistan, like other countries around the world, has a poor record of completing projects in the allotted time and cost (Adaway *et al.*, 2016). The delay has resulted in acquiring spare time to complete the project due to various factors, adversely impacting the construction stockholders (Clients, Contractors and Consultants) regarding financial and national interests and meeting growing population needs.

Pakistan's construction industry is also affected by delays which adversely impact construction stakeholders (Hossain *et al.*, 2021). Due to delays in construction projects, it has been observed that more than 35% of the cost is increased from its original approved cost (Rashid *et al.*, 2020).



The identification and impacts of critical delay factors in the construction industry motivated many researchers Haseeb *et al.*, (2011); Hanif *et al.*, (2016); Sohu *et al.*, (2016); Soomro *et al.*, (2019); Maqsoom *et al.*, (2019) and Shaikh *et al.*, (2020), to perform research related to delay in construction, these past researchers have identified critical factors of delay in the construction industry of Pakistan.

A study conducted by Sohu *et al.*, (2016) identified nine (9) critical factors of delay in highway projects in Pakistan, using a structured questionnaire and average index method was used to rank the critical factors from identified common factors of construction. Delay causes identified/ measured, such as late funding, rework, late delivery of material, shortage of skilled labor, which lead project to delays in building construction projects in Pakistan and most critical risk factor of delay involved in building construction industry is in adequate project management was reported by (Kamal *et al.*, 2019).

Another study conducted by Shahid *et al.*, (2015), limited to residential building projects in Pakistan, identified that delay is the crucial factor affecting the construction of residential buildings in Pakistan. Considering the reported studies it was extracted that minimal studies have been performed on delays related to the building construction industry of Pakistan, which could cover the study of the determination of mitigation measures and the relationship between the critical factors and suggested mitigation measures.

The delay has resulted in acquiring spare time to complete the project due to various factors, adversely impacting the construction stockholders (Clients, Contractors and Consultants) regarding financial and national interests and meeting growing population needs.

Therefore, there is a gap in this area of study to find out factors causing delays in the building construction sector, along with a study on mitigation measures for the delay factors in the construction of building projects in Pakistan.

This study is focused on the identification of common delay factors in construction projects globally, the determination of critical delay factors in building construction projects in Pakistan, mitigation measures to control the critical delay factors, and also a correlation among mitigation measures with critical factors of delay in the construction of building projects of Pakistan.



1.3 Research Questions

The following research questions have been developed for this study in light of the above problem statement.

- i. What are the delay factors in construction projects globally?
- What are the critical factors of delay in building construction projects in Pakistan?
- iii. What are the controlling measures for the critical delay factors of building construction projects in Pakistan?
- iv. What are the significant measures for each critical delay factor using Pearson correlation?

1.4 Objectives of study

- i. To identify the common factors of construction delay.
- ii. To examine the critical factors causing delays in building construction projects of Pakistan.
- iii. To propose the possible mitigation measures for identified critical factors of delay in the construction of building projects of Pakistan.
- iv. To determine the relationship among controlling measures and their critical delay factors.

1.5 Scope of the research

This study is focused on the building construction industry of Pakistan. Respondents of this study were construction stakeholders (Clients, Contractors and Consultants) relevant to the construction of building projects in Pakistan. Total 41 numbers of the building construction projects from all provinces of Pakistan were included in this study. Ninety-six (96) respondents filled out the questionnaires. This study has adopted a quantitative approach for the pilot study and an actual study for the identification of critical delay factors. Whereas the qualitative method was used to determine possible mitigation measures, for which data was collected from 30 respondents, data from the survey were examined using the frequency analysis method. The Pearson Correlation

technique was used to find the relationship between identified mitigation measures and critical factors of delay in building construction projects of Pakistan.

1.6 Significance of the study

This study is specified to the building construction industry of Pakistan; previous studies like Haseeb et al., (2011); Hanif et al., (2016), Sohu et al., (2016), Soomro et al., (2019), Maqsoom et al., (2019) and Shaikh et al., (2020) carried out in relevance to the overall construction industry of Pakistan. This study has not only found the critical delay factors but also identified the mitigation measures and their relationship with the identified critical factors of delay, which suggest the gap of the research area. The findings of this study will be a helpful guide to the stakeholders (Clients, Contractors and Consultants) of the building construction projects to overcome the identified critical delay factors by utilizing the suggested mitigation measures. This ruetion of study will also be beneficial for the stakeholders in the successful completion of building construction projects within time.

1.7 **Thesis structure**



This study is divided into six chapters as follows;

Chapter 1: This chapter includes the introduction and purpose of conducting this study. This chapter also contains the introduction, problem statement, scope of study, and objectives.

Chapter 2: This chapter includes a detailed review of the delay in the construction industry worldwide and research about the delay in Pakistan's construction industry. All common factors of delay identified from the literature review are also presented in this chapter.

Chapter 3 contains the research methodology for achieving the study's objectives. This chapter also represents the research methods adopted for achieving this study's objectives.

Chapter 4: This chapter includes the results of the pilot study and the results of conducted questionnaire survey to identify critical factors of delay in building projects and mitigation measures for critical delay factors.

Chapter 5: This chapter covers the results of the relationship between the critical factors and the mitigation measures.

Chapter 6: This chapter explains the conclusion and findings of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is an essential part of research or project that involves analysing and examining existing literature, research, and scholarly material. The primary objective of the literature review is to provide a comprehensive and critical overview of the current state of knowledge on a specific research question or topic.

To identify the causes of delays in a construction project, a critical analysis of research was conducted over the previous research. Using a literature analysis, an algorithm was designed to drive corrective actions for building construction project delays. Previous research on construction project delays and challenges addressed in the literature are described in detail.

Construction delays are caused by the circumstances listed below, according to various researchers, including Choong (2018), Golizadeh *et al.*, (2015), Halepota (2005), Jarkas and Bitar (2011), Alsuliman (2017), and Egwim *et al.*, (2021). The following causes of delay in construction projects were identified.

Delay by the client/owner in giving the site to the contractor is the situation where site handing over by the owner to the contractor is delayed and contributes to the delay of the project. The case where the client made several revisions to the predetermined provision of work throughout construction resulted in the scope change at the execution phase, which led to factors like rework. There were delays due to poor communication between Client, Contractor and Consultant, related to poor communication between construction stockholders, impacting the project concerning time overrun. The consulting firm came up with faulty designs, and drawings were



found to require rework about design and drawing, adversely affecting the project cycle. Lack of necessary equipment is when the required materials/plants /tools are not procured within the scheduled time frame. The client gave the wrong information or hid information is the occasion where the client does not disclose the misleading information, which eventually results in the delay of the project with respect to its design delays, and scope change. Client's late payment is a circumstance where the client is not paying the due payments, which creates a disturbance of cash flow for the project. Challenging site conditions faced by the contractor are the situation where the site is situated at the location, where it is difficult to execute the site activities due to various reasons, for example (bad weather, law in-order situation, insufficient working space).

2.2 Pakistan construction industry

Pakistan's construction industry significantly contributes to its economy, accounting for around 2.7% of its GDP. The sector comprises many sub-sectors, including residential and commercial building construction, infrastructure development, and engineering services.



In recent years, the construction industry in Pakistan has witnessed significant growth due to increased investment in infrastructure development projects such as the China-Pakistan Economic Corridor (CPEC) and the development of Special Economic Zones (SEZs). These initiatives have increased demand for construction materials and services, resulting in the industry's growth. However, the industry still faces challenges, including the lack of skilled labor, limited access to financing, and a lack of investment in research and development. The industry is also facing issues related to regulatory and bureaucratic hurdles that are impeding its growth. Despite these challenges, the Pakistan government is promoting the development of the construction industry. For example, in 2020, the government announced a construction package to incentivize the sector to boost economic activity and create employment opportunities. Overall, the Pakistan construction industry has significant potential for growth, and with the right policies and investments, it can play a critical role in the country's economic development. Different researchers gave various meanings of the term 'delay' as indicated by the development perspective. Like a few different nations, the development business of Pakistan joins a binding commitment to advancing the nation's economy. As indicated by the plan of the Pakistan government, precisely, "Development area in Pakistan 2014 Improvement estimates for 2015-2020", Pakistan is intended to grow its development industry up to a 4.2% commitment in the country's GDP in 2014. During the underlying half year of 2014, the objectives were extensively accomplished, with development fueled generally by the structural designing development movement. The economy of Pakistan was improved by the commitment to lodging and framework advancement; nonetheless, a great imperfection in satisfying the settled-upon time frame of tasks was noticed. This uncovered an absence of comprehension of the delays experienced by the partners during development projects in Pakistan. Various ventures experienced an unforeseen deficiency of cash flow. There is a need to recognize the job of postponing factors in the stretching of time concurred for the culmination and the impact of deferrals on the general nature of the venture.

As reported by the Pakistan Credit Rating Agency Limited (PCRA) in 2022, it was highlighted that the construction sector is expected to grow by 92% in the coming seven years. The construction industry has contributed almost PKR 1,409 billion (US\$7.8 million) to Pakistan's Gross Domestic Product (GDP) in 2021. The majority of construction revenue, says the PCRA, is from government contracts, such as the building of infrastructure, highways, offices, and airports. The report anticipates Pakistan to further expand its ranking by constructing mega projects under the China-Pakistan economic corridor. Pakistan's public sector continues to invest heavily into infrastructure projects, with the most significant apportionment for developing national highways and railways and residential communities; under Public Private Partnership (PPP), nine construction and rehabilitation of road and transit projects are in the pipeline. The industry also has a significant economic significance on gross domestic profit (GDP), with a contribution of 14.3% in 2021 and is expected to contribute 14.8% in 2022. An increase in costs saw the prices of primary construction materials rocket in 2021. Bitumen, primarily used in road infrastructure, was reported to have gone up 48.6%, while timber and softwood prices saw increases between 7% and 11%.



2.3 Delay in construction projects

Construction sites are experiencing one of the severe problems in the shape of delay in modern days. This issue can prompt many adverse consequences like questions among proprietors and project workers, increased expenses, loss of usefulness and income, and agreement end. Assaf & Hejji, (2006) proclaimed that the developmental delay is really an extra measure of time needed to finish the venture based on what is settled on the customer and worker for hire. Another meaning of the delay outlined was not achieving the targets within the proposed timeline.

Even though deferrals are a typical characteristic of all development projects, their size fluctuates starting with one venture and then onto the next, which begins from days and leads to months and years and sometimes more time (Masood *et al.*, 2015). There are many discussions among scholars to shed light on delays in construction projects and present various definitions, types, factors, and effects.

According to (Shrivas & Singla, 2022), delay in construction projects in India is a very common problem that directly affects the client's performance. Almost 58% of building projects have been observed to be delayed in India due to some critical factors, which were the supply of payment, supply of material on time, selection of contractors and poor management. The construction industry needs attention to control delay factors that negatively impact all project stakeholders.



Forty-two (42) reasons of delays were identified by Motaleb & Kishk, (2010), changes to the work orders, commercial and financial problems from the owners, and time and cost overruns were the most important effects.

A thorough survey was performed by Assaf & Hejji, (2006) for the time performance factor of major Saudi Arabian construction projects. From the survey, 73 different reasons for being late were found. They looked at the various causes and how important they were from the point of view of the client, the consultant, and the contractor. They found that "changing the order" was the most common reason for delays. Studies from Saudi Arabia show that almost 70% of building projects were behind schedule.

2.4 Characterization of construction delay

Construction delay refers to any event or circumstance that causes a project to fall behind schedule. Construction delays can have significant implications, including increased costs, reduced productivity, and damage to relationships between project stakeholders.

Construction delay has been the breaking point for research studies for many years among scholars (Doloi et al., 2012). Delay is recognized as the most well-known, expensive, intriguing, and dangerous issue experienced in development projects Shi et al., (2001). According to Al-Emad & Nagapan (2015), time overrun is a major problem TUN AMINAT that has made it hard for the construction industry to finish projects on time.

2.5 **Types of construction delay**

According to Kumar (2020), Hamid et al., (2015), Khahro & Memon (2018), postponements can be gathered into four general classifications dependent on legally binding structures as follows:

i. **Non-Excusable Delays**

A non-excusable delay is differing, triggered exclusively by a project worker or its providers, and can be inside a Contractor's control (Gardezi et al., 2014). For example, a worker for hire slow advancement, subcontractor slow advancement, broken hardware, troubles in financing the project by the project worker, helpless site the board and oversight by a worker for hire, helpless correspondence, and coordination by a project worker with different gatherings, and lacking arranging and planning. This deferral is intrinsically the project worker's obligation and no alleviation is permitted. Accordingly, non-passable postponements generally bring about no extra cash, and no extra time is conceded to the worker for hire.



ii. Excusable None-Compensable Delays

At the point when a delay is brought about by factors that are not predictable, past the project worker's reasonable control, and not owing to the project worker's issue or carelessness, it very well might be "forgivable." Likewise, it may be characterized well when neither the proprietor nor the project worker is answerable for the postponement. These deferrals are usually called "demonstrations of God" since they are not the obligation or issue of a specific party (Tumi *et al.*, 2009). Appropriately, the worker for hire won't get paid for the expense of delay; however, he will be qualified for an extra ideal opportunity to finish his work and is diminished from any authoritatively forced exchanged harms for the time of deferral. Instances of this kind of deferral are severe climate and demonstrations of God flood, wind harm, contract changes, and work debate and strike

iii. Excusable Compensable Delays

Excusable compensable delays are brought about by the proprietor or the proprietor's representatives. For instance, changes in the significant extent of the work by the proprietor during development, suspension of the work by the proprietor, and the proprietor's inability to allow site access. If this sort of postponement is capable, the project worker is qualified for an expansion of time and a change for any increment in costs brought about by the deferral.



At the point when more than one kind of deferral coincides and both, either together or autonomously, sway the undertaking's advancement, this sort of postponement is called Concurrent deferral. Simultaneous postponements happen when both proprietor and the worker for hire are liable for the event of a delay.

Many construction projects are facing a different type of delay from the types as mentioned earlier of delay. In almost all types of projects, delay has occurred, which is a big challenge for construction industry stakeholders.



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