The Impact of Pandemic Crisis on Construction Projects Performance: A case study of Pakistan during COVID-19

By

Syed Rafay Ali Bukhari

(00000277381)

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Examination Committee Members

1. Name: Dr. Muhammad Umer Zubair Signature:_____

2. Name: Dr. Khurram Iqbal Signature:_____

Supervisor's name: Dr.-Ing. Abdur Rehman Nasir Signature:_____

Date: _____

_____

Head of Department

Date: _____

COUNTERSIGNED

Date: _____ Dean/ Principal

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Department of School of Civil and Environmental Engineering

National University of Sciences and Technology

Student Name: Syed Rafay Ali Bukhari Signature: _____

Examination Committee:

a) Dr. Muhammad Umer Zubair Signature: _____

(Assistant Professor, Dept. of Construction Engineering and Management, NIT, SCEE, NUST)

b) Dr. Khurram Iqbal Signature: _____

(Assistant Professor, Dept. of Construction Engineering and Management, NIT, SCEE, NUST)

Supervisor Name: Dr.-Ing. Abdur Rehman Nasir Signature: _____

Name of Dean/ HOD: Dr.-Ing. Abdur Rehman Nasir Signature: _____

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Dedicated to
My loving parents, brother, sister, teachers, friends, and my colleagues.

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ABSTRACT

The advent of COVID-19 has brought unprecedented effects on construction markets globally due to governmental policies, supply chain disruptions, and workforce restriction etc. However, construction industry of developing countries is more vulnerable to the obstacles associated with the pandemic. As such, the goal of this paper is to capture the impact of COVID-19 on construction projects' performance in developing countries by taking Pakistani construction sector in consideration. A multistep project-based research methodology was adopted by the researchers, including literature analysis and questionnaire survey with 25 construction professionals to list out factors affected by the COVID-19; formulation of open-ended question against each factor; collecting of data using semi-structured interviews and presenting challenges and adopted mitigation strategies to examine the perceived impact. Results show that the pandemic has caused a total of 13 challenges that impacted project performance which are grouped under five groups including material and equipment, human resource, occupational health and safety, finance and contracts. The factors that impacted the most due to the pandemic are cash flow management, supply chain disruptions, increased overheads, construction safety measures, material shortage, contractual issues, and construction workforce. The findings of the study show difference in the captured impact of the pandemic among various regions across the country. This research contributes to the body of knowledge by providing a foundation for researchers to enhance investigating the impact of the COVID-19 with its predictabilities rooted in developing countries.

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LIST OF ABBREVIATION

COVID-19	Corona Virus Disease of 2019
EOT	Extension of Time
IPC	Interim Payment Certificate
KPK	Khyber Pakhtunkhwa
MEP	Mechanical Electrical Plumbing
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Brief Description

Globally construction has always been responsible for contributing to a sizeable proportion in Gross Domestic Product (GDP) of most countries (Sitsabo Dlamini, 2012). The construction sector has the potential to engage and constructively exploit materials and human resources for the development of infrastructure and housing that boosts local employment and enhances economic effectiveness (Anaman et al., 2007). Ofori (2015) mentioned that to fulfill a broad range of economic and physical needs to achieve national goals the construction industry plays an essential role.

The outbreak of COVID-19 has severely affected the globe (Shafi et al., 2020) the disease

was declared a global pandemic in May 2020 by World Health Organization (WHO, 2020). COVID-19 has caused an immense and unprecedented economic shock to world economies the likes of which have not been seen in decades (Kose et al., 2020). Furthermore, every industry has been affected by COVID-19 which also includes the construction sector and its various operations (Gamil & Alhagar, 2020). The pandemic has imposed several challenges that resulted in delays of construction projects. Many of the challenges are due to health and safety challenges, disruptions in the supply chains, financing issues, lack of workforce, introduction of new laws, challenges in worksite accessibility, contractual claims and unavailability of tools, equipment, and materials(Asaad & El-adaway, 2021; Scott et al., 2020; Gamil & Alhagar, 2020). Consequently, numerous construction companies are struggling to manage the effects of

the pandemic on the projects' performance caused by market disruptions and investment reductions by the governments (Raoufi & Fayek, 2021). During the peak of the pandemic job loss was a crucial problem in all industries and particularly construction industry faced a major job loss due to suspension of project (Gamil & Alhagar, 2020). Conclusively, the emergence of a global pandemic i.e. COVID-19 has resulted in a partial or impartial shutdown of the construction industry on a global scale (Bsisu, 2020). To curtail the impact of the pandemic, construction organizations and firms should have implemented adequate planning and mitigation strategies to cope with the challenges (Goodman, 2020.)

1.2 Justification Of the Topic and Relevance to National Need

It is evident that construction sector has been affected by the advent of COVID-19. However, construction markets in developing countries are expected to be more at risk because of the situation of the pandemic (Al-Mhdawi et al., 2022). Indeed, a larger portion of identified positive cases within developing nations are anticipated to significantly affect their construction sector as governments seek to minimize the risk of contamination among their populace (Simmons, 2020). This aligns with Diop, (2020), who found that the reallocation of government budget funds to contain increased COVID-19 cases is one of the causes of disruptions to infrastructure projects in developing countries. Moreover, travel restrictions and supply chain disruption have significantly affected infrastructure projects in developing countries because of lack of expertise as well as high dependency on imported materials(Diop, 2020). Furthermore, developing countries usually face issues such as financial challenges, inflation, foreign exchange rates variations, material price fluctuations, and changing interest rates (Derakhshanalavijeh & Teixeira, 2017). This may further intensify such issues due of COVID-19. Regarding a report by the World Bank, it is anticipated that in 40 years south Asia will come to terms with its worst economic crisis

together with a significant number of other countries because of a deep recession (World Bank, 2020).

Therefore, it is imperative to discover the nature and the magnitude of the impact of COVID-19 on the construction sectors and specifically on the construction industries of developing countries (Al-Mhdawi et al., 2022). Pakistan is among those countries rated to be significantly affected by COVID-19 (UNCTAD, 2020). It is also evident from the Labor Force Survey of Pakistan that anticipated a rise in unemployment of 8.1% during the fiscal year 2020–21 as compared to that of 5.8% (2017–18). The above discourse justifies that Pakistan will suffer in various aspects where construction sector is no exclusion. The literature about COVID-19 is still very short regarding the construction industry sector. Moreover, no significant research has been published to investigate the COVID-19 impact on construction performance in Pakistan. Therefore, this research aims to study the performance of construction sector through a project-based and hybrid approach (i.e., organized literature review followed by rating on each factor through questionnaire by construction professionals). with following three objectives:1) To identify critical factors influencing project performance during COVID-19, 2) to investigate the impact of COVID-19 on project performance using semi-structured interviews and 3) to present adopted strategies that address challenges during pandemic. The associated objectives are put in place to help identify and compile an extensive list of factors affected by the COVID-19, to find out the extent of impact on construction project performance, and to present the mitigation strategies adopted against the challenges faced on construction projects.

1.3 Objectives

- To identify critical factors influencing project performance during COVID-19
- To investigate the impact of COVID-19 on project performance using semi-structured interviews
- To present adopted strategies that address challenges during pandemic

1.4 Area of Application

The area of application of this study is mainly in presenting of adopted strategies that will help construction industry of Pakistan as well as other developing countries in times of pandemics. This study is performed in construction sector of Pakistan, which is a developing construction market, but the results can be applied to other developing markets as well. Provided they have the same socio-economic class. The COVID-19 pandemic has exposed many layers of faults that reside in the current global construction industry. Furthermore, the methodology is adopted by this study can be used as foundation for researchers and authors in finding out construction projects' performance in developing countries.

1.5 Organization of thesis

This thesis comprises of five chapters. The brief description is described below:

1.5.1 Chapter 1

This chapter includes the description of the topic, justification of the topic, relevance to national needs and objectives of the research.

1.5.2 Chapter 2

This chapter comprised of the review of already conducted studies on the impact of COVID-19 on construction industry of various countries. This chapter also discuss about the construction industry of Pakistan.

1.5.2 Chapter 3

This chapter include the tools and techniques applied to carried out the research.

1.5.3 Chapter 4

This chapter comprises of data and analysis followed by results and discussion of the findings.

1.5.4 Chapter 5

This chapter concluded about the findings of the study followed by limitation and future work.

CHAPTER 2

LITERATURE REVIEW

2.1 Impact on Construction Industry

The emergence of the COVID-19 has deteriorated many aspects of construction projects' performance such as technological, political, social, communication, economic, planning and execution (Stiles et al., 2021). Construction sector is strongly affected by COVID-19 (David, 2020). The implications of COVID-19 on Construction industry are twofold, first work has been halted or changed whereas the second projects paused while new construction practices come to introduce(Stiles et al., 2021). During the pandemic first problem in the construction sector was observed is the shortage of material from suppliers (Gamil & Alhagar, 2020). The second major issue was dealing with scheduling errors which cause discrepancies in schedules and payments(Ali, 2020). This ultimately lead to cost overruns and time delays (Gamil & Alhagar, 2020). Unforeseen shortages of materials evitability lead to overpricing that caused drastic changes in the form of unjustifiable construction costs (Fernandes, 2020). Another major concern was the reduced movement of people during the pandemic also known as "lockdown strategy"(IMF, 2020). This can be attributed to liability for extension of time and compensation for the inevitable costs incurred due to it (Ogunnusi et al., 2020). Due to such restrictions, countries with high population numbers like Indonesia and China remain in lockdown which limits accesses to many recourses needed for construction (Riadil, 2020). Construction heavily depends on movement of personnel, any compromise to this process will have effects on construction quality, time and costs(ILO, 2020).

Furthermore, a study conducted by *Suiko* (2020) on 45 independent construction projects revealed productivity losses of about 7 % due to various factors including labor shortages and social distancing protocols among those on the top. Similarly, a study conducted by Sami et al (2021) explored the impact of pandemic on UAE construction industry and found that pandemic caused financial losses, unavailability of resources, delays in projects and presented strategies adopted by the stakeholders to address the challenges. In a like manner. Nguyen (2021) explored the impact on Vietnamese construction sector and found that construction companies facing decline in revenues, mitigated them by cutting-off staff and reducing workers' wages. Similarly, another study examined the impact on UK construction industry and identified various challenges including low productivity rates, cash-flow disruption, and price escalation etc. (Alsharef et al., 2021). Another study conducted by (Aigbavboa & Aghimien, 2021) suggested that the impact of pandemic in South Africa can be mitigated by giving tax relaxations and financial support to construction companies. Likewise, (Agyekum et al., 2021) identified the various factors affecting construction industry of Ghana and their corresponding mitigation strategies adopted by the construction companies. Moreover, (Al-Mhdawi et al., 2022) quantified the impact of COVID-19 on private and public sector of Iraq construction industry by identifying factors and various construction themes. Due to the pandemic many projects have not only seen delays but some of them have stopped completing to be started again at a later dates(Stiles et al., 2021). These events and how to deal with such events are not part of traditional contractual literature(Fu & Shen, 2020). A comprehensive contract should be formulated these bodies which includes terms and conditions which can deal with such unforeseen events and conditions and help manage them in a proper manner(Reynolds,

2021). In some cases, Covid 19 can be seen as a force majeure occurrence which in any standard form of contract leads to extension of time (Aviantara, 2020). The extension of time does not included compensation for cost. However, any new legal formality or law spaced by the local government supersedes the contractual position/ obligation proposed at the start of the projects(Ogunnusi et al., 2020). Keeping these aspects in mind legal balancing of contracts during covid 19 is a very huge undertaking which greatly impacts all construction work (Aviantara, 2020)

2.2 Covid-19 And Pakistan Construction Industry

Pakistan possesses a Human Development Index of 0.56, ranking the country in a medium development category and at a rank of 154 out of 189 countries (UNDP, 2020). It is witnessed that construction industry of Pakistan was impacted due to COVID-19 (Shafi et al., 2020). Construction is considered as one of the main components of industrial sector in Pakistan's economy. The construction sector contributes 2.61 percent to GDP and absorbs 7.61% percent of labor force (PES, 2021). According to Pakistan Economic Survey 2020-21, the total workforce in the country were reduced from 55.74 to 35.04 million due to COVID-19 (PES, 2021). This indicates that people were either unable to work or lost their jobs in construction sector as well due to it being highly labor intensive (Zafarullah, 2017). To mitigate the severe impact of pandemic on economy and the construction workforce, the government of Pakistan announced a construction package of Rs 1,240 billion (USD 11.209 billion). This resulted in the resumption of jobs and increased construction growth rate of 8.34% for 2020-21 as compared to the previous figure of 5.46% in 2019-20 (PES, 2021). This highlights that construction industry of Pakistan has experienced serious hurdles that needs to be investigated from the ground realities.

However, no single research study is published to record the challenges and the strategies exercised by the stakeholders for the mitigation. Therefore, this research targets to fill this gap by doing a project-based study encompassing various types of construction projects from different geographical location to ascertain a realistic picture.

2.3 Factors Affecting Construction Project Performance

To identify the impact of the pandemic on the construction sector, many studies have conducted a literature review analysis. The researchers carried out a thorough database search to find out the essential factors. The research papers were selected that were strictly relevant to COVID-19 in the sector of the construction and discussed the impact and aftermath on various construction processes during the year 2020. Various papers mentioned the factors affecting the project performance during COVID-19, through literature review analysis factors were extracted that are mentioned in the Table 2.1.

Table 2.1: Project Performance Factors

Sr.	Factors	Selected References
1	Challenges in importing material and equipment	(Sami et al., 2021; Piro, 2020)
2	Challenges in locally procuring materials	(Ali, 2020),(Alenezi, 2020)
3	Escalation of material prices	(Edward,2020), (Gamil & Alhagar, 2020), (Alenezi, 2020)
4	Job uncertainty of employees	(Assaad & El-adaway, 2021; Kaushal, 2021; Ogunnusi et al., 2020)
5	Foreign workers returned to their country due to Covid-19	(Bsisu, 2020)
6	Shortage of labor	(Wang et al., 2021; Gamil & Alhagar, 2020)
7	Effect on Construction Safety	(Jeon et al., 2022; Bsisu, 2020)

Sr.	Factors	Selected References
8	Need of educating worker about COVID-19	(Bsisu, 2020)
9	Legal issues/Disputes arising from contracts	(Kim et al., 2021 ;Scott et al., 2020)
10	Financial Market instability	(Raoufi & Fayek, 2021; Piro, 2020)
11	Delays in Payment of Salary	(Jeon et al., 2022; Ali, 2020; Sami et al., 2021)
12	Difficulty in maintaining required operational cash flow	(Ogunnusi et al., 2020)
13	Increasing cost overheads in project	(Kaushal, 2021; Gamil & Alhagar, 2020;Ali, 2020; Aviantara, 2020)
14	Decline in turnover of construction companies	(Nicola et al., 2020)
15	Risk-Averse behavior of investors	(Raoufi & Fayek, 2021)
16	Travel restriction	(Aviantara, 2020), (ILO, 2020)
17	Delays in project	(Ogunnusi et al., 2020)
18	Restrictions on labor mobility	(Ali, 2020),(Alenezi, 2020)
19	Low Productivity of Labor	(Edward,2020), (Gamil & Alhagar, 2020), (Alenezi, 2020)
20	Cost of procuring COVID-19 specific PPEs(Sanitizers, Gloves etc.)	(Assaad & El-adaway, 2021; Kaushal, 2021; Ogunnusi et al., 2020)
21	Lack of coordination amongst stakeholders	(Bsisu, 2020)
22	Continuation of construction of high priority projects	(Wang et al., 2021; Gamil & Alhagar, 2020)
23	Delays in Equipment availability	(Jeon et al., 2022; Bsisu, 2020)
24	Lack of fund to implement adequate response to COVID-19	(Bsisu, 2020)
25	Reduction in labor wages	(Kim et al., 2021 ;Scott et al., 2020)
26	Challenges in Recruiting	(Sami et al., 2021; Piro, 2020)

Sr.	Factors	Selected References
27	Decline in Stock markets	(Ali, 2020),(Alenezi, 2020)
28	Effect on Project Quality	(Edward,2020), (Gamil & Alhagar, 2020), (Alenezi, 2020)
29	Decrease in the pace of construction activities due to social distancing	(Bsisu, 2020)

2.4 Rating Shortlisted Factors

Having performed the extensive literature review, the list of factors shown in Table 2.1 were further shortlisted by construction professionals. The professionals were selected with the minimum experience of more than 5 years working in AEC industry during COVID-19. The selected professionals had work environment from various cities and provinces contributing towards the diversity in the study. The demographics and experience of selected professionals are shown in **Figure 1.1** and **Figure 1.2** respectively.

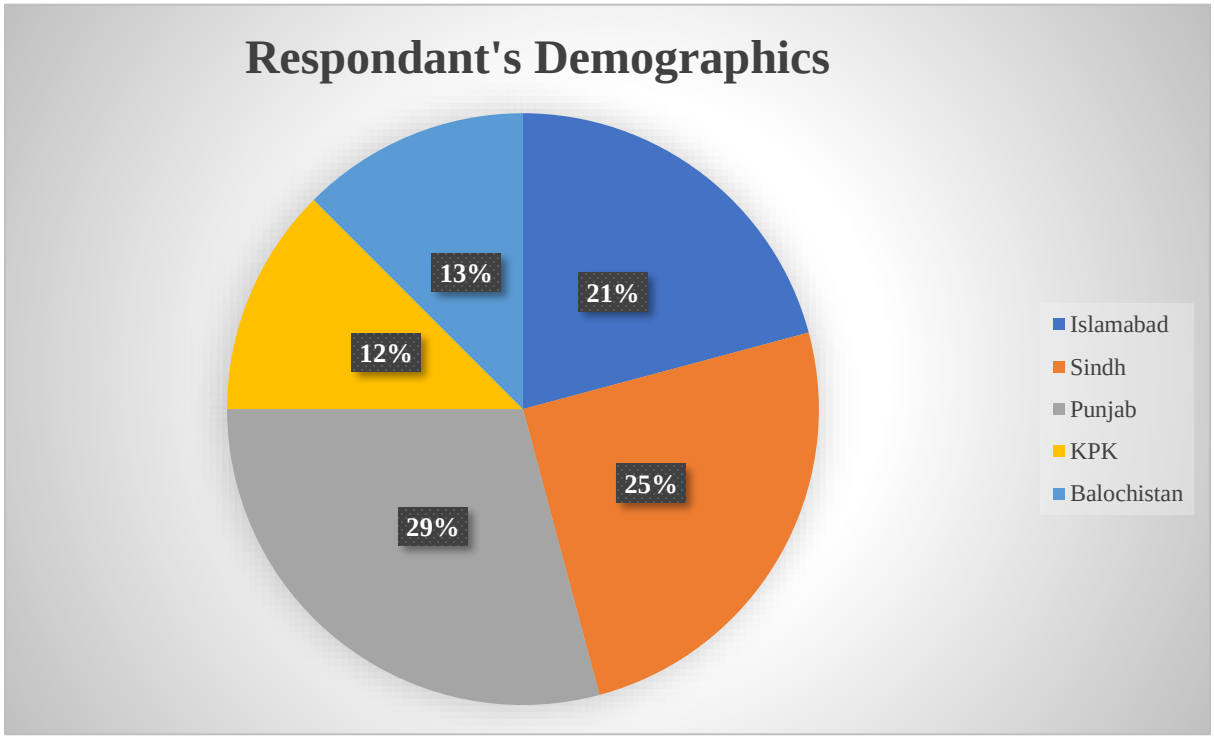

Figure 1.1: Respondent's Demographics

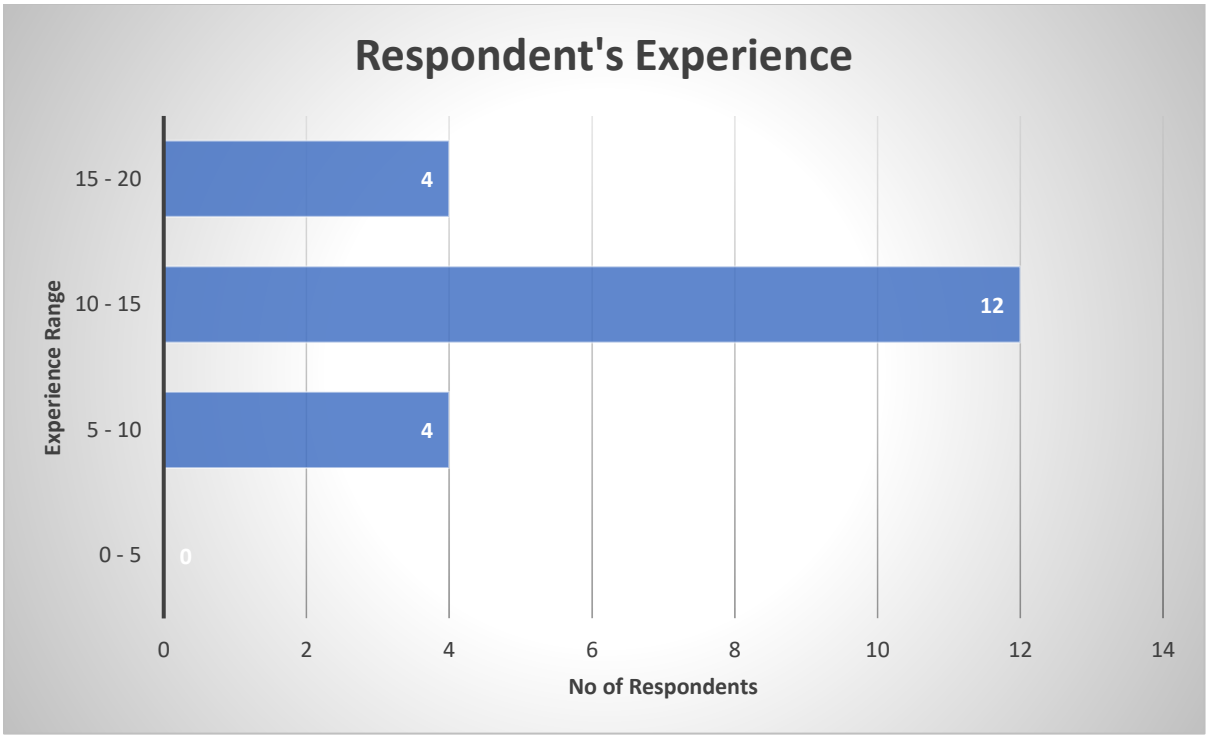

Figure 1.2: Respondent's Experience

The purpose for shortlisting factors is to develop relevance with developing countries as the list of factors included all studies. Table 2.2 shows the list of factors with RII.

Table 2.2: RII of Factors

Sr.	Factors	RII
1	Challenges in importing material and equipment	4.28
2	Challenges in locally procuring materials	3.8
3	Escalation of material prices	3.64
4	Job uncertainty of employees	4.44
5	Foreign workers returned to their country due to Covid-19	3.72
6	Shortage of labor	3.32

Sr.	Factors	RII
7	Effect on Construction Safety	4.12
8	Need of educating worker about COVID-19	3.84
9	Legal issues/Disputes arising from contracts	3.64
10	Financial Market instability	4
11	Delays in Payment of Salary	3.96
12	Difficulty in maintaining required operational cash flow	3.92
13	Increasing cost overheads in project	3.6
14	Decline in turnover of construction companies	3.56
15	Risk-Averse behavior of investors	4
16	Travel restriction	4.32
17	Delays in project	4.12
18	Restrictions on labor mobility	2.96
19	Low Productivity of Labor	2.92
20	Cost of procuring COVID-19 specific PPEs(Sanitizers, Gloves etc.)	2.8
21	Lack of coordination amongst stakeholders	2.64
22	Continuation of construction of high priority projects	2.52
23	Delays in Equipment availability	2.52
24	Lack of fund to implement adequate response to COVID-19	2.48
25	Reduction in labor wages	2.48
26	Challenges in Recruiting	2.4

Sr.	Factors	RII
27	Decline in Stock markets	2.36
28	Effect on Project Quality	1.56
29	Decrease in the pace of construction activities due to social distancing	1.44

CHAPTER 3
METHODOLOGY

3.1 Introduction

To achieve the objectives of the study, a comprehensive research methodology was adopted comprising of three phases. In the first phase, a thorough literature review was performed on 48 research papers related to the COVID-19 pandemic, to identify the factors that can affect construction projects' performance. A preliminary survey was then conducted to shortlist the most significant factors of the construction industry by using the Relative Importance Index (RII) calculated through .

Equation 1 $\mathbf{RII = \Sigma W / (A*N)}$

The exercise resulted in 13 shortlisted factors. The next step was then to divide the shortlisted factors into appropriate construction themes using past literature. In the second phase, an open-ended question was formed against each shortlisted factor. 20 on-going construction projects, with 4 from each province of the country were targeted for the study purposes. Following a qualitative approach, the study adopted the conduction of semi-structured interviews as used (Al-Mhdawi et al. 2022) from construction professionals of targeted projects in order to get the insights about the project performance during the pandemic times. This approach was selected as other pandemic related studies had also recommended its appropriateness due to its allowance of getting exhaustive views and experiences (Simpeh and Amoah 2021; Jallow et al., 2020). The recorded interviews were conducted though face-to-face discussions with strict compliance of social distancing protocols. The participants were asked to respond only in the perspective to their projects. In the final phase, the collected data was analyzed to find out the challenges posed by

COVID-19 on the targeted projects' performance, followed by an appropriate discussion on mitigation strategies and conclusion. All the steps are showed in the given figure.

