Critical Risk Factors influencing Time Schedule of Residential Projects in Pakistan

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ABSTRACT

Delays in residential construction projects are common issues in both developing and developed countries. This research aims to identify the key reasons behind these delays in Pakistan. When the projects run behind schedule, this can lead to problems such as exceeding the budget, reduced productivity at the construction site, and potentially lower quality work. The study involved a detailed survey using questionnaires that were addressed to industry professionals. Their responses were used to rank the critical factors causing delays. The most significant factors were found to be fluctuating material prices, financial challenges for contractors, underestimating project duration, poor site management, inexperienced contractors, ineffective project management, communication gaps among project stakeholders, shortage of skilled workers, changes in project design, unqualified contractors, and inadequate project planning. Identