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Project Risk Management in Construction Industry of Pakistan

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Abstract

The construction process is inherently prone to risks. Risk management is an essential and integral part of project management that enables professionals to quantify and analyze risks that may pose potential threats to project performance in terms of cost, quality, safety, and time. Therefore, the construction process requires continuous evaluation and monitoring of risks. but Pakistan is yet to introduce such a risk rating tool for commercial buildings projects. This research was conducted to identify and assess the risks involved in commercial buildings construction projects in Pakistan based on the local conditions and ground realities.

A total of 45 most relevant risk factors were identified from previous studies, and then based on the type of risks factors, these were grouped in 9 risks categories. A questionnaire was administered to construction industry professionals such as contractors, consultants, public and private clients to indicate the potential impact of various risk factors on project objectives, on a Likert scale of 1 to 5. The retrieved data was analyzed, and Relative Importance Index (RII) was calculated for each risk factor. Key findings show that the financial risks were the most critical which affect project budget and schedule. Among 45 risk indicators on construction projects, top 3 risk factors in descending order of severity were unavailability of funds (RII = 4.110), financial delays (RII = 4.055) and improper planning and budgeting (RII = 3.945). Based on RII, 15 most crucial risks have been segregated. The results of this research will facilitate contractors, consultants, and project managers to take proactive measurements for effective risk management so that project intended goals could be achieved.

Keywords/tags

Risk management, Commercial building, Cost and schedule, Risk identification, Risk analysis, Risk importance

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Acronyms

GDP	Gross Domestic Product
PMI	Project Management Institute
TPM	Traditional Procurement Method
PMBOK	Project Management Body of Knowledge
EOT	Extension of Time
RQ	Research Question
WAM	Weighted Average Method
CS	Cumulative Score
RII	Relative Importance Index
SD	Standard Deviation

1 Introduction

Construction industry plays a significant role in global economy, contributing to the gross domestic product (GDP) by 14.3% in 2021, and 14.8% in 2022. Additionally, it provides employment to approximately 7% of the global workforce. In 2021, the construction industry in Pakistan grew at a rate of 14.4% and made a contribution of nearly PKR 1,409 billion to the country's GDP. Therefore, a major goal of many developing countries is the development of construction industry. The policies are formulated in various developing countries to prevent construction companies from collapse. For the development of construction industry of a country, risk management awareness plays an important role. It is increasingly recognized now that each phase of construction project is vulnerable to various risks for all involved shareholders starting from the feasibility study through to execution of the project to use of built facility. Pakistan construction industry, as compared to others, has a poor record of effective risk management as annual rate of occurrence of construction risks are very high. Moreover, the construction risks occur in a variety of ways. Over the past few decades, there has been growing concern surrounding the nature and effects of risks on projects due to their impact on project constraints such as time, cost, scope, and quality as shown in figure 1 below:

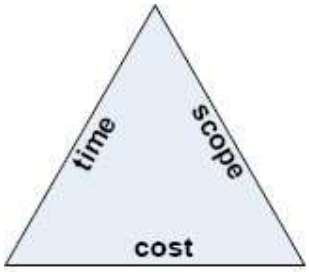

Figure 1. Project Triangle

Risk is important to all the stakeholders involved in construction projects i.e. contractors, consultants, public and private clients. However, the risk assessment of construction project is poorly understood and complicated (Shou et al., 2018). The activities of construction projects are inherently vulnerable to various risks such as those related to design issues, political, commercial, external, construction and operation. However, all these risks need to be taken care of effectively so that the objectives of the project can be obtained within reasonable time and budget.

According to Project Management Institute (PMI), Risk is the likelihood of occurrence of an unfavorable and unwanted outcome. Edward & Bowen defined Risk as the likelihood of occurrence of an unfavorable event during a specific time. While planning or making a decision, risk is uncertainty or lack of ability to predict the consequences or outcomes of the uncertainty.

Ashworth & Hogg (2002) stated that Each project follows a specific life cycle, which comprises a series of activities and phases from initiation to conclusion. Each of these phases carries a certain level of risk. Odeyinka et al., (2008) emphasized that in most of the cases these risks are not considered effectively and as a consequence construction industry has very poorly performed. They insist that in order to effectively resolve these problems, risk management practices need to be integrated into the initial phases of projects such as at the time of estimation of project cost and time, as it will be highly helpful to reduce time and cost overruns.

The construction risk management consists of a series of processes such as identification, analysis of risks' severity and impact and response to control risks at construction projects (PMI, 2003). Construction project risk management aims maximization of opportunities i.e. positive results and alleviation of negative results and its consequences i.e. threats. Project risk management encompasses process of risk management planning, engagement in identification of risk, completion of qualitative and quantitative analysis of risk, development of response plan and continuous risk monitoring. Risk management on construction projects is an ongoing process. The risk management in construction projects aims to maximize the likelihood and impact of opportunities on projects and to minimize the likelihood and impact of threats like increased costs or schedule delays.

In Pakistan, projects completed in recent decades exhibits poor understanding of risk management by constructional professionals and the general public, as these projects failed to meet the key requirements of effective risk management. Several projects have been abandoned without completion in Pakistan due to occurrence of risks, but relevant literature review stressed that project cost and time overrun can be reduced considerably if required attention to risk management is paid. It will alleviate abandonment of construction projects and most importantly project cost and time overrun. Also, the Pakistani construction industry is yet to introduce the use of formal

techniques of risk assessment and management which are very important in order to control the time and cost of the project in construction industry.

Among other constraints in regular use of the quantitative analytical techniques for construction risk management on projects, lack of understanding and insufficient experience of construction professionals and other stakeholders involved are the most important. Keeping this in view, literature calls for application of effective risk management in an industry which is inherently prone to various types of risks so that intended project objectives could be achieved.

2 Research Design

2.1 Research Problem

Most of the projects in construction industry suffer from cost escalation and lag from master schedule. The major reason for these unanticipated consequences is insufficient planning before contract award and inadequacy to analyze the reasons leading to this mess (Creedy et al., 2010). Improper and inadequate assessment of risk factors in construction industry is one of the main reasons for ineffective project delivery (J. Dada & Jagboro, 2007). Every phase of construction projects is vulnerable to various risks for all involved shareholders starting from the feasibility study through to execution of the project to use of built facility. This demands a proactive approach in project risk assessment and management to maximize the profit and minimize the losses.

Major constraints in regular application of quantitative analytical techniques for risk management are insufficient experience and lack of risk perception of the stakeholders in the construction projects. Keeping this in view, application of risk management techniques in construction projects have been emphasized by Jannadi & Almishari (2003).

The construction projects risk management pays most considerations to financial, management & socio-political problems. As construction projects are vulnerable to a variety of risks i.e. environmental, legal, market and construction risks, and mostly these risks are occurred due to the use of substandard material, shortcoming of design, and the usage to which built facility is put to. These risks also depend on type of project, type of procurement method used, project phase and

geographical location of the project. In Pakistan construction industry, there has been a little work on identification of various risk factors and their potential impact on commercial buildings projects.

2.2 Research questions

In Pakistan, the commercial buildings projects completed in recent years show a poor record of risks management as several projects have been left incomplete owing to occurrence of major unforeseen risks, but relevant literature review stressed that project cost and time overrun can be reduced considerably if required attention to risk management is paid. It will alleviate abandonment of construction projects. Furthermore, the Pakistani construction industry is yet to introduce the use of formal techniques of risk analysis and management which are vital in construction projects to minimize time and cost of projects due to lack of knowledge and maximize profitability (Joshua, 2010). Considering this perspective, the objectives of this research are as under:

1. What are the project risks, risk types and risk indicators of planning and execution phase involved in the construction of commercial buildings in Pakistan?
2. What are the most critical risks in planning and execution phase in the construction of commercial buildings in Pakistan based on potential impact?

The logical answers to these questions are sought in this research.

2.3 Limitations of the scope

In order to avoid generalizability and harvest useful and reliable results, the research has been narrowed down considering following aspects:

2.3.1 Project Procurement

This research considers Traditional Procurement Method (TPM) for the project. This method was chosen because it is most widely used in construction projects in Pakistan. Therefore, it will help avoid generalizability as it excludes following procurement methods:

a. Design and Build

b. Project Management
c. Construction Management
d. Labor only

2.3.2 Project Phase

Project Management Institute (PMI) divides a project into five phases, and risks encountered in each phase could considerably differ than those in other phases. For this study, planning and execution phase have been chosen because realistic planning reduces amount of risks, and execution is the stage where ideas are transformed into realities and involves more risks as compared to other phases of a project. Remaining three phases i.e. Initiation, Performance and Control, and Project Close-out have been eliminated. Complete project life cycle is shown in Figure 2.

Figure 2. Project life cycle

2.3.3 Project Type

This research focuses on projects involving construction of commercial buildings. These may include restaurants and hotels, shopping malls, hospitals and healthcare centers, and residential apartments. The study excludes infrastructure, industrial construction, and small-scale residential construction. Moreover, this research not only applies to public sector projects but also for private sector. Though the need of the client will vary in both, that will allow the needs and expectations of client to meet precisely.

2.3.4 Project Geographical Location

Location of a project is crucial when it comes to risks faced by commercial buildings construction projects. This research was carried out in Pakistan and will take into account, ground realities faced by construction projects in Pakistan.

2.4 Research Environment

Pakistan is a developing country which is an awful long way from development almost in every sector. Our construction industry is going through same dilemma. Environmental degradation, IMF supported economy and massive taxes, these are the major challenges faced by construction industry. Most of the projects in construction industry suffer from cost escalation and lag from master schedule. The major reason for these unanticipated consequences is insufficient planning before contract award and inadequacy to analyze the reasons leading to this mess. In Pakistan, at formal level, risk management in construction industry is a very rare practice. A recent study aimed to analyze the extent to which risks management is practiced on construction projects in Pakistan, found that most of the contractors are not practicing formal risk management (Iqbal et al., 2014). Consequently, construction projects suffering from various types of risks result in increased budgets and prolonged durations, lesser productivity and poor performance i.e. lower quality.

Therefore, this research will help enhance understanding of risks and effective management thereof by stakeholders in construction industry which in turn, will facilitate them while making decisions keeping in view all the potential risks and their impact on project deliverables during the course of a project.

2.5 Conceptual Framework of Research

Methodology is the systematic way to perform systematic research. It comprises the detailed analysis of the methods applied in the research, to make sure research conclusions are valid, reliable and credible. The researched need to take an overview of various steps to understand the problem, to see the logic behind the chosen methods to use during study. Methodology also clarifies the reasons why a particular method/technique have been chosen (Tang, 2021).

The conceptual framework used for this research has been given in figure 3.

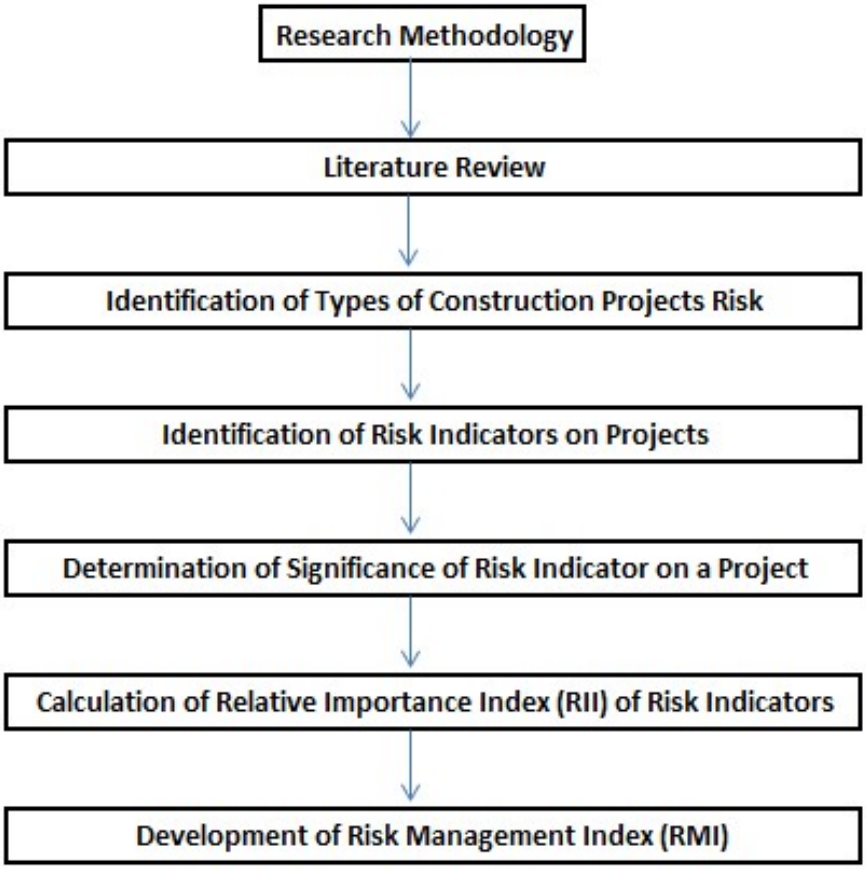

Figure 3. Conceptual framework of research

2.6 Information Retrieval and Source Material

Source and reference material used to carry out this research was obtained from various sources which are listed below:

1. Google scholars
2. Taylor and Francis online.
3. ASCE Journal of Construction Engineering & Management
4. International Journal of Project Management
5. Theseus
6. Research based Development course material.
7. Qualitative Research course material.

8. Any other published material available on internet.

3 Literature Review I

3.1 Risk Overview

The risk is inherent to human life and exists in every human endeavor. Risk is the likelihood of occurrence of an unfavorable and unwanted outcome (PMI, 2003). Edwards & Bowen (1998) defined Risk as the likelihood of occurrence of an unfavorable event during a specific time. It is also defened as uncertainty or lack of ability to predict the consequences or outcomes of the uncertainty in a decision or planning stage. Any risk when occurs, results as an opportunity or threat but in most cases, it has been observed that risks give rise to disadvantages much more as compared to advantages. Nowadays, due to it's consistent occurence, risk has become a norm rather than an exception in almost all projects (Arcila, 2012).

The rootcause of project risk is the uncertainity that exists in every project. The knowledge of risk management is so crucial to success of a project that it has been recognized as one of the 10 knowledge areas of project management by Project Management Institute (PMI). PMI emphasizes that project managers must be aware of all 10 knowledge areas in order to deliver a successful project. The study and understanding of risk management carries more significance due to the fact that every knowledge area of project management also involves risks in themselves. Keeping in view presence of risk in all areas of project management, this reseach was organized to explore various risks and their indicators along with their potential impact on project deliverables in construction projects that involves commercial buildings.

PMBOK 10 knowledge areas are shown below in figure 4.

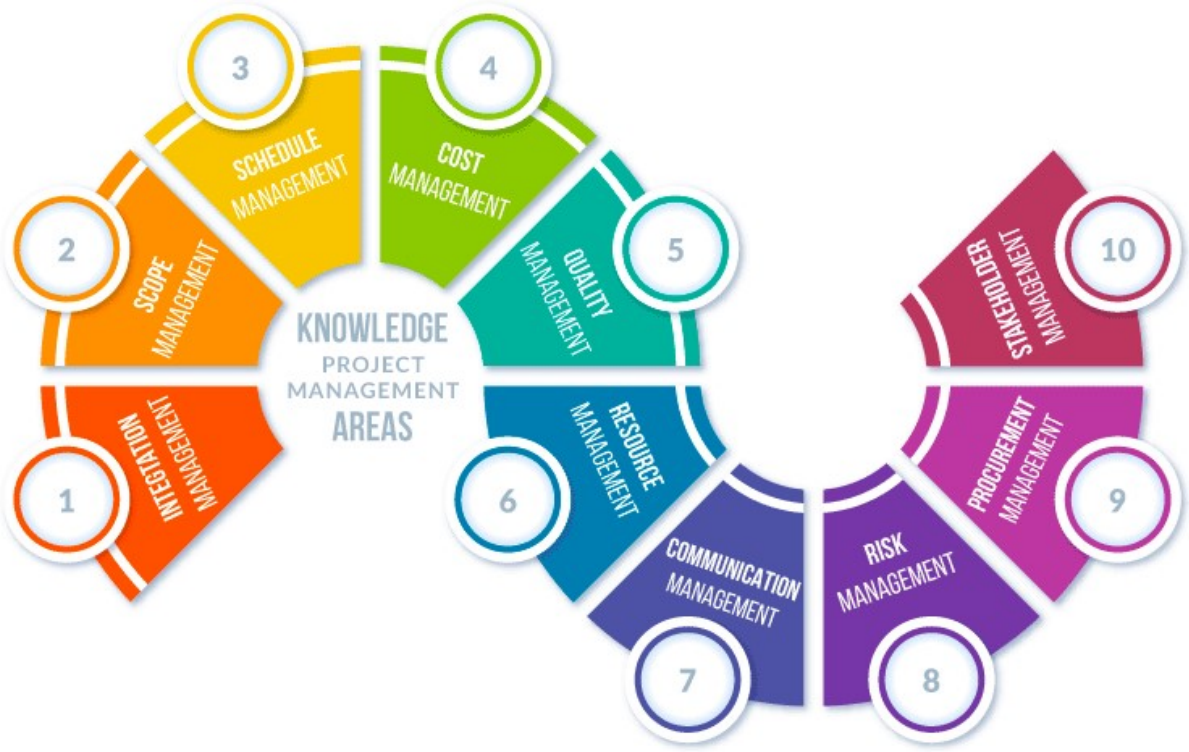

Figure 4. PMBOK Knowledge Areas

3.1.1 Project Risk

According to the concept of construction industry, risk is a multi-facet term and it is defined as the manifestation of some kind of event or factor or multiple events or factors that may harm the project during whole duration of construction (Faber, 1979). It may be due to the lack of liability about the final results or due to the lack of concerns in planning or decision situation (Hertz & Thomas, 1983). The insecurity about the forecasts of final results is always present. There may be probability of better results as compared to expectations or they may be even worse from expectations (Lifson & Shaifer, 1982).

As risk contains many definitions, there are also various categories of risk for different situations. For example in the whole process of construction, some people categorize risk into two ways as external or internal risk. While many other classify risk into more elaborative forms like social-political risks, market related risks, safety risk, financial risk etc. (Songer & Molenaar, 1997).

The types of risk definitely depends upon the situation of the construction project either it is international, domestic or local. According to Hastak & Shaked (2000), all risks are classified into three different broad levels like, project, country and external. This type of classification of risk is needed to check the effect of one risk on others and to check the extenuation of each risk. Some risks like project risk is applicable to all kinds of project either it is local or international. Project levels risk only give information about construction sites and they may include site safety, problems related to logistical storage and movement, design shortcomings and inadequate quality control etc. (Thobani, 1999).

The country level risks are perceived as a function of the partisan and macroeconomic stability. They emerge when the authorities of the country introduce foreign currency exchange or trade restrictions or expropriate property, or change trade legislation etc. Macroeconomic stability is actually linked with the economic and financial policy and to check the countries susceptibility to financial fluctuations. External risk mostly damages the international projects due to lack of knowledge about prevailing social conditions, unknown and new procedural formalities of economic and political scenarios, regulatory authority and governing frameworks etc. But, this research focuses on domestic or local commercial buildings projects in Pakistan.

There is also a concept that risk perception is influenced by the belief, judgment, attitude and feelings of the people. According to the Royal Society, the perception of risk cannot be reduced to a single particular mathematical term, such as like products of probabilities and consequences because it involves many assumptions that is a social phenomenon. According to Ritchie & Marshall (2007), there are different factors that influences the risk perception like practical experience, peer group influence, an individual's cognitive characteristics, educational background, the availability of information etc.

Exposure to a particular type of risk on a particular organization may differ from organization to organization. This vulnerability to organization may be a business disaster, the rates of major construction accidents, the risk of project financial disadvantage, disagreement and organizational level risks. It is very important to identify the particular type of risk so that proper strategies can be made to minimize the effect of that risk or eliminate it properly so that its negative aspects can be controlled.

Risk very often can be integral making it very hard to manage them. An adequate management of risks theoretically and practically is required to deal with them. Management of risk is a properly organized and formal process that may be needed to analyze, identify and respond to a risk thoughout the project to control or eliminate the chances of that risk. Significant improvement for any construction project may be seen by adopting the proper procedure of risk management.

3.2 Risk Management

Risk management is vital for successful and timely completion of any project. According to Augustine et al., (2013), the benefits of implementing Risk Management could be the following:

i. Minimizing costs overruns.
ii. Minimizing extension of time (EOT) claims.
iii. Improving the quality of construction projects.
iv. It helps the federal and provincial government to develop policies / strategies to alleviate construction project risk.
v. It assists stakeholders in the construction industry, including investors and developers in making well-informed decisions.
vi. It enables banks to conduct a thorough assessment of the project's viability and feasibility before offering their financial services.
vii. It enables insurance companies to rate construction risk using the Risk Management Index to determine the risk index of the project.

3.2.1 Concpet of Risk Management

The construction risk management consists of a series of processes such as identification, analysis of risks' severity and impact and response to control risks at construction projects (PMI, 2003). Construction project risk management is a process which involves maximization of opportunities i.e. positive results and alleviation of negative results and its consequences i.e. threats. Project risk management encompasses process of risk management planning, engagement in identification of risk, completion of qualitative and quantitative analysis of risk, development of response plan and continuous risk monitoring. Risk management on construction projects is an ongoing process. The risk management in construction projects aims to maximize the likelihood and impact of

opportunities on projects and to minimize the likelihood and impact of threats like budget or schedule overrun.

Risk management can be divided into five steps as follows:

i. **Plan Risk Management:** Defines how to conduct risk management activities.
ii. **Identify Risks:** Determine which risks affect the project and document their characteristics.
iii. **Perform Risk Analysis**: Prioritize risks for further analysis or action by assessing and combining their probability of occurence and potential impact.
iv. **Plan Risk Responses:** Develop options and actions to enhance opportunities and reduce threats to project objectives.
v. **Monitor and Control Risk:** Track identified risks, monitor residual risks, identify new risks and evaluate effectiveness of risk management process.

Management of construction risk starts with the process of identifying the risks related to a particular project. It should be ensured that risk analysis/evaluation and risk response should be developed for identified risks only to keep it relevant and avoid waste of time and resources.

The process of risk analysis and evaluation is sandwiched between processes of risk identification and their control. Sometimes the evaluation of impact of risk may be incorporated with the uncertainty in the both qualitative and quantitative terms. The analysis or evaluation may include high financial significances, high probabilities, or a combination thereof which may give rise to a considerable economic impression. After, all the project risks are identified and evaluated, proper method should be adopted to treat those particular risks. The contractors should devise plan and should take counter measures in order to minimize the impact of the identified risks.

Based on significance and nature of risks, mitigation and control measure should be developed. The aim of risk management is not to eliminate all the identified risks. Actually the objective of risk management is to develop a work plan for decision to remove the critical risks effectively and professionally (Perry & Haynes, 1985).

The complete process of risk management has been illustrated in figure 5.

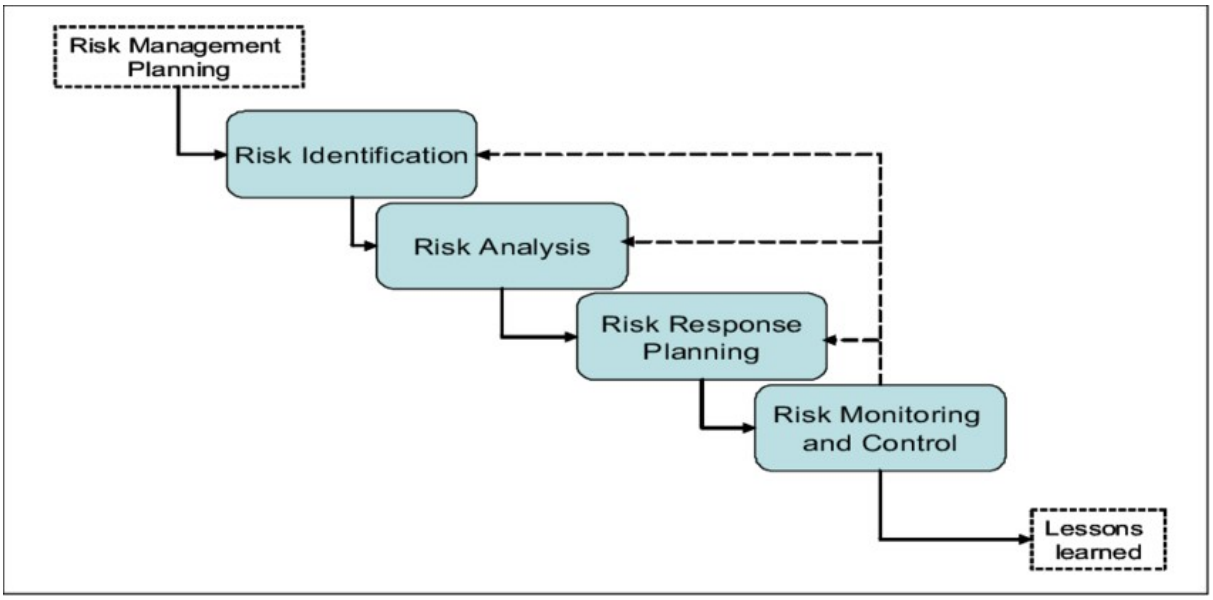

Figure 5. Risk Management Process

To Pakistani public and construction professionals, the concept of risk management is relatively fresh. This is because construction projects carried out in recent decades did not meet the necessary requirements for efficient risk management. It becomes evident by abandonment of several commercial buildings projects without completion in Pakistan due to occurrence of risks, but relevant literature review stressed that project cost and time overrun can be reduced considerably if required attention to risk management is paid. It will alleviate abandonment of construction projects and most importantly project cost and time overrun. Also, the Pakistani construction industry is yet to introduce guidelines particularly focused on commercial buildings projects in Paistan which are very important for successful delivery of a project.

Among other constraints in regular use of the quantitative analytical techniques for construction risk management on projects, lack of understanding and insufficient experience of construction professionals and other stakeholders involved are the most important. In view of this, literature review emphasis the application of risk management models for effective management of risks in order to achieve initial project objectives.

3.2.2 Risk Contributing Factors

Risk management is a relatively new field in the construction industry in Pakistan and is gaining prominence due to increasing construction activity and competitiveness (Iqbal et al., 2015). A thorough review of work done on the subject by Hameed & Woo (2007) , (Iqbal et al., 2014), and (Choudhry et al., 2014) was carried out to extract risk factors that are more appropriate for Pakistan's construction industry. Literature review also exhibits that there is a close resemblance of project risks among develoing countries, and for holistic view of various risks faced by construction industry in Pakistan, it is useful to review available literature of Pakistan in particular, and of developing countries in general to ensure that all the relevent and potential risks are identified and are taken care of appropriately by project managers. Table 1 shows a summary of previous most relevent studies on the subject:

Table 1. Summary of most relevent studies

Author(s)	Risks Identified	Country	Type of Construction Project(s)
Hameed & Woo (2007)	31	Pakistan	Not specified
Sweis et al., (2008)	40	Jordan	Residential Projects
Ogunsanmi (2015)	52	Nigeria	Considers design and build projects only
Iqbal et al., (2014)	37	Pakistan	Not specified
Alnuaimi & Mohsin (2013)	49	Oman	Not specified
Khodeir & Mohamed (2015)	63	Egypt	Not specified
Choudhry et al., (2014)	37	Pakistan	Bridges

Only one study carried out by Sweis et al., (2008) highlighted the risks inherent in commercial buildings projects i.e. residential buildings. Thereffore, due to scarcity of literature on risks specific to commercial buildings projects, particularly in Pakistan, there was a requirement to review the risks linked to different types of construction projects and adapt the same to residential projects

wherever they seem relevent. This calls for an extensive review of risk factors across different types of projects in deveolping economies across the globe.

Based on previous work done on the subject, a total of 42 research articles were reviewed to extract most relevent risk factors on residential buildings. The sources utilized include ”Theseus”, ”ASCE”, ”Google Scholars”, “Taylor & Francis Online” and any other available content on internet. A total of 45 risk factos were identified based on literature review from 2001-2023. This period was focused to observe latest developments in this field. Various studies have identified same risk factors under different nomenclature. For this study, nomenclature was adapted from Augustine et al., (2013) which offers clarity and uses unambiguous language. The identified factors are given in Table 2 below:

Table 2. Identifeid Risk Factors

Sr. No.	**Factor**	**References**
1	Design Changes	Sweis et al. (2008) Iqbal et al. (2014) Andi (2006)
2	Financial delays	Fawzy et al. (2018) Perera et al. (2009) Siew Goh & Abdul-Rahman (2013)
3	Increase of Labor Cost	Yafai et al. (2014) Siew Goh & Abdul-Rahman (2013) Mahendra et al. (2013)
4	Breach of Contract by Project Partner	Chan & Kumaraswamy (1997) Baghdadi & Kishk (2015) Augustine et al. (2013)

5	Poor Communication	Shen et al. (2019) Augustine et al. (2013) Kartam & Kartam (2000)
6	Contractual Anamolies	Iqbal et al. (2014) Siew Goh & Abdul-Rahman (2013) Khodeir & Mohamed (2015)
7	Improper Project Feasibility Studies	Sohrabinejad & Rahimi (2015) Choudhry et al. (2014) Wiguna & Scott (2005)
8	Political Instability	Alashwal & Al-Sabahi (2018) Hameed & Woo (2007) Sohrabinejad & Rahimi (2015)
9	Delay in Approval from regulatory Bodies	Baghdadi & Kishk (2015) Kartam & Kartam (2000) Perera et al. (2009)
10	Improper Project Organization Structure	Chileshe & Boadua Yirenkyi-Fianko (2012) Sohrabinejad & Rahimi (2015) Augustine et al. (2013)
11	Internal Management Problems	Sohrabinejad & Rahimi (2015) Augustine et al. (2013)
12	Disputes and Claims	Jimoh et al. (2016) Hameed & Woo (2007) Arditi & Pattanakitchamroon, 2006

13	Corruption/Bribery	Chatterjee et al. (2018) Baghdadi & Kishk (2015) Siew Goh & Abdul-Rahman (2013)
14	Improper planning & Budgeting	Schieg (2006) Sweis et al. (2008) Yafai et al. (2014)
15	Inadequate Site Investigations	Andi (2006) Kartam & Kartam (2000) Hameed & Woo (2007)
16	Increase of Material Cost	Mahendra et al. (2013) Yafai et al. (2014) Siew Goh & Abdul-Rahman (2013)
17	Change in Bank Formalities/ Regulation	Chan et al., 2019 Sohrabinejad & Rahimi (2015)
18	Defective Work and Quality Issues	Szymański (2017) Baghdadi & Kishk (2015) Andi (2006)
19	Fluctuation of Exchange Rate	Mahendra et al. (2013) Fernando et al. (2017) Zou et al. (2014)
20	Rise in Material/Fuel Prices	Perera et al. (2009) Yafai et al. (2014)

		Choudhry et al. (2014)
21	Material Shortage & Theft	Fernando et al. (2017) Baghdadi & Kishk (2015) Kartam & Kartam (2000)
22	Stiff Environmental Regulations	Ibáñez-Forés et al., 2018 Kulakowski & Alimahomed-Wilson, 2019 Nguyen et al., 2015
23	Incompetent Sub-Contractor(s) Unclear Scope of Work	Wiguna & Scott (2005) Sohrabinejad & Rahimi (2015) Baghdadi & Kishk (2015)
24	Improper Verification of Contract Documents	Sohrabinejad & Rahimi (2015) Wiguna & Scott (2005) Augustine et al. (2013)
25	Change of Government Policies	El-Sayegh (2008) Siew Goh & Abdul-Rahman (2013) Hameed & Woo (2007)
26	Unrealistic Cost Estimates and Schedules	Mahendra et al. (2013) Jimoh et al. (2016)
27	Absence of Team Work	Chileshe & Boadua Yirenkyi-Fianko (2012) Augustine et al. (2013) Sohrabinejad & Rahimi (2015)
28	Competition from other Companies	Wong & Cheung (2005)

		Jimoh et al. (2016) Ansah et al. (2016)
29	Healthy Working Environment for the Workers	Mahendra et al. (2013) Ansah et al. (2016) Baghdadi & Kishk (2015)
30	Poor Quality of Procured Materials	Aibinu & Odeyinka, 2012 Sohrabinejad & Rahimi (2015) Andi (2006)
31	Law of Arbitration Clause in Contract Agreement	Jimoh et al. (2016) Ansah et al. (2016) Augustine et al. (2013)
32	Fatalities	Hinze et al., 2002 Chileshe & Boadua Yirenkyi-Fianko (2012) Sohrabinejad & Rahimi (2015)
33	Inadequate Forecast about Market Demand	Kokubu et al., 2014 Ofori, 2017 Siew Goh & Abdul-Rahman (2013)
34	Fluctuation of Interest Rate	Chan et al., 2019 Sawhney & Sharma, 2005 Fernando et al. (2017)
35	Unclear Scope of Work	Hameed & Woo (2007) Yafai et al. (2014) Kartam & Kartam (2000)

36	Change of Top Management	Sohrabinejad & Rahimi (2015) Augustine et al. (2013)
37	Fluctuation of Inflation Rate	Khodeir & Mohamed (2015) Kartam & Kartam (2000) Hameed & Woo (2007)
38	Equipment and Property Damage	Siew Goh & Abdul-Rahman (2013) Mahendra et al. (2013) Jimoh et al. (2016)
39	Environmental Impact of the Project	Nguyen et al., 2015 Tam & Tam (2008). Connaughton et al., 2014
40	Change in Climatic Conditions	Perera et al. (2009) Yafai et al. (2014) Kartam & Kartam (2000)
41	Lack of Enforcement of Legal Judgement	Sohrabinejad & Rahimi (2015) Kartam & Kartam (2000) Andi (2006)
42	Unavailability of Funds	Baghdadi & Kishk (2015) Li et al., 2018 Khodeir & Mohamed (2015)
43	Change in Bank Formalities/Regulation	Augustine et al. (2013) Chan et al., 2019 Sohrabinejad & Rahimi (2015)

44	Shortage of Skillful Workers	Aibinu & Jagboro, 2002 Mahendra et al. (2013) Hatem et al., 2016
45	Accidents	Iqbal et al. (2014) Baghdadi & Kishk (2015) Siew Goh & Abdul-Rahman (2013)

3.3 Grouping of Identified Factors

A total of 45 factors have been identified based on literature review. After further assessment, these factors have been classified into nine major categories based on relevent studies. Various studies have considered various risk classification systems. PMI has classified project risks into external and internal categories, a few studies has calssfified project risks into project, country and international levels. This study cosiders grouping of various risk factors based on their types e.g. financial, legal etc. which has been adapted from Iqbal et al., (2014).

Grouping of identified factors are given in Table 3.

Table 3. Grouping of Identified Risk Factors

Sr. No.	Risk Type	Identified Factors
1	**Financial Risks**	Rise in Material/Fuel Prices Fluctuation of Inflation Rate Financial Delays Fluctuation of Interest Rate Change in Bank Formalities/Regulation Fluctuation of Exchange Rate Unavailability of Funds

2	**Managerial Risks**	Improper planning & Budgeting Poor Communication Improper Project Feasibility Studies Improper Project Organization Structure Internal Management Problems Incompetent Sub-Contractor(s) Absence of Team Work Change of Top Management
3	**Technical Risks**	Design Changes Inadequate Site Investigations Unrealistic Cost Estimates and Schedules Shortage of Skillful Workers Poor Quality of Procured Materials Material Shortage & Theft
4	**Market Risks**	Increase of Labor Cost Increase of Material Cost Competition from other Companies Inadequate Forecast about Market Demand
5	**Legal Risks**	Contractual Anamolies Breach of Contract by Project Partner Improper Verification of Contract Documents Law of Arbitration Clause in Contract Agreement Lack of Enforcement of Legal Judgement Disputes and Claims

6	**Political Risks**	Change of Government Policies Political Instability Delay in Approval from regulatory Bodies Corruption/Bribery
7	**Construction Risks**	Insufficient Technology Defective Work and Quality Issues Unclear Scope of Work
8	**Health and Safety Risks**	Accidents Equipment and Property Damage Fatalities
9	**Environmental Risks**	Change in Climatic Conditions Environmental Impact of the Project Healthy Working Environment for the Workers Stiff Environmental Regulations

3.3.1 Financial Risks

Delays in receiving payments from clients or general contractor can impact cash flows and financial stability of a project (Fawzy et al., 2018). Similarly, rapid fluctuations in the prices of construction materials can result in increased project costs (Pant et al., 2020). Furthermore, fluctuation of inlation rate as well as interest rate also affects the project. A construction project may have different type of financial risks such as inflation, unavailibity of funds, change in interest rates and bank regulations. If someone is working on the international project, it is very necessary to understand and have information about how the foreign currency will fluctuate. It is also essential to have

information about tax policy before starting international project as different countries have drastically different taxes.

3.3.2 Management Risks

The most important management risk is ambiguous productivity of different resources as poorly planned projects can lead to delays and cost overruns (Tang et al., 2010). Moreover, communication breakdowns among project stakeholders can result in misunderstandings and project disruptions (Shen et al., 2019). Therefore, it is very necessary to check before the start of any kind of project either you have high skilled staff, their roles or tasks are particularly defined to them or not. Failure in this whole process may lead towards disastrous losses. Similarly, improper feasibility studies, absense of team work and change of top management during a project are high impact risks which can severely affect project objectives.

3.3.3 Technical Risks

Anything that restricts you from creating a product that your customer wants may lead to a situation of technical risks. This is due to the less availability of materials, uncertainty of resources, inadequate site examination and incomplete design. These types of risks occurred only when there are certain changes in the scope and requirements within project as emphasized by Song et al. (2018). Also, issues with the quality of construction materials can compromise structural integrity (Aibinu & Odeyinka, 2012). Besides, shortage of skillful labor, inadequate site investigations and unrealistic cost/schedule estimate are among main risk factors in commercial buildings projects.

3.3.4 Market Risks

Market risk is also known as systematic risk. It occurs when the investor experience losses that may affect the overall process of construction markets in which they are involved. Intense competition

among construction companies can lead to bidding competition and reduced profit margins (Wong & Cheung, 2005). Along the same lines, market instability and fluctuations in demand for construction services can impact project profitability (Siew Goh & Abdul-Rahman, 2013). Likewise, escalated material and labor costs are also effective risk factors.

3.3.5 Legal Risks

Legal risk is actually the risk of economical or reputational loss. It occurs due to factors like lack of awareness and some kind of misunderstandings. The law and regulation that apply to your business and their relationship, processes, products and facilities also creates several legal risks. Disagreements over contract anamolies, obligations, or changes can lead to disputes and litigation (Arditi & Pattanakitchamroon, 2006). Likewise, Issues related to payment delays, disputes, or non-payment by clients, subcontractors, or suppliers can lead to legal actions (Cheng & Kelly, 2017). At times, these risks can prove highly costly from both financial and reputational aspects. These risks also include breach of contract or any clause thereof by the partner, presence of arbitration clause in the contract, and delayed enforcement of legal judgements in a particular country.

3.3.6 Political Risks

During a construction project, there are certain socio-political risks which are faced by construction projects. Political unrest, government policy shifts, or civil disturbances in a region can disrupt construction projects and pose risks to investments (Li et al., 2019). Similarly, prevalent corruption practices in certain areas may lead to demands for bribes or kickbacks, increasing project costs and legal risks (Akintoye & MacLeod, 1997). There are always certain regulations and codes that need to be followed and it depends upon geographical location of a certain project. Furthermore, frequent changes in government regulations and policies, including construction permits and land use regulations, can affect project feasibility and timelines (Zou et al., 2019).

3.3.7 Construction Risks

A construction risk is may be defined as any exposure to a certain loss. Each project offers many type of varying risks because every construction project is different from other. For the running of successful project, there must be a need for contractor to recognize and assess those variable risks. Using outdated or poorly maintained construction equipment increases the risk of equipment breakdowns and project delays (Kumar & Iyer, 2019). Unclear work scope is also a major area which poses threat to project actual cost and approved work program.

3.3.8 Health and Safety Risks

There is also a chance of adverse health effects through which a person may suffer if exposed to a hazard during a construction activity. Work at height, slips and trips, extreme temerature, noise and vibration, electrical hazards as well as equipments' hazards pose serious threats to human lives and well being. Therefore, these risks need to be addresses in an effective manner and a safety culture within the organization along with proper training of workforce can be helpful to implement H&S policy as emphasized by Hinze et al., (2002).

3.3.9 Environmental Risks

Environmental risks in the construction industry refer to potential adverse impacts on the environment that can result from construction activities. These risks can lead to regulatory non-compliance, project delays, and additional costs. Environmental risks mostly include natural disasters, climate, and seasonal consequences. These types of risks are mostly ignored when people are unaware of local conditions. If you want to work within a new city there must be a need to collect information about the weather pattern of that region. In this way you may overcome the potential delays and losses due to environmental changes. This risk feature involves issues or

concerns associated with the environmental problems, concerns, and actions confronting the project during the project performance and process.

4 Literature Review II

This part of report primarily focuses on recent research on risk management in construction industry of Pakistan. The most prominent works have been carried out by Hameed & Woo (2007), Iqbal et al., (2014) and Choudhry et al., (2014). Salient findings of these researchers have been summarized below.

Hameed & Woo (2007) identified 31 relevant risk factors in construction industry of Pakistan based on literature review and industry experts' interviews. This study found that most critical risks factors are:

- Delays in resolving contractual disputes.
- Delayed payments
- Political instability
- Financial failure
- Inadequate scope of work definition

However, this study considers contractors' perspective only to establish responsibility of risks thereby lacking a holistic view of industry experts, as viewpoint of owner and consultants were not obtained. Furthermore, identified risk factors were not classified into any sort of categories which make it hard for project managers to focus on certain critical risk categories.

Iqbal et al., (2014) adapted the same methodology to identify 37 risk factors and found out that most critical risk indicators in Pakistan's construction industry based on experts' judgements are:

- Financial issues
- Accidents on site
- Defective design
- Inaccurate schedule
- Poor performance of subcontractors

However, the research does not focus on a specific type of construction projects rather offers generalizability. This study also does not classify risks into certain categories which is, from execution management's point of view, a better approach so that most significant risks could be paid due attention in a proactive manner to achieve project objectives within scheduled time and stipulated cost.

Choudhry et al., (2014) identified 37 risks factors related to bridge construction in Pakistan with the help of industry experts and previous research, and concluded that considering ground realities of Pakistan, most significant risk factors are:

- Unavailability of funds
- Financial failure of contractor
- Poor site management
- Inadequate site investigations
- Improper project planning

Choudhry et al., (2014) also classified all the identified risk factors in seven categories namely:

1. Financial
2. Contractual
3. Design
4. Health and Safety
5. Management
6. Construction
7. External

The study pointed out that financial risks are the most critical risks followed by external risks and design risks. Therefore, calls for proactive management of risks as per their criticality and impact on project goals.

This study compliments work done by Hameed & Woo (2007) and Iqbal et al., (2014) as this not only offers a specific area of research i.e., bridge construction, but also classify identified risks factors into certain categories, and highlighted most significant risk types to facilitate project managers and their teams. However, this study lacks following aspects:

- Only considers bridge construction projects whereas a major part of construction activity in Pakistan involves commercial buildings construction (hotels, malls, hospitals, residential apartments etc.).
- Does not consider environmental risks which is an increasingly important area due to global awareness of environmental impacts of construction activities. United Nations General Assembly (UNGA) resolution titled as *Transforming our world: the 2030 Agenda for*

Sustainable Development emphasizes on minimizing ecological impacts of construction activities. Goal 15 of the resolution titled as "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" calls for global realization and contribution for sustainable development. Therefore, it is essential for all future projects to take environmental consideration into account right from planning phases for a better world for our future generations.

- Does not incorporate market risks which is another important area for Return on Investment (ROI) and cash inflows for other projects in portfolio management. Lee and Kim (2017) highlights the intense competition in the construction industry. Market risks include price wars at tender stage and the need for continuous innovation to stay competitive.

4.1 Risks Identification Chart

Following an in-depth study of various risks by previous researchers as explained earlier, below chart was formulated for further investigation of impact of various risks as illustrated in figure 6.

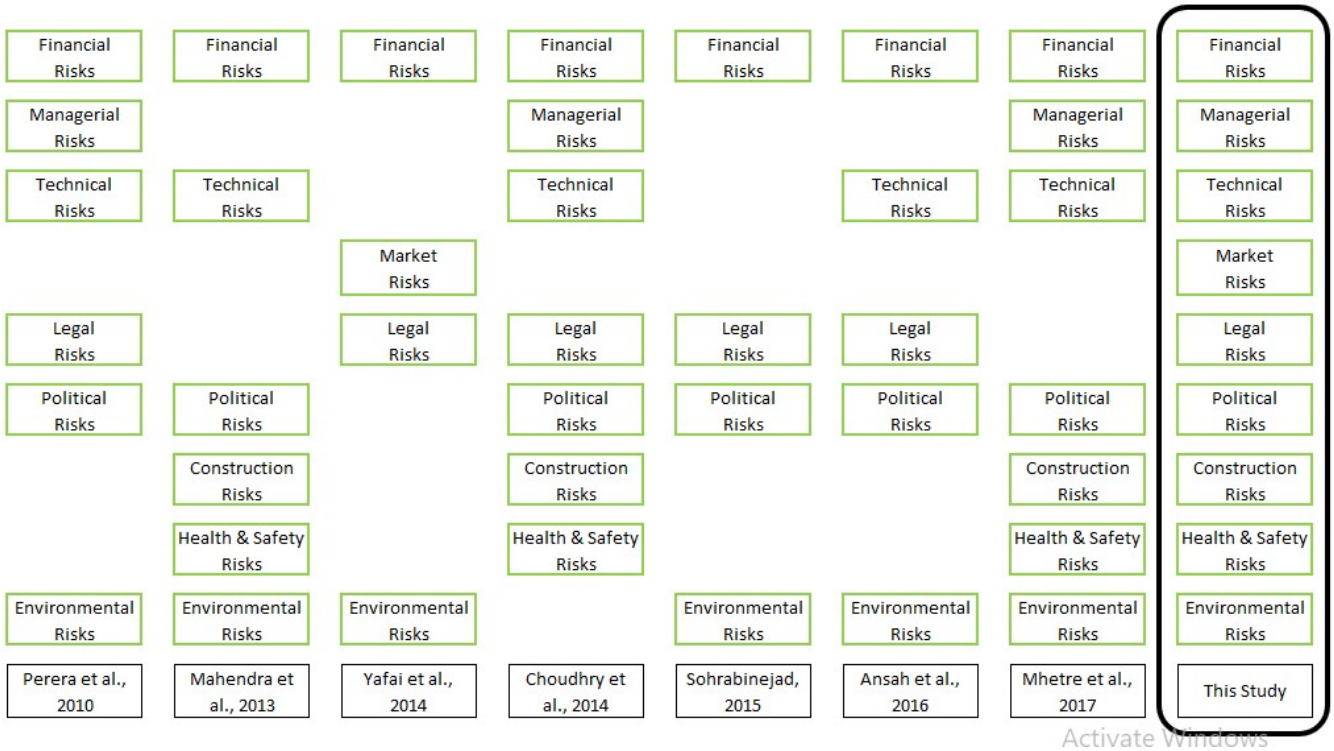

Figure 6. Risks Identification Chart

5 Implementation

This chapter discusses sampling method, development, composition, and piloting of questionnaire along with respondents' brief profiles.

5.1 Research Methods

The selection of most appropriate research method is entirely dependent on research questions and intended outcomes (Tähtinen et al., 2020). Furthermore, the manner in which data is gathered significantly impacts the dependability of a study and the validity of its findings, as emphasized by Fellows & Liu (2008). The research approach or data collection method should be chosen based on the specific type of data (quantitative, qualitative, or a combination of both) that is needed and can be feasibly obtained. Principally, qualitative and quanittative are two main approaches to collect data or conduct research (Naoum, 2007).

In case, research is intended to explore personal experiences, behaviors or social phenomena, qualitative approach is most likely suited in this case. This approach answers the questions like "what, why, how" (Tang, 2021). However, major disadvantages of qualitative methods include that it is highly subjective and results are generally interpretation based, and can be time-consuming and resource-intensive to conduct and analyze, particularly when working with a large number of participants. Furthermore, it is also prone to personal bias and does not offer possibilities for replicability.

Quantitative research, on contrary, revolves around questions like "how many, when, where". This approach employs numerical data and is strengthened by statistitical analysis. Data sampling is probablistic or random. Research outcomes are dettailed and structured, and in most cases, offers generalizeablity i.e. these are replicable (Tang, 2021). Keeping in view resarch questions and intended outcomes, this research used quantitative approach.

5.2 Population and Sampling

"Population" refers to a distinct group selected for a specific study, which could be a collection of individuals meant to be representative of the study's outcomes. In cases where conducting research

on the entire population is not feasible, a sampling method must be employed to randomly choose participants. The choice of the population and the sampling method used can significantly impact the research results. Ideally, the selected samples should accurately mirror the composition of the studied population, ensuring that the results are representative.

Several statistical sampling techniques can be used for this purpose, including simple random sampling, systematic sampling, stratified sampling, clustered sampling (Tähtinen et al., 2020). These methods are known as probability sampling techniques because they allow for the calculation of the probability of selecting a portion of the population. Utilizing these methods provides a reasonable level of confidence that the selected samples accurately represent the entire population (Rooney & Evans, 2014).

Simple random sampling involves giving every individual in the population an equal opportunity to be selected. This means that the selection process relies entirely on chance. On the other hand, systematic sampling entails choosing individuals at regular intervals, like every second individual, but it requires having a complete and unbiased list of the entire population. It's crucial to ensure that this list is not arranged in a manner that would introduce bias into the sampling process.

Stratified sampling is a method that involves segmenting the population into homogeneous subgroups according to particular attributes. This approach requires a thorough comprehension of the population. Subsequently, samples are chosen in a manner proportional to the size of each subgroup. This technique proves particularly beneficial when the identified characteristic has a substantial influence on the subject of the study, as it aids in guaranteeing that the sample faithfully mirrors the population's makeup.

When a comprehensive population list is unavailable or not feasible for the study, an alternative method is cluster sampling. In this approach, particular clusters, such as companies or agencies, are chosen, and all individuals within these selected clusters are included in the sample. This method is commonly known as cluster sampling.

In addition to methods discussed above, convenience sampling is also another flexible but effective method. Convenience sampling involves selecting readily available individuals or items for the study.

Researchers often opt for this method due to its accessibility (Bryman, 2016). Convenience sampling is often less expensive than other sampling methods because it doesn't require extensive planning, complex sampling frames, or significant travel to access participants. This can be especially beneficial when working with limited resources (Creswell & Creswell, 2017). As argued by Neuman (2014), for small-scale research projects or studies with limited scope, convenience sampling may be a practical choice. It allows researchers to collect enough data to draw initial insights without the complexities of larger sampling methods. Keeping in view merits discussed above, for this study, members of population are chosen based on their relative ease of access and it was ensured that sampling covers all the regions of subject area so that a holistic view could be obtained.

5.3 Data Collection

Quantitative research aims to establish connections between dependent and independent variables. Data can be gathered using methods such as interviews, questionnaires, and observations. In this study, a questionnaire has been chosen due to its suitability for exploring opinions, values, attitudes, and experiences. Frequency distribution and Likert scale values can be used for explanation of data received through questionnaire to address research questions. There are two different methods which are used to collect data from respondents i.e. Interview survey and questionnaire survey. For this research, questionnaire survey method was used. Questionnaires were administered via internet as this not only offers convenience but also quick retrieval of desired data from across the globe. However, a potential disadvantage of this is low return rate of questionnaire by the targeted recipients, but this could be controlled by increasing the sample size. Additionally, recipients with different backgrounds and experiences may perceive questions differently, and they may not be well familiar to express themselves in writing. Therefore, it is crucial to consider these aspects in planning and piloting of the questionnaire. An effective and good questionnaire should:

- Be easily comprehensible.
- Be clear (questions and response choices)
- Avoid leading questions (neutral approach)
- Be valid (that measures the intended results)
- Offer easy handling of answers.

Moreover, the questionnaire's length should be reasonable to encourage respondent participation while still acquiring insightful responses to the research questions. (Tähtinen et al., 2020).

5.3.1 Questionnaire Planning

Questionnaire form consist of three main sections:

1. Introduction of researcher and purpose of research, and instructions for respondents.
2. Personal information of respondents
3. Questions

As suggested by Tähtinen et al., (2020), section 3 has further subsections. A total of nine subsections were made, each named after nine risks categories as defined in chapter 3. The detailed structure of questionnaire form is given in Table 4A, and complete questionnaire is attached as Appendix A.

Table 4A. Questionnaire form structure.

Section	Description
1	**General** A brief background and purpose of research Instructions for answering Appreciation for response Confidentiality Likert Scale
2	**Personal Information** Name Location Type of organization (contractor, client, consultant) Position in organization Academic qualification level Experience (in years)
3	**Questions** Financial Risks – 7 Questions Management Risks – 8 Questions

	Technical Risks – 6 Questions Market Risks – 4 Questions Legal Risks – 6 Questions Political Risks – 4 Questions Construction Risks – 3 Questions Health and Safety Risks – 3 Questions Environmental Risks – 4 Questions

5.3.2 Questionnaire Piloting

Piloting a questionnaire is highly recommended as it provides the researcher with the opportunity to make adjustments based on the outcomes. For instance, alterations can be made to the sequence of questions, and adjustments can be applied to phrasing and instructions in order to enhance the research's validity and reliability (Tähtinen et al., 2020). In the context of this thesis, the piloting process primarily focused on verifying technical functionality and question clarity. The content and sequence of the questionnaire underwent evaluation by an industry expert, and necessary enhancements were implemented based on their recommendations. However, a more extensive piloting process was not carried out.

5.3.3 Questionnaire Execution

Digital resources were utilized to for survey. The questionnaire was sent out for the selected participants via email, Facebook messenger and Whatsapp depending upon the ease of access and to enhance the chances of receiving a response, followed by reminder wherever it seemed necessary.

5.4 Response Rate and Respondents

The questionnaire was administered to commercial buildings construction professionals in provinces of Punjab, Sindh, Khyber Pakhtunkhwa (KP) , Baluchistan (BA), Federally Administrated Tribal Areas (FATA), Gilgit Baltistan (GB), and Azad Jammu and Kashmir (AJK). These all places were selected to gather data so that a broad overview of constructions risks can be obtained. The study's population consisted of contractors, consultants, public clients, and private clients who are

consistently engaged in construction project risk management. Although 120 questionnaires were administered to construction professionals, and 73 (60.83%) responses were returned. Table 4B below shows state-wise distribution and retrieval of questionnaire.

Table 4B. Questionnaire Distribution

State	Punjab	Sindh	KP	BA	FATA	AJK	GB	Total
Distributed	84	8	16	3	3	3	3	120
Retrieved	52	3	11	3	1	2	1	73

Figure 7 illustrates the location (province) of respondents of questionnaire:

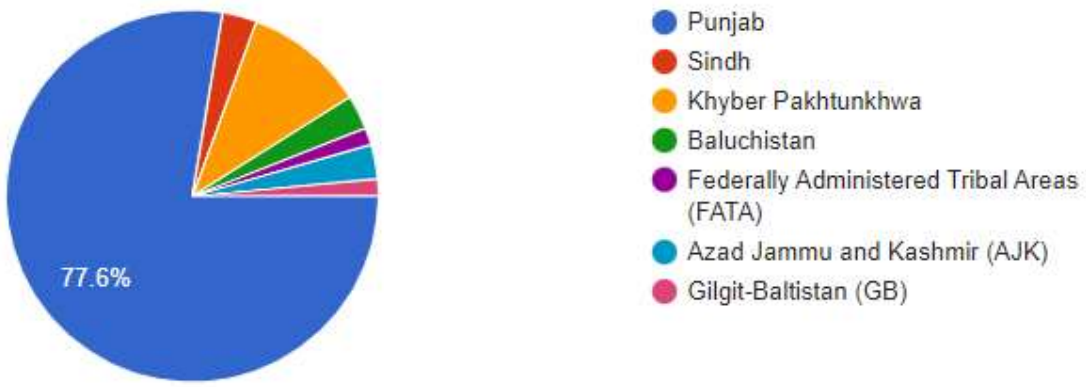

Figure 7. Respondents of Questionnaire

The distribution ratio and subsequently response ratio from Punjab is exceptionally high as it is the biggest province with over half the population of Pakistan and is the world's fifth-most populous subnational entity, and the most populous outside China or India with 110 million population out of 208 million population of entire Pakistan. Punjab is also the most developed state of Pakistan where most of the construction work takes place.

The details of respondents' organization type are given in Figure 8.

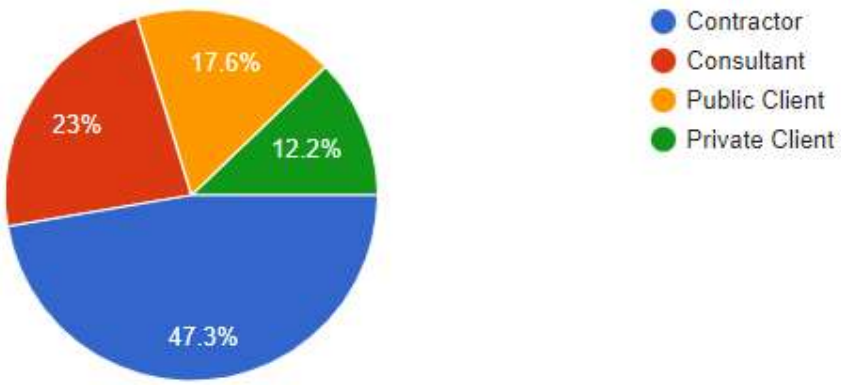

Figure 8. Organization Type of Respondents

All the stakeholders of construction industry were taken into account in order to get a comprehensive picture of the industry. Therefore, questionnaire was distributed to a variety of contractors, consultants, public clients and private clients. The Public and private clients were dealt separately in order to have wider perspective of client's viewpoint on risk assessment in construction projects as client is the one who has to bear the ultimate consequences of cost, time, performance and safety risks.

The highest qualification of the respondents is given in Figure 9. The experiences of respondents range from 2 years to more than 20 years in the construction industry of Pakistan.

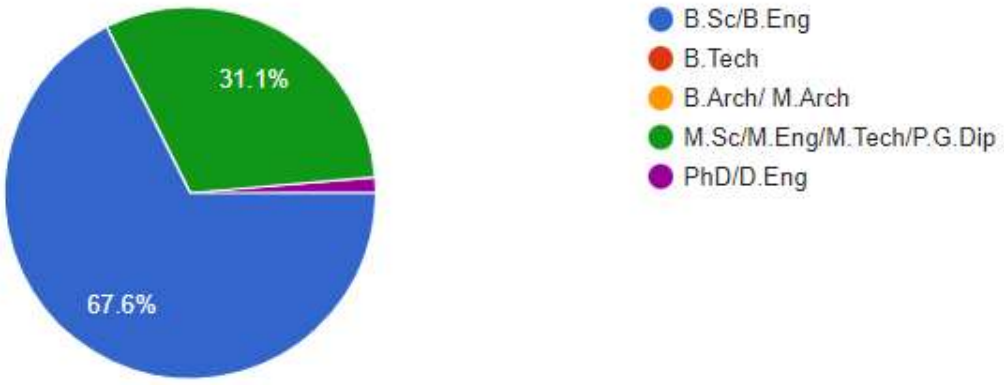

Figure 9. Highest Qualification of Respondents

6 Results and Analysis

The results of the study based on the responses of questionnaire are given below:

6.1 Financial Risks Factors

Weighted Average Method (WAM) was selected to analyze the potential impact of various risk factors on project goals. For this, cumulative score (CS) was calculated by multiplying Likert scale value with the respective number of respondents and then adding up all the resultant values. Then Relative Importance Index (RII) was calculated by dividing the cumulative score by total number of respondents i.e., 73. RII is appropriate approach in this scenario as suggested by Shash 1993; Ghosh and Jintanapakanont 2004.

Scale: 1– Insignificant 2–Minor 3 – Moderate 4 – Major 5 – Extraordinary

Table 5. Summary of financial risk factors

Financial Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Fluctuation of Inflation Rate	1	7	25	34	6	256	3.507	14.153
Fluctuation of Interest Rate	4	14	32	22	1	221	3.027	12.798
Rise in Material/Fuel Prices	1	5	20	30	17	276	3.781	11.718
Fluctuation of Exchange Rate	2	10	24	30	7	249	3.411	11.866
Change in Bank Formalities/Regulation	13	28	24	8	0	173	2.370	11.480
Unavailability of Funds	2	2	12	27	30	300	4.110	13.372
Financial Delays	2	3	8	36	24	296	4.055	14.859

Table 5 shows that “Unavailability of Funds” (RII = 4.110, SD= 13.372), “Financial Delays” (RII = 4.055, SD= 14.859) and “Rise in Fuel/Material” (RII = 3.781, SD= 11.718) were found to be most critical financial risk indicators in commercial buildings project of construction industry. The mean financial Relative Importance Index (RII_F) comes out to be 3.466. Unavailability of funds effects construction projects the most, particularly in public projects where policies and funds allocations are subject to revisions in accordance with vision and priorities of governments formed by different political parties as per their slogans and commitments in election campaigns. Besides there are frequent financial delays due to official constraints and processes which takes more than reasonable time. Raise in material and fuel prices is also another major problem as fuel prices are revised by Oil and Gas Regulatory Authority (OGRA) on fortnightly basis, and most of the times the prices go up. Moreover, rapid devaluation of Pakistani Rupee is major reason for rise in material prices causing serious impacts on projects cost. Therefore, it is quite evident that construction industry which is involved in long term construction projects will have to face several financial challenges in order to meet the project cost and schedule deadlines and should take these aspects into account at the time of bidding/tendering.

6.2 Management Risks Factors

Table 6. Summary of managerial risk factors

Management Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Improper planning & Budgeting	3	4	9	35	22	288	3.945	13.686
Poor Communication	2	7	24	27	13	261	3.575	10.738
Improper Project Feasibility Studies	3	6	12	28	24	283	3.877	10.991
Improper Project Organization Structure	3	10	21	29	10	252	3.452	10.310
Internal Management Problems	18	30	17	7	1	162	2.219	11.149
Incompetent Sub-Contractor(s)	2	5	23	27	16	269	3.685	10.922
Absence of Team Work	3	9	17	31	13	261	3.575	10.526
Change of Top Management	3	19	17	25	9	237	3.247	8.649

The results in Table 6 show that “Improper Planning and Budgeting” (RII = 3.945, SD = 13.686), “Improper Project Feasibility Studies” (RII = 3.877, SD = 10.99) and “Incompetent Sub-Contractor(s)” (RII = 3.685, SD= 10.922) are the most critical risk indicators in management category which affects the project’s completion within scheduled time and budget. The mean Management Relative Importance Index comes out to be (RII_M = 3.447). The project planning should be realistic and practical as improper and unrealistic planning always cause threats to projects goals. Similarly, thorough feasibility study should be done before commencement of the project. In order to minimize management risks, the construction companies should pay more attention to management related issues by forming better organization structures and employing better sub-contractors with a reliable track record.

6.3 Technical Risks Factors

Table 7. Summary of technical risk factors

Technical Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Design Changes	6	9	23	27	8	241	3.301	9.659
Inadequate Site Investigations	2	9	25	28	9	252	3.452	11.283
Unrealistic Cost Estimates & Schedules	3	5	19	25	21	275	3.767	9.940
Shortage of Skillful Workers	4	10	14	39	6	252	3.452	14.170
Poor Quality of Procured Materials	4	29	23	13	4	203	2.781	11.238
Material Shortage & Theft	4	12	29	24	4	231	3.164	11.480

The results in Table 7 show that “Shortage of Skillful Workers” (RII = 3.452, SD = 14.170), “Design Changes” (RII = 3.301, SD = 9.659) and “Material Shortage and Theft” (RII = 3.164, SD = 11.48) make to the top of technical risk indicators. The mean Technical Index comes out to be (RII_T = 3.32).

Most of the workers in construction industry are employed on project-based contracts. They are laid off as soon as project gets completed. Sometimes even during the last stage of project whenever deemed reasonable by project management. Another reason for shortage of skillful workers is low wages in the industry. Most of the construction companies are not willing to pay higher wages to experienced and skillful workers. Instead, they compromise on work quality utilizing unskilled or lesser skilled workers. At times, project is stopped for financial or political reasons and workforce is compelled to quit in the given circumstances. Furthermore, frequent design changes during the project life cycle affects timely completion of the project and its budgeted cost. Unavailability of specifications at the time of commencement of the project cause time and cost overruns. In time materials supply is another important issue and should be considered at initial stages. The construction sector should engage the contractor from the initial project appraisal phase to address and minimize technical project risks.

6.4 Market Risks Factors

Table 8. Summary of Market risk factors

Market Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Increase of Labor Cost	5	18	31	18	1	211	2.890	11.929
Increase of Material Cost	1	14	17	33	8	252	3.452	11.971
Competition from other Companies	3	15	30	21	4	227	3.110	11.459
Inadequate Forecast of Market Demand	5	15	23	26	4	228	3.123	10.065

Table 8 displays the results, indicating that "Increase in Material Cost" (RII = 3.452, SD = 11.970), "Inadequate Market Demand Forecast" (RII = 3.123, SD = 10.064), and "Competition from Other Companies" (RII = 3.11, SD = 11.458) have been identified as the most significant market risk factors. The average Market Index is calculated as (RII_{MK} = 3.144). In a country like Pakistan, characterized by an unstable economy, there has been a consistent record of inflation over the past decade. This inflation has led to a substantial increase in construction material costs. Materials are anticipated

to account for 42% and 79% of the total project cost for commercial and public projects, respectively, according to Achuenu and Ujene (2006). Consequently, budgeted project costs can be significantly affected by material shortages or increase in material prices. This situation could be managed if the government takes steps to regulate prices for essential construction materials like cement, steel, crushed stone, and sand, while also ensuring their availability to users.

6.5 Legal Risks Factors

Table 9. Summary of legal risk factors

Legal Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Contractual Anamolies	4	14	28	25	2	226	3.096	11.824
Breach of Contract by Project Partner	3	11	22	28	9	248	3.397	10.164
Improper Verification of Contract Documents	4	13	14	35	7	247	3.384	12.137
Law of Arbitration Clause in Contract Agreement	4	15	34	17	3	219	3.000	12.542
Lack of Enforcement of Legal Judgement	4	10	32	24	3	216	2.959	12.837
Disputes and Claims	0	11	21	35	6	255	3.493	13.759

As per Table 9, results show that “Disputes and Claims” (RII = 3.493, SD. = 12.79), “Breach of Contract by Project partner” (RII = 3.397, SD = 10.163) and “Improper Verification of Contract Documents” (RII = 3.384, SD = 12.136) are the most influential factors among legal risks. Calculation shows that mean Index for legal risks (RII_L) comes out to be 3.221. The specifications of project deliverables are not available in entirety at the time of commencement of the projects and this ambiguity give rise to claims and disputes. In addition to this, frequent change orders are also a major cause giving rise to disputes. Legal Process of dispute settlement in Pakistan consumes a lot of time and money. Therefore, arbitration clause should be incorporated in project documents to avoid such risks.

6.6 Political Risks Factors

Table 10. Summary of political risk factors

Political Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Change of Government Policies	10	13	16	21	13	233	3.192	4.159
Political Instability	5	8	25	24	11	247	3.384	9.290
Delay in Approval from regulatory Bodies	1	4	20	28	20	281	3.849	11.567
Corruption/Bribery	2	7	16	21	27	283	3.877	10.164

As per Table 10, results show that “Corruption and Bribery” (RII = 3.877, SD= 10.163), “Delay in Approval from Regulatory Bodies” (RII = 3.849, SD = 11.567) and “Political Instability” (RII = 3.384, SD = 9.289) are the major risk factors that belong to political risks. As a result, mean Political Index comes out to be 3.575.

Due to lack of accountability and enforcement of law, bribery and corruption is a massive risk. Most of the time construction personnel have to give bribe in order to get legal and rightful work done. As stated above, due to lack of accountability and responsibility, the approval processes particularly in public sector are much slower and time consuming and at times construction work has to be put on hold due to pending approval and client/contractor has to bear the incurred cost due to delay on part of regulatory bodies. Political instability is another major factor. Government changes and so do their policies. At times, government deliberately delays the interim payments of the projects which are not beneficial to them thereby causing time and cost overrun. Continuation of policies and projects inherited by last governments, timely approval and transparency in construction contract award should be encouraged to reduce political risks.

6.7 Construction Risks Factors

Table 11. Summary of construction risk factors

Construction Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Insufficient Technology	5	7	25	27	9	247	3.384	10.526
Defective Work and Quality Issues	0	8	24	26	15	267	3.658	10.900
Unclear Scope of Work	4	7	19	33	10	257	3.521	11.718

Table 11 show that “Defective Work and Quality Issues” (RII = 3.658, SD = 8.341) and “Unclear Scope of Work” (RII = 3.521, SD = 11.7175) are the most influential Construction Risk Indicators in construction industry. The mean Construction Index (RII_C) comes out to be 3.521. Many a times, quality of work is not up to the mark due to lack of knowledge/experience of the workers, used of substandard materials on account of lesser prices or construction activities done in hurry in order to meet the already lagging schedule. Therefore, poor quality work involves excessive reworks which tend to increase time and cost overrun. Ambiguous work scope is another major issue which causes massive deviations from planned schedule and budgeted cost. In order to avoid such construction risks, specification should be crystal clear and complete in all respects at the time of commencement of the project. The specifications should also include list of approved manufacturers and resources to ensure quality product.

6.8 Health and Safety Risks Factors

Table 12. Summary of health and safety risk factors

Health and Safety Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Accidents	2	15	25	24	7	238	3.260	10.164
Equipment and Property Damage	5	14	25	24	5	229	3.137	9.762
Fatalities	4	17	18	18	16	244	3.342	5.983

As per Table 12, results show that “Fatalities” (RII = 3.342, SD = 5.983), and “Accidents” (RII = 3.260, SD = 10.163) were found to be most impactful risk factors in Health and Safety category. The calculated mean Health and Safety Index (RII_{HS}) stands at 3.247. There should be implementation of OSHA guidelines on all construction sites. The workers must wear Personal Protective Equipment (PPEs) so that the site accidents, near-misses, fatalities and equipment damage can be controlled. A very low mean Health and Safety Index (3.247) implies the awful condition of awareness regarding health and safety of workers in Pakistan construction industry particularly in buildings projects.

6.9 Environmental Risks Factors

Table 13. Summary of environmental risk factors

Environmental Risk Indicators	Degree of Severity as Quoted by 73 Respondents					Cum. Score	RII = Cum. Score/73	Standard Deviation
	1	2	3	4	5			
Change in Climatic Conditions	9	16	24	20	4	213	2.918	8.112
Environmental Impact of the Project	5	15	31	18	4	220	3.014	11.014
Healthy Working Environment for the Workers	5	14	28	21	5	226	3.096	10.065
Stiff Environmental Regulations	6	16	34	15	2	210	2.877	12.361

According to Table 13, the findings indicate that the "Healthy Working Environment for Workers" (RII = 3.096, SD = 10.064) and the "Environmental Impact of the Project" (RII = 3.014, SD = 11.013) rank as the most significant Environmental Risk Indicators within the construction industry. The mean index for environmental risks (RII_E) stands at 2.976.

Creating a healthy working environment is of utmost importance as it directly contributes to increased worker productivity. Construction projects are affected by several environmental factors such as seasonal variations, soil characteristics, and topographical considerations. Furthermore, conducting an environmental impact assessment (EIA) for the project before its commencement is essential to mitigate any adverse effects the project may have on the environment.

6.10 Reliability and Validity

According to Cypress (2017), reliability pertains to obtaining honest and reliable results through repetition and replication, which helps to increase the dependability of the data and the research results, and validity refers to whether we have researched and measured the right things. (Kananen, 125).

In the planning stage, the survey was examined by an industry expert. A small test group was also used to test the survey, so that the validity would increase and also to ensure the unambiguity of language used and the functionality of survey form.

The validity of the research always gets affected by the selection of sample group. It was ensured that the survey is administered to working professionals from all across the country to obtain a comprehensive understanding of the subject matter. Although response rate of 60.83% is comparatively higher because author approached the people which were already professionally connected, but this is also a clear indicator of validity.

In most cases, the participants have an impact on the results of the survey. Within the overall population, there are various types of individuals, and their perspectives on the subject can shape how they respond to the questions. Some individuals may have a genuine interest in the topic, while others may consider it unrelated.

Moreover, the rate of non-responses, which refers to those who did not provide answers to the survey, could result in overlooking the viewpoints of certain individuals. Consequently, this could lead to less reliable research outcomes.

Another aspect which ensures validity of the results is the partial agreement of this research with the study carried out by Choudhry et al., (2014) for bridge construction in Pakistan.

In summary, this survey seems to be reliable and valid, at least according to the author.

6.11 Research Ethics Review

Wester (2011) suggests that ethical research requires conducting the entire research process responsibly. She identifies several factors that could pose ethical threats in research, such as manipulating research questions, or samples to obtain specific results, and introducing one's own biases or views into the research. These threats have the potential to affect the accuracy and credibility of research results, also known as conclusion validity. Therefore, it is important for researchers to safeguard human participants and inform them of the potential risks and benefits of the study. In this study, the respondents of questionnaire were assured that their information will be kept confidential and will not be shared or revealed without prior consent.

In this study, an electronic questionnaire was administered to construction industry professionals for data collection. Respondents' background information such as experience, type of organization, area/state they belong to, and their highest qualification. Anonymity was promised to the respondents, and it was committed that the information obtained will be erased once the data analysis is complete. Although the author's personal interests played an important role in motivating this research, ethical guidelines were followed throughout the entire research process.

7 Conclusions and Discussion

As shown in Table 14, out of 45 risk indicators, top 15 risk factors in descending order of severity were unavailability of funds (RII = 4.110), financial delays (RII = 4.055), improper planning and budgeting (RII = 3.945), improper project feasibility studies (RII = 3.877), corruption/bribery (RII = 3.877), delay in approval from regulatory bodies (RII = 3.849), rise in material/fuel prices (RII = 3.781), incompetent sub-contractors (RII = 3.685), defective work and quality issues (RII = 3.658), poor communication (RII = 3.575), absence of team work (RII = 3.575), unclear scope of work (RII = 3.521), fluctuation of inflation rate (RII = 3.507), disputes and claims (RII = 3.493) and increase of material cost (RII = 3.452).

Out of 15 most critical risk factors as listed in Table 15, 4 belong to financial risks category, 5 belong to management, 2 from each political and construction risks categories, 1 from each of legal and market risks, and none from health/safety and environmental risks which shows lack of awareness of construction professionals about health, safety, and environment as shown in Table 15.

Table 14. Ranking of most critical risk factors

Risk Factor	Mean RII	Rank
Unavailability of Funds	4.110	1st
Financial Delays	4.055	2nd
Improper planning & Budgeting	3.945	3rd
Improper Project Feasibility Studies	3.877	4th
Corruption/Bribery	3.877	5th
Delay in Approval from regulatory Bodies	3.849	6th
Rise in Material/Fuel Prices	3.781	7th
Incompetent Sub-Contractor(s)	3.685	8th
Defective Work and Quality Issues	3.658	9th
Poor Communication	3.575	10th
Absence of Team Work	3.575	11th
Unclear Scope of Work	3.521	12th
Fluctuation of Inflation Rate	3.507	13th
Disputes and Claims	3.493	14th
Increase of Material Cost	3.452	15th

Table 15. Corresponding risk type of 15 most critical risk factors

Risk	Total Risk Factors	Share in 15 most critical Risk Factors
Financial	7	4
Management	8	5
Political	4	2
Construction	4	2
Legal	6	1
Market	4	1
Technical	6	0
Health and Safety	3	0
Environmental	4	0

The results are in agreement with the study by Choudhry et al., (2014) for bridge construction in Pakistan. Therefore, for effective risk management in commercial buildings project, project teams and stakeholders should be extremely cautious to deal with these risks in an effective and proactive manner keeping in view their perceived impact on project goals.

7.1 Research Aims, Objectives and Questions

This research had two clearly defined objectives as mentioned in chapter 1. They have been re-written below:

1. What are the project risks, risk types and risk indicators of execution phase involved in the construction of commercial buildings in Pakistan?
2. What are the most critical risks in execution phase in the construction of commercial buildings in Pakistan based on potential impact?

Research thoroughly resonds to Reseach Question (RQ) 1, as 45 risks factors were identified and subsequently 9 risks categories were formulated based on the nature of each risk factor. 2nd RQ aimed to establish criticality of of all the risk factos identified in RQ1 based on their perceived potential impact on the project goals. Research was able to generate a list of 15 most critical risk factors faced by the commerial buildings projects in construction industry of Pakistan thereby facilitating all the stakeholders in industry to manage the critical risks in effective and proactive manner for a win-win situation for all.

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Appendices

Appendix 1. Questionnaire Form

Section 1: Background and purpose of the research

Project Risk Management in Construction Industry of Pakistan

Dear Respondent

The construction process is inherently prone to risks. Risk management is an essential and integral part of project management that enables professionals to quantify and analyze risks that may pose potential threats to project performance in terms of cost, quality, safety, and time.

This research aims at finding the critical risks influencing commercial buildings projects' success in Pakistan. Based on literature review, Construction Risks and their Indicators have been identified. It is required to mark the impact of these Risk Indicators on project success.

Your response to this survey will be highly appreciated. Your personal information will be kept completely confidential.

Sincerely,
Muhammad Javed

Section 2: Personal/Professional Information of Respondent

1. **Name**
2. **Location of Work**

- ◯ Punjab
- ◯ Sindh
- ◯ Khyber Pakhtunkhwa
- ◯ Baluchistan
- ◯ Federally Administered Tribal Areas (FATA)
- ◯ Azad Jammu and Kashmir (AJK)
- ◯ Gilgit-Baltistan (GB)

3. **Organization working with**

- [ ] Contractor
- [ ] Consultant
- [ ] Public Client
- [ ] Private Client

4. **Position in Organization**

5. **Please indicate your highest level of education.**

- [ ] B.Sc/B.Eng
- [ ] B.Tech
- [ ] B.Arch/ M.Arch
- [ ] M.Sc/M.Eng/M.Tech/P.G.Dip
- [ ] PhD/D.Eng

6. **Experience**

- [ ] 0-5 Years
- [ ] 6-10 Years
- [ ] 11-15 Years
- [ ] 15-20 Years
- [ ] More than 20 Years

Section 3: Questions

You are kindly requested to mark the severity of each risk indicator on the scale of 1-5.

SCALE

1: Insignificant	2: Minor	3: Moderate
4: Major	5: Extraordinary	

7. Financial Risk Indicators

	Insignificant	Minor	Moderate	Major	Extraordinary
Fluctuation of Inflation Rate	◯	◯	◯	◯	◯
Fluctuation of Interest Rate	◯	◯	◯	◯	◯
Rise in Material/Fuel Prices	◯	◯	◯	◯	◯
Fluctuation of Exchange Rate	◯	◯	◯	◯	◯
Change in Bank Formalities and Regulation	◯	◯	◯	◯	◯
Unavailability of Funds	◯	◯	◯	◯	◯
Financial Delays	◯	◯	◯	◯	◯

8. Political Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Change of Government Policies	◯	◯	◯	◯	◯
Political Instability	◯	◯	◯	◯	◯
Delay in Approval from regulatory Bodies	◯	◯	◯	◯	◯
Corruption/Bribery	◯	◯	◯	◯	◯

9. Management Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Improper Planning & Budgeting	◯	◯	◯	◯	◯
Poor Communication	◯	◯	◯	◯	◯
Improper Project Feasibility Studies	◯	◯	◯	◯	◯
Improper Project Organization Structure	◯	◯	◯	◯	◯
Internal Management Problems	◯	◯	◯	◯	◯
Incompetent Sub-Contractor(s)	◯	◯	◯	◯	◯
Absence of Team Work	◯	◯	◯	◯	◯
Change of Top Management	◯	◯	◯	◯	◯

10. Health and Safety Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Accidents	◯	◯	◯	◯	◯
Equipment and Property Damage	◯	◯	◯	◯	◯
Fatalities	◯	◯	◯	◯	◯

11. Technical Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Design Changes	○	○	○	○	○
Inadequate Site Investigations	○	○	○	○	○
Unrealistic Cost Estimates and Schedules	○	○	○	○	○
Shortage of Skillful Workers	○	○	○	○	○
Poor Quality of Procured Materials	○	○	○	○	○
Material Shortage & Theft	○	○	○	○	○

12. Market Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Increase of Labor Cost	○	○	○	○	○
Increase of Material Cost	○	○	○	○	○
Competition from other Companies	○	○	○	○	○
Inadequate Forecast about Market Demand	○	○	○	○	○

13. Legal Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Contractual Anamolies	◯	◯	◯	◯	◯
Breach of Contract by Project Partner	◯	◯	◯	◯	◯
Improper Verification of Contract Documents	◯	◯	◯	◯	◯
Law of Arbitration Clause in Contract Agreement	◯	◯	◯	◯	◯
Lack of Enforcement of Legal Judgement	◯	◯	◯	◯	◯
Disputes and Claims	◯	◯	◯	◯	◯

14. Construction Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Insufficient Technology	◯	◯	◯	◯	◯
Defective Work and Quality Issues	◯	◯	◯	◯	◯
Unclear Scope of Work	◯	◯	◯	◯	◯

15. Environmental Risk Factors

	Insignificant	Minor	Moderate	Major	Extraordinary
Change in Climatic Conditions	◯	◯	◯	◯	◯
Environmental Impact of the Project	◯	◯	◯	◯	◯
Healthy Working Environment for the Workers	◯	◯	◯	◯	◯
Stiff Environmental Regulations	◯	◯	◯	◯	◯