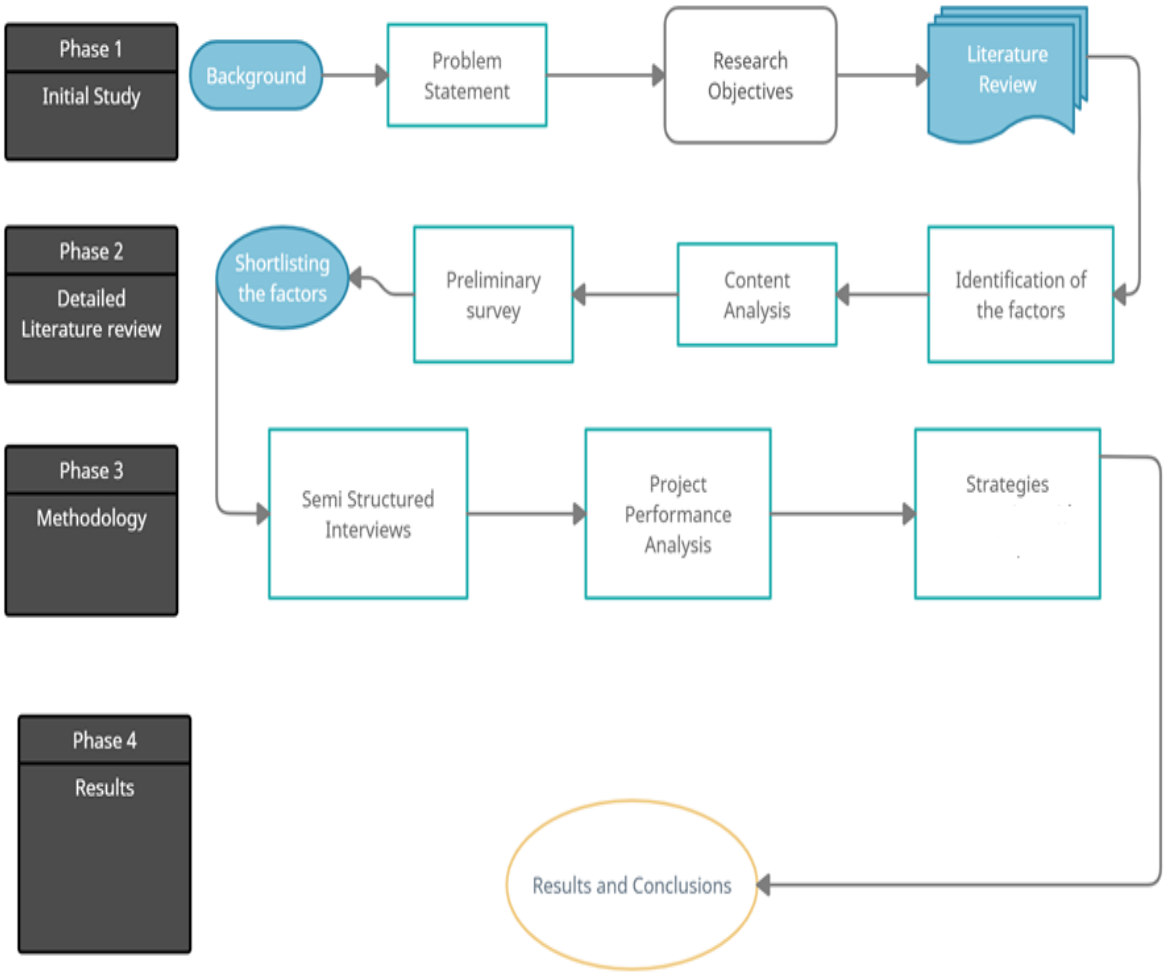

Figure 1.3: Research Methodology

3.2 Identification of Factors:

The research has carried out a thorough database search to find out the essential COVID-19 associated factors that can influence the construction sector. Searching of relevant papers was performed using Scopus, Google Scholar, and Clarivate repositories as used by (Al-Mhdawi et al. 2022). Keywords used for searching included “novel coronavirus”, “COVID-19”, “pandemic and construction”, “COVID-19 impact”, “pandemic impact on construction”, “COVID and cost”, and “COVID and time”. Only those research papers were selected that were relevant to the construction and COVID-19. After exhausting the said literature, 64 factors were obtained from a total of 48 shortlisted papers. Owing to similar meaning, the authors reduced the factors to 9 to avoid repetition. Since these shortlisted factors might not truly corresponds to the situation of the local construction industry, therefore, there was a need to verify such factors from the industry experts. For this purpose, a total of twenty-five construction practitioners having an experience of minimum 10 years were contacted to verify the relevancy of these factors. The survey, conducted between October 2020 to Jan 2021, assessed the significance of the factors on the construction projects of Pakistan project performance at a 5-point Likert scale where 1= no significance, 2= slightly significance, 3= moderate significance, 4= high significance, 5= very high significance

Hassan Naveed et al. (2017) in their study shortlisted factors on the basis of their above mean RII scores. Same methodology was used that resulted in shortlisted of 13 factors. Furthermore, based on the analyzed literature, the authors categorized these factors into five construction themes namely Human Resource, Financial, Occupational Health and

Safety (OHS), Contracts and Material & Equipment. All the 13 factors along with their RII scores are presented under their respective themes in **Error! Reference source not found.**.

3.3 Development of Survey Instrument:

Having finalized the categories, for each factor the open-ended questions were developed for semi-structured interviews, and it is necessary to formulate open-ended questions before the interviews (Alsaawi, 2016). This method was preferred because it allows the researchers to identify the challenges and enable experts to speak in greater detail on the subject (Sami et al., 2021), additionally it is a constructive method in determining complicated phenomena or situations (Galletta & Cross, 2016), also past studies has been using it to identify managerial factors related to construction and engineering management (Lestari et al., 2019). The open-ended questions were developed in a sequence, allowing respondents to correlate to the preceding question and more precisely summarize and express their justification in a coherent manner. All the questions against each factor are presented in the survey instrument section of **Error! Reference s ource not found.**.

Table 3.1: Identification of Factors

Identification of Factors		**Survey Instrument**
Sr.	Factors	Question
Material & Equipment		
1	Challenges in importing material and equipment	What challenges did you face in importing material and how did you manage challenges while importing material or equipment during Covid-19?

2	Challenges in locally procuring materials	What challenges did you face while procuring material locally during Covid-19 and how did you manage it?
Identification of Factors		**Survey Instrument**
Sr.	Factors	Question
3	Escalation of material prices	Prices are escalated during pandemic. How your project performance affected by escalation? And how did you manage it?
Human Resource		
4	Job uncertainty of employees	Did COVID-19 create job uncertainty? If yes, how did that job uncertainty impacted your project performance?
5	Foreign workers returned to their country due to Covid-19	Are there foreign employees working on your project? If yes, did they return to their respective countries? Also, how did you manage difficulties created after their departure?
6	Shortage of labor	Do you face labor shortage on your project? Also, how do you cope with the shortage of labor to achieve the desired project performance?
Occupational Health and Safety		
7	Effect on Construction Safety	How did covid-19 affect the construction safety on your project?

8	Need of educating worker about COVID-19	Up to what extent there is a need of education our labor community regarding Covid-19? Will it create any impact on productivity/performance of project?
Identification of Factors		**Survey Instrument**
Sr.	Factors	Question
Contracts		
9	Legal issues/Disputes arising from contracts	What kind of contractual disputes did you face during pandemic and how did you manage it?
Financial		
10	Financial Market instability	What were the challenges related to financial market instability during Covid-19, How did you cope with hurdles for your project during Covid-19?
11	Delays in Payment of Salary	How delays in salaries of staff affected the performance of project?
12	Difficulty in maintaining required operational cash flow	What difficulties did you face in maintaining operational cash flows? How did you cope cash flow for your project during COVID-19?
13	Increasing cost overheads in project	What were the reasons for additional cost overheads during the pandemic?

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Data Collection and Analysis:

The participants were contacted, and interview dates were confirmed as per their availability. To conduct face-to-face discussions, interviews were conducted with strictly social distancing compliances introduced by the authorities in Pakistan. Initially, a brief introduction was given to participants and asked for their consent to use all the relevant feedback in the research. The participants were asked to respond only relevant to their project experience. The interviews were recorded, and their durations were approximately 30 to 45 minutes. To analyze the results of this study content analysis was conducted on Microsoft Excel, which is presented in the Findings and Discussion section.

4.1.1 Demographics of Projects:

For selecting the projects for case studies, the researchers focused on projects that were willing to partake in the study and their accessibility is easy. The various types of projects were selected working in both government and private sector with four number of projects from each province: Sindh, Punjab, Baluchistan, Khyber-Pakhtunkhwa, and Islamabad Capital Territory resulting in total 20 number of projects. The relevant details of the projects are comprised in **Error! Reference source not found.**.

Table 4.1: Profile of Projects

Sr.	Project	Type	Working Sector	Cost (Millions)	Location
1	A	Building	Private	640	Islamabad
2	B	Building	Private	589	

Sr.	Project	Type	Working Sector	Cost (Millions)	Location
3	C	Building	Government	8000	
4	D	Building	Private	4989	
5	E	Infrastructure	Government	283	KPK
6	F	Infrastructure	Private	13058	
7	G	Heavy Engineering Construction	Government	858	
8	H	Building	Private	176	
9	I	Building	Private	1200	Punjab
10	J	Building	Private	1174	
11	K	Heavy Engineering Construction	Government	6454	
12	L	Infrastructure	Government	5124	
13	M	Heavy Engineering Construction	Government	10500	Sindh
14	N	Infrastructure	Private	2600	
15	O	Building	Private	26	
16	P	Heavy Engineering Construction	Private	1300	
17	Q	Heavy Engineering Construction	Government	19230	Baluchistan
18	R	Infrastructure	Private	1807	
19	S	Heavy Engineering Construction	Government	12983	
20	T	Building	Private	160	

4.1.2 Demographics of Respondents:

Several construction professionals having key positions and hands-on experience were interviewed. For the choosing of interviewees, the researchers selected a purposive sampling method where the researchers approach area experts of specific field (Creswell & Clark, 2011). Considering the impact of the COVID-19 on construction sector is a complicated issue, and therefore it is necessary that the interviews be conducted with experts. Consequently, respondents were selected based on their diverse experience and subject knowledge. The sample of the study included members of contractor firms from top management, coordination teams, execution staff, and planning teams. Table 4.2 consisted of respondents' background information such as experience, qualification, and position.

Table 4.2: Respondents Profile

S.NO	Position of Respondents	Project	Experience	Qualification
1	Senior contract manager	A	20	MSc
2	Manager Projects	B	17	MSc
3	Assistant Project Engineer	C	17	MSc
4	Project Coordinator	D	16	BSc
5	Project Manager	E	19	BSc
6	Deputy Project Manager	F	16	BSc
7	Project Manager	G	22	BSc

S.NO	Position of Respondents	Project	Experience	Qualification
8	Project Engineer	H	17	MSc
9	Project Manager	I	16	BSc
10	Project Manager	J	14	BSc
11	Planning Engineer	K	13	MSc
12	Project Coordinator	L	13	MSc
13	Site Engineer	M	12	BSc
14	Project Engineer	N	15	BSc
15	Construction Manager	O	17	BSc
16	Civil Engineer	P	15	MSc
17	Senior Quantity Surveyor	Q	14	BSc
18	Manager Projects	R	16	MSc
19	Project Engineer	S	18	BSc
20	Project Manager	T	14	BSc

4.2 Results and Discussion:

4.2.1 Material and Equipment

Q1: What challenges did the project face in importing materials and how were those challenges managed?

All the participants indicated that they faced many challenges in importing materials. Supply shortages at source, increased shipment cost, port congestions were some common challenges that led to delays and cost overruns. One of the participants

mentioned that they had tried to import generators from the United Kingdom for more than six months, but the shipment was delayed due to supply shortages and staff rotations at the source. Another participant stated that procuring Dampa ceiling from a local supplier that deals with OEM also resulted in project delay due scarcity of product at source. One more participant described the procurement of wind turbines and their allied components from multiple destinations like Germany, China, and Taiwan. The organization ended up paying double the amount of shipment cost for timely arrival because of a high priority project. Four participants revealed that importing various MEP items faced challenges of ordering in limited quantity due to port congestion issues.

Most of the projects tried to cope with the challenges by switching to local suppliers. Instances of material replacement were also practiced on some projects; however, some of the suggested replacements were rejected by the client due to their possible adverse impact on quality. One project stakeholder agreed to reduce the material approval time from 14 days to 1 day in conditions of contract in order to manage the delays caused by COVID-19. Only one recently started project was able to overcome the imported material procurement issues by engaging multiple vendors in its initial phase of execution.

Q2: What challenges did you face while procuring material locally during Covid-19 and how did you manage it?

In material procurement from the local market, inter-provincial travel ban, local industry closure, and supply shortages were common challenges faced by the targeted construction projects. Majority of the participants addressed that consultant's inability to travel caused hinderances in material approval which ultimately caused delays. Three participants stated that procurement of bricks, stones and marble was delayed due to

provincial border closure. Participants mentioned that the closure of the steel industry resulted in severe steel shortage that badly affected the projects in terms of their timelines. To mitigate the effects, most of the companies adopted to diversify their material sources for the projects. Seven participants commented that whenever possible, their companies ordered material in bulk from other provinces because of the unpredictability around the inter-provincial transport restrictions. However, this exercise led to upfront cash flow problems for contractors. Another participant stated that their project managed to obtain the transport permit for their material delivery due to it being on high priority. One of the companies adopted a strategy to replace its wooden shuttering with that of steel because of its reusability and no vulnerability on shortage. Some participants stated that their organizations managed to contract with a ready-mix concrete supplier to counteract shortages of cement and aggregates.

Q3: How much the escalation of material prices affected your project performance? How did you manage the issue?

Majority of the participants agreed that their projects were affected by price escalation of materials. According to some participants, cost overruns in projects were mostly attributed to uncertain fluctuations of material prices that caused project performance to deter in term of project cost. The delays in delivery at destinations and shortages from the source are the main reasons for such steep prices. One participant explained that steel prices witnessed sudden increased price in market that caused unforeseen cost overruns on the project. Contrary, there were instances where this raise in material prices did not affect few projects because of sufficient material availability on

project sites due to them being in far flung areas. The contractors were bound to order in bulk at the first place and afterwards, the resumption of market after lockdown helped in the fall of material prices which ultimately resulted in no major effect on those projects. With regard to mitigation of price escalation affects, many of the participants believed that the major affect was mostly covered through the price adjustment formula applicable on the contracts. Whereas some participants mentioned that their clients helped in procuring materials at pre-covid market rates due to their influence on the suppliers.

The following table is the conclusion of the data analysis and discussions regarding the material and equipment challenges faced during COVID 19.

Table 4.3: Material and Equipment Challenges, Impact and Strategies

Sr	Challenge	Project	Province	Impact	Action Taken	%
1	Lock down	A B	ISLAMABAD	Schedule delay	Ordered in bulk whenever possible, replaced material, and Claimed EOT	20
		F	KPK	Schedule delay and Cost increased	Diversified material sources	
		P	SINDH	Schedule delay	Claimed EOT	
2	Provincial border closure	F	KPK	Schedule delay	Diversified material sources	35
		H			Taken long route	
		J, K	PUNJAB	Schedule delay	Ordered in bulk whenever possible and Claimed EOT	

Sr	Challenge	Project	Province	Impact	Action Taken	%
		Q, R	BALOCHISTAN	Schedule delay	Claimed EOT	
		S			Change Design	
3	International Border Closure	C, D	ISLAMABAD	Schedule delay	Change Design and Claimed EOT	40
		E, G	KPK	Schedule delayed and Cost increase	Design Change and Claimed EOT	
		I, J	PUNJAB	Quality Compromised and Cost decrease	Switched to local supplier	
		M, O	SINDH	Schedule delayed	Claimed EOT and Design Changed	
4	Supply chain disruption	A B	ISLAMABAD	Schedule delayed	Diversified material sources and Claimed EOT	60
		C		Schedule delayed	Claimed EOT and Replaced Material	
		D		Schedule delayed and Cost decreased	Claimed EOT and Switched to local supplier	
		E, G	KPK	Schedule delayed	Claimed EOT	
		J	PUNJAB	Schedule Delayed and Cost Increased	Imported Material in small slots	
		L			Claimed EOT	
		M, O	SINDH	Schedule Delayed and Cost Increased	Paid more cost and Claimed EOT	

Sr	Challenge	Project	Province	Impact	Action Taken	%
					Claimed EOT	
		R	BALOCHISTAN	Cost decreased and Schedule delay	Switched to local supplier	
		T		Schedule delay	Diversified material sources	
5	Local Industry Closure	A B	ISLAMABAD	Schedule delayed	Diversified material sources	30
		D			Design Change	
		F	KPK	Schedule delayed	Claimed EOT	
		I	PUNJAB	Schedule delayed and Cost Increased	Claimed EOT	
		L				
6	Port Congestion	C, D	ISLAMABAD	Schedule delayed and Cost increased	Switched to a local supplier and Claimed EOT	40
		E	KPK	Schedule delayed and Cost increased	Diversified material sources	
		G			Claimed EOT	
		I	PUNJAB	Quality compromised and Cost decreased	Switched to local supplier	
		M	SINDH	Schedule delayed	Imported material in small quantity and paid more in shipment	
		O			Claimed EOT	
7	Exporter Country's Policies	C	ISLAMABAD	Schedule delayed and Cost increased	Paid more shipment cost	10

Sr	Challenge	Project	Province	Impact	Action Taken	%
					and Claimed EOT	
8	Material Approval	C	ISLAMABAD	Schedule Delayed	Reduced material approval time from 14 days to 2 days	10
		L	PUNJAB	Schedule Delayed	Claimed EOT	
9	Price Escalation	C, D	ISLAMABAD	Cost increased	Help was taken from the client	50
		F	KPK		Preordering	
		I, J, L	PUNJAB		Diversified material sources	
		M, N, P	SINDH		Diversified material sources	
		S	BALOCHISTAN		Help was taken from the client	

Firstly, the study's findings revealed that 60% of the projects encountered supply chain disruptions as challenges that negatively impacted the cost and timeline of the projects, it is also stated by (Sami et al., 2021; Al-Mhdawi et al., 2022). All the four projects in Islamabad were delayed whereas only one project decreased its cost additionally while delaying. To mitigate its effects, all projects in Islamabad claimed EOT along with other strategies like replacing material, diversifying material sources, and contact local suppliers. Also, two projects in KPK were delayed because of the same issue and claimed EOT because no action could be taken. Similarly, the other two projects from Punjab faced delays and cost overruns, so they adopted to import in smaller numbers and regular intervals to lessen the effects of delays. The two projects in Sindh faced the same issues as

the ones in Punjab, however, to mitigate the damages the Sindh project acted by paying more shipment costs and claiming EOTs. Furthermore, two projects in Baluchistan faced delays and cost increments to soften the effects of supply chain disruptions, one project switched to local suppliers whereas the other one contacted multiple supplier.

Secondly, the rest of the 40% of projects observed port congestion and international border closure as the main hurdle in maintaining project performance. Considering port congestion, it has affected the projects all over the country except in Baluchistan. Two projects in Islamabad and KPK were delayed due to port congestion that led to increased costs which resulted in switching to local suppliers and claiming EOT as mitigation measures. In KPK claiming EOT was the adopted strategy while in Islamabad the mitigation measure was to contact multiple suppliers. In Punjab, only one project compromised its quality and decreased costs by switching to a local supplier whereas in Sindh two project were delayed and adopted to import in several slots and pay more shipment costs while also claiming EOT. Moving onto international border closure, two projects from Islamabad and Sindh were delayed they reacted by claiming EOT and changing their design to mitigate further impacts. Similarly, two projects in KPK were delayed which caused a significant rise in costs that enabled them to claim EOT and change their design to accommodate the new prices. In Punjab, two projects switched to local suppliers to mitigate delays and compromise their quality.

Thirdly, almost 35% of the projects from KPK, Punjab, and Baluchistan collectively have acknowledged provincial border closure as a threat to project performance. It has impacted projects in terms of delays and to counteract its effects two projects from KPK diversified their material sources and took longer routes for onsite

material delivery. Whereas in Punjab, both projects were ordered in bulk whenever possible and claimed EOT. Similarly, out of three projects in Baluchistan, two claimed EOT whereas the remaining project embraced the mitigation approach of design changes.

Fourthly, 30% of the projects mentioned the closure of local industry as a challenge for their project. Three of the projects in Islamabad were delayed due to the closure of local industry. To mitigate its effects, two projects tried to find new alternatives whereas one project changed its design. Similarly, a project KPK and two projects in Punjab were delayed and found no option to manage industry closure effects so they eventually claimed EOT.

Fifthly,20% of the project from Islamabad, KPK and Sindh encountered the government-mandated lockdowns as a barrier for their progress and faced delays. Both projects-controlled delays by ordering in bulk whenever possible, replacing materials, and claiming EOT whereas the remaining project used multiple suppliers to overcome the issue. The project in KPK lessened the effect of lockdown by diversifying material sources whereas the project in Sindh could not adopt any mitigation strategy and only claimed EOT.

Sixthly, only 10% of the projects from Islamabad and Sindh considered the exporter country's policy as an obstacle to project progress. Both projects faced delays and cost overruns and took up to lessen the impacts by paying more shipment costs and claiming EOT. Similarly, the same percentage of the projects are confronted with material approval. Two projects from Islamabad and Punjab were delayed due to late material approval and to minimize its repercussions project in Islamabad reduced its material approval time and claimed EOT whereas the project in Punjab claimed EOT only.

Lastly, half of the projects highlighted price escalation as a major hurdle in project success. The effect of price escalation was observed across most projects. Projects in Islamabad and Baluchistan mitigated the impact by taking help from their respective clients in procuring materials. Similarly, the project in KPK faced cost overruns because of supply chain disruptions, to mitigate the effects preordering of material was done. However, three projects from Sindh and Punjab province faced cost overruns due to increased traveling costs and supplier price hikes, consequently, through diversifying their material sources by contacting multiple suppliers they mitigated the effects cost escalation.

4.2.2 Human Resource

Q1: Did COVID-19 create job uncertainty? How did job uncertainty created by Covid-19 impact the project performance?

According to the data of 20 case studies, majority of the participants agreed with the notion of job uncertainty among construction workers due to COVID-19 which influenced the project positively or negatively. Six participants stated that the employees were showing their best to secure their jobs that positively affected the project performance. Whereas five participants stated that their workers suffered from distress due to the uncertain situation in market, that negatively affected their productivity and worsened the project performance. Additionally, two participants commented that half of the project employees were sent on leave that created a burden on the remaining ones to achieve the desired project objectives.

On the other hand, couple of the participants revealed that their project was not much affected by this uncertainty because the construction industry was allowed to start physical work after a period of around one month. Moreover, two participants stated that

their projects were not affected due to the job uncertainty because of being high priority projects that ensured a significant amount of labor and staff on-site. The workers of projects in remote areas also did not face any job uncertainty because their sites were in remote area which bounded the contractors to have ample number of workers present to proceed in accordance with project timelines.

Q2: What challenges did your project face with regard to the foreign workers employed on the project?

Out of 20 projects, 15 projects did not have foreign workers employed on the projects. Whereas the remaining five projects had employees from China, Germany, and Turkey. Out of five projects, foreign employees of only one project managed to depart to their respective countries after foreseeing the crisis early. Whereas employees from remaining four projects did not return to their countries because of quarantine policies, international border closure, and fear of job loss. According to respondents, the projects did not suffer much but the well-being of those employees suffered more due to being away from their families during the pandemic times.

Q3: How do you cope with the shortage of labor to achieve the desired project performance?

Only 4 projects faced labor shortages due to COVID-19. The major reasons for this shortage were travel restrictions and the mindset of construction workforce. Intercity travel restrictions via public transport were placed by various provincial governments from time to time even after the withdrawal of the major lockdown. For the latter reason, most of the construction workers believed that the coronavirus was only active in cities and not in villages. This belief stopped workers who live in villages, from returning to project sites

located in urban areas. Moreover, the quarantine in isolation and vaccination rules imposed by the employers were also other concerns among workers that stopped them from travelling back to project sites. This labor shortage resulted in the increased overheads for the employers. The available workers were pampered with increased amenities on project sites, COVID-19 safety awareness talks and were also provided enhanced financial incentives for job continuity in order to meet the project objectives.

The other 16 projects did not face labor shortages due to availability of ample workforce around the project vicinity and the poverty concerns among the workforces.

The following table is the conclusion of the data analysis and discussions regarding the Human Resource challenges faced during COVID 19.

Table 4.4: Human Resource Challenges, Impact and Strategies

S. No	Challenge	Projects	Province	Impact	Action Taken	Affected project %
1	Job Uncertainty/ Limited Staff	A B	Islamabad	Productivity Increased	----------	55
		D		Productivity Decreased due to limited staff	Paid more in overtime	
		G	KPK	Key Employees move toward more secure jobs and schedule delay	Hired new employees immediately	
					Switched Key staff to online and reduced site visits	
		J, K, L	Punjab	Productivity decreased and Anxiety induced	Paid more to key employees	
		O	Sindh	Schedule delay and	Switched Key staff to	

S. No	Challenge	Projects	Province	Impact	Action Taken	Affected project %
				Anxiety induced	online and reduced site visits	
		P		Productivity increased	----------	
		R	Baluchistan	Schedule delay	Paid more in overtime and other allowances	
2	Labor Shortage	A, B,	Islamabad	Schedule Delay and Quality compromised	Contacted multiple labor and Increased facilities	20
		D		Schedule Delay	Gave incentives and Paid travelling allowance	
		J	Punjab	Schedule Delay and Cost increased	Gave incentives to labor and traveling allowances	
3	Foreign Employees Returning	M	Sindh	Management disturbed	Hired new employees immediately	5

The study findings revealed that job uncertainty, foreign employees' departure, and labor shortages were challenges for projects. 55% of the projects from all provinces mentioned that job unpredictability created by COVID-19 posed a threat to their project performance. Out of three projects in Islamabad, two projects experienced an increase in productivity whereas only one decreased its productivity because of limited staff which was somewhat mitigated by incentives and paid overtime. Only two projects in KPK were

delayed, one faced staff resignation which were mitigated by switching office work to online mode, reducing site visits, and immediately hiring replacements for those who left. All the projects in Punjab, decreased their productivity and employees faced anxiety which was neutralized by payment incentives to key performing employees. Out of Two projects in Sindh, one project faced delays and productivity decreased which was remedied by reducing site visits and working hours whereas the other project increases in its productivity. Similarly, only one project was delayed due to limited staff and job uncertainty, and to alleviate its effects employer paid more in overtime and allocated more allowances.

In Pakistan, only 20% of the projects encountered labor shortages as a hurdle to their project progress. Out of three projects in Islamabad, two projects compromised their quality due to required skilled labor and were delayed whereas another project was only delayed. To manage effects, the former contacted multiple labor and increased their capabilities whereas the latter gave traveling allowance and paid incentives. Only one project in Punjab was delayed and faced cost overrun due to shortage of labor and to ease the effects the project adopted the same pattern of paying more to labor for relocation. Lastly, only 5% of the projects from across the country experienced returning of foreign employees to their respective country resulted in management disturbance that was mitigated by new hiring immediately.

4.2.3 Occupational Health and Safety

Q1: How does covid-19 affect the construction safety of your project?

According to the findings, it is observed that most of the projects had a significant impact on OHS due to COVID-19. All the participants mentioned that the compliance of

COVID-19 protocols resulted in the increased OHS overheads on their projects. Additional safety engineers were hired on two projects to cater for the conduction of daily safety drills pertaining to COVID-19 and monitoring of social distance compliance by the workers. Similarly, COVID-19 protocols pushed the constructors for creation of more labor camps facilitated with wall-mounted sanitizers. Moreover, the project sites were complemented with posters printed in local languages promoting wearing of facemasks and using sanitizers. Similarly, some projects witnessed installation of walk-through sanitization gates at access points for enforced compliance of COVID-19 protocols. The provision of facemask, sanitizers and gloves also resulted in the increased cost of PPE procurement. In one project, medical team was also called on site to ensure safety and well-being by daily screening of the workers during the start.

Q2: What were the challenges faced due to compliance of COVID-19 based OHS protocols? Is there a need for educating workers regarding Covid-19?

Some respondents mentioned that the stress created among the workers due to COVID-19 protocols decreased their productivity which affected the project pace. All the participants mentioned that compliance of COVID-19 SOPs initially slowed down workers' overall performance. This is aligned with the findings of (Stiles, Golightly, and Ryan 2021). According to one participant, the stress was causing absenteeism among workers as well. Considering challenges in implementing SOPs, most of the participants stated that workers were mostly reluctant to follow COVID-19 protocols which made the task even more challenging. The participants also stated that there were sanitizers and masks available on site; however, no one committed to consume them due to lack of seriousness. For the justification, participants mentioned that the workers in remote areas

were unaware of the virus and its effects. Similarly, the workers were not ready to mentally accept COVID-19 and its consequences that ultimately pushed them to unfollow the SOPs on site. One participant stated that they faced extreme resistance by the workers when asked to be vaccinated.

On some projects, these challenges were coped by implementing the fines on violation of COVID-19 protocols. Contrary, the workers were also awarded with the financial incentives on positive compliance.

Due to these challenges, all the projects' respondents unanimously agreed that the construction workers of Pakistan have lack of awareness and require education and training regarding COVID-19. Regarding the impact of training on project performance and productivity, the participants believed that the education might affect the productivity of the workers by creating awareness. The workers will have a safe feeling which will help in completing the task on time.

Lastly, most of the participants also stated that there will be an impact on project performance however it will only create awareness among workers. Similarly, a participant commented that the SOPs could not be followed in every task as required this is due to the nature of the work as few workers need to work shoulder to shoulder in lifting heavyweights.

The following table is the conclusion of the data analysis and discussions regarding the Occupational Health and Safety challenges faced during COVID 19.

Table 4.3: Occupational Health and Safety Challenges, Impact and Strategies

Sr	Challenge	Projects	Province	Impact	Reasons/Action Taken	Affected project %
1	Maintaining Construction Safety	A, B	Islamabad	Cost increased	Paid Hired new safety engineers, Cost of SOPs	65
		C, D			Paid Cost of SOPs	
		E	KPK	Cost increased	Paid Cost of SOPs	
		H			Paid Cost of SOPs, Cost of Labor Camp	
		I	Punjab	Cost increased	Paid Cost of SOPs, Cost of Labor Camp	
		J			Paid Cost of SOPs, Installation of Sanitization Gate	
		K, L			Paid Cost of SOPs, Hired new safety engineers	
		M	Sindh	Cost increased	Paid Cost of SOPs, hired emergency and on-call medical team	
		N			Paid Cost of SOPs, Increased overheads	

Sr	Challenge	Projects	Province	Impact	Reasons/Action Taken	Affected project %
		T	Baluchistan	Cost increased	Paid Cost of SOPs, Installation of Sanitization Gate	
2	Educating and Training Labor	A, B	Islamabad	Cost increased	Paid in Hiring new safety engineers	40
		E, H	KPK	Productivity Increased	Imposed fine	
		K, L	Punjab	Cost increased	Incentives	
		O	Sindh	Productivity Increased	Imposed fine	
		T	Baluchistan	Cost increased	Paid in Hiring new safety engineers	

The study revealed that 65% of the projects encountered maintaining construction safety as a real challenge for the progress of their project. Whereas 40% of the projects faced difficulties in educating their workers regarding COVID-19.

4.2.4 Financial

Q1: What were the challenges related to financial market instability during Covid-19? What actions were taken to mitigate the effect of those challenges?

The respondents of 14 projects representing the majority, agreed to the notion of financial market instability during the COVID-19 period after the resumption of market. Major challenges faced by the projects due to financial flux were supply chain disruptions, cash flow interruptions and material price fluctuations that caused delays in most of the projects. A major challenge faced by the projects was the continuously increasing delivery

costs of the material resources demanded by the suppliers after the lockdown due to market uncertainty. This led to a disrupted supply chain for most of the critical material resources used on projects. Participants also shared that various supplier stopped providing material on credit causing cash flow interruptions. This factor led to delayed payments to other stakeholders like sub-contractors, staff, and workers of the project. Similarly, some participants highlighted that there was market unpredictability in terms of availability of raw materials, that resultantly pushed the suppliers to demanded higher rates of their material products than normal. There were a couple of projects which were not affected by these challenges, but their respondents agreed to the unstable financial market perception. Major reason for no-impact on those projects were availability of ample material resources until the financial situation becomes normal.

Contrary to this, participants from 6 projects disagreed with the perception of financial market instability. For rationale, they stated that the economic activity decreased globally because of total lockdown; however, in Pakistan the government took special measures and gave relief to the construction industry to maintain the economic activity. According to them, the special package announced by the government for the construction sector as discussed previously, resulted in increased construction activity as compared to other sectors. In their views, this assist much in resumption of the industry after the withdrawal of first lockdown.

For mitigation, participants stated that financial management was done through strategic planning and prioritization. The less critical activities were put on hold and finances were diverted to the most critical ones. To mitigate the effect of supply chain

disruptions and material price fluctuations, the stakeholders started to place orders 6 months in advance to acquire material.

Q2: Did your project workers faced delay in salary receipt? If yes, how did this delay affected the performance of the project?

A total of 12 projects representing the simple majority did not face this challenge of delayed salaries disbursement. These project mainly belonged to the public sector which had their financial budget already approved by the government up to the fiscal year i.e., June 2020. The construction sector got the special package by the government afterwards which resulted in smooth payment to contractors and ultimately to his employees. However, participants of 4 projects mentioned that their project faced the issue of delayed salary payments to employees. According to these participants, major reasons for these delays were imbalance of cashflow, market instability and non-payment by the clients. Due to the cash flow imbalance, some projects also faced a 20% reduction in addition to the delay of 2 months in salary disbursement to workers. Moreover, the financial market instability caused the investors to halt the investment that ultimately resulted in delayed payment of salaries to project staff.

This issue did cause the decreased motivation among the project employees; however, the performance of those projects was not reported to be affected due to this challenge because of a common understanding about the uncertain market situation created due to COVID-19.

Q3: What difficulties did you face in maintaining operational cash flows or payment? How did you cope with cash flow for your project during COVID-19?

According to the majority of respondents, despite the availability of allocated budget, the projects faced operational cash flow problems because of the disruptions caused by pandemic to normal operations that resulted in delayed preparation and approval of invoices within the stipulated time. This also delayed payments from main contractors to sub-contractors, vendors, and suppliers because most of such payments were linked to pre-set milestones and deliveries of various items that were either not executed or not approved due to the restrictions imposed by the pandemic.

Another participant stated that delivery of material on credit was stopped and the overall flow of cash with the vendors was disrupted in the chain due to fewer business activities. Likewise, a participant highlighted that the major effects of cash flow problems were delayed payments to petty contractors that gave rise to slow progress which further escalated late payments.

To maintain operational cash flows, one participant mentioned that the minimum limit of an interim payment certificate was abolished on his project along with a reduced payment period of 15 days. Similarly, another participant commented that their organization managed cashflows by borrowing capital from its other business portfolios.

Q4: What were the reasons for additional cost overheads during the pandemic?

According to the study findings, participants identified the reasons for cost overheads include additional costs due to time delays, additional labor payments, shortage of materials, repeated closure of sites due to rise in covid cases in the area, high price fluctuation of materials and the increased cost for OHS implementation.

Different strategies were mentioned and implemented by stakeholders to address the increased cost overheads and reducing its impact on the overall cost of the project. One participant mentioned that the client helped to execute SOPs and provided the additional

required funds for the purpose. Additionally, given the uncertainty, many organizations reduced their profit margins to secure jobs and strengthen their positions during the pandemic.

The following table is the conclusion of the data analysis and discussions regarding the financial challenges faced during COVID 19.

Table 4.4: Financial Challenges, Impact and Strategies

Sr	Challenge	Projects	Province	Impact	Action Taken	Affected project %
1	Issue Timely Salaries	E, F, H	KPK	Lack of Motivation and Absenteeism	Gave surety about salaries	40
		J, K, L	Punjab		Gave surety about salaries	
		N, O	Sindh		Gave surety about salaries and paid half salaries	
2	Cashflow management	A, B,	Islamabad	Schedule delay	Decrease IPC limit and time	75
		C			EOT claim	
		E	KPK		Taken money from another project within the organization	
		F, H			Decrease IPC limit and time	
		J, K, L	Punjab		Taken help from a client in procuring material and Claim EOT	
		N, O	Sindh		EOT claim	
		T	Baluchistan		EOT Claim	
3	Lack of funds	I, J	Punjab	Schedule delay	EOT claim	20

Sr	Challenge	Projects	Province	Impact	Action Taken	Affected project %
		N, O	Sindh		EOT claim	
4	No crediting	E	KPK	Schedule delay	Decrease IPC limit and time	5
5	Increasing cost overheads	A B	Islamabad	Cost increased	Reduce temporary staff	60
		D			Change Contract type	
		F	KPK		Reduce profit margins	
		I, K	Punjab		Diversifying material sources and reducing the profit margin	
		M, N	Sindh		Reduce temporary staff	
		O			Reduce profit margins and staff	
		Q R, T	Baluchistan		Taken help from the client and reduced payment time	

The study's findings revealed that 40% of the projects from collectively KPK, Punjab, and Sindh encountered timely issuing of salaries to their staff as a challenge that created absenteeism and lack of motivation. To manage this issue, employer gave surety about payment, and even on some project's employer paid half of the salary timely while promising for the other portion.

Second, 75% of the projects from across the country faced problems in managing cashflows which resulted in delaying the projects. All three projects were delayed in Islamabad for the same reason. Consequently, to control the delays two projects adopted a

strategy to reduce IPC limit and time whereas the other just claimed EOT. Similarly, three projects were delayed in KPK due to cashflow mismanagement, and to mitigate the effects one project took cash from another project within the organization whereas the other two projects demanded early issuance of IPC. Also, the projects in Punjab faced delays however it managed by taking help from clients in procuring material and claiming EOT. Likewise, two projects from Sindh and one project from Balochistan were delayed due to cash flow mismanagement and to lessen the impacts EOT was claimed.

Third, 20% of the projects from Sindh and Punjab were collectively delayed due to lack of funds and no method could be implemented to lessen the impact, so EOT was claimed. Whereas, only one project from KPK highlighted, “No crediting” as a challenge for their project that resulted in cashflow disruption that ultimately delayed the project. To mitigate, it was asked to decrease the IPC limit from 45 days to 25 days.

Lastly, 60% of the project from across the country increased their job overheads. All the three projects in Islamabad increased their cost and to mitigate, the two projects reduce the temporary staff whereas the other project requested a change in its contract type. Similarly, one project increased its cost and mitigated it by compromising its profit margin. Also, two projects in Punjab faced cost overrun that mitigated the effects by diversifying material resources because some suppliers were demanding higher rates which were reducing profit margins. Considering the projects in Sindh, three projects increased their cost and to lessen the impact, two projects reduced their temporary staff whereas the other reduced profits margins as well as reduced staff numbers. Likewise, three projects in Balochistan were facing cost overrun that mitigated them by taking help from the client and requesting the client to reduce the payment time.

4.2.5 Contracts

Q1: What kind of contractual disputes did you face during a pandemic and how did you manage it?

The construction projects in Pakistan are usually driven by the FIDIC condition of contracts (ref). In these conditions, some clauses outline methods and guidelines to deal with such situation, such as Clause 8 (delays, and suspension), Sub-clause 8.4 (delay caused by authorities) and 8.7 (delay damages) and Clause 19 (force Majeure). However, according to some respondents, these clauses failed to completely address the loss of parties under the pandemic situation because such events had not previously occurred and were totally unanticipated.

Out of 20 projects, all the projects were granted extension of time (EoT) due to the pandemic. However, 7 projects faced disputes between the parties regarding the grant of cost associated with the EoT due to pandemic. The main reason for disputes on such projects was the fixed-job overheads faced by the contractors with limited staff allowed by the client during the execution.

Moreover, many amendments were made to existing contracts to accommodate the revised completion dates, payments methods, material and equipment specifications, authority approvals and inspection methods. For example, a participant mentioned that the material approval time by the consultant was reduced from 16 to 2 days. Similarly, the minimum limit of an interim payment certificate was removed with a reduced payment period of 15 days.

The following table is the conclusion of the data analysis and discussions regarding the Contracts challenges faced during COVID 19.

Table 4.5: Contracts Challenges, Impact and Strategies

Sr	Challenge	Project	Province	Impact	Reasons/Action Taken	Affected project %
1	Cost associated with EOT	A, B	Islamabad	Increased cost overheads	No action taken because of dispute	35
		C, D		Increased cost overheads	No action taken because of dispute	
		L	Punjab	Increased cost overheads	No action taken because of dispute	
		N	Sindh	Increased cost overheads	No action taken because of dispute	
		P			No action taken because of dispute	

The study findings revealed that only 35% of the projects faced dispute over cost associated with the EOT from all over the country except KPK and Balochistan. All the four projects faced this issue in Islamabad whereas only one project and two project faced this problem in Punjab and Sindh respectively. All the projects increased their cost overheads, and no action could be taken that is why it is still a dispute.

CHAPTER 5

CONCLUSION

5.1 Conclusion

This research captured the impact of COVID-19 on construction projects' performance of Pakistan. First, the authors conducted literature review analysis followed by questionnaire survey with 25 construction professionals to list out a comprehensive and validated list of construction factors affected by COVID-19. Second, 20 semi structured interviews were conducted from professionals experienced in the Pakistani construction industry to collect the data for finding out the impact of each factor on construction project performance. Third, analysis was performed on the collected data resulted in presenting challenges and mitigation strategies encountered by the project across the country. The study presented the data that explains differences in the captured impact in various provinces. Based on the adopted research methodology, the authors identified a total of 17 construction factors that impacted project performance grouped under five construction groups, including material and equipment, human resource, occupational health, and safety, financial, contracts and miscellaneous. The highly impacted factor during the pandemic includes cash flow management, supply chain disruptions, increasing overheads, and job uncertainty. Whereas, the less affected factor includes timely approval of material, exporter country's policies and returning of foreign employees. The pandemic had relatively higher impact on the private sector compared with the public sector. Ultimately, the authors contribute to the body of knowledge by providing the foundation for finding out the impact of pandemic on their project performance in developing countries. The findings of the study document the impact of COVID-19 on various dimension and aspects

of the construction projects along with the adopted strategies to mitigate the impact. This provides useful insight for construction professional to adopt proactive measures to manage the existing projects in the light of continued pandemic.

5.2 Future Recommendations

For future work, the researchers can develop guidelines and strategies to mitigate the challenges associated with the pandemic on the construction sector of developing countries using the same methodology. The researchers can investigate the impact of COVID-19 on developing versus developed countries; and can also study differences in the pandemic's impact on the identified construction themes and factors in terms of quality, time, and cost separately.

5.3 Limitations

The research findings are limited to the literature review analysis and 20 semi structured interviews seeking opinions from construction professionals employed in Pakistani construction industry. The researcher did not access to the project documents to validate the findings of the study. The study has not applied any statistical analyses of correlation, causality and regressions is also one of the limitations.

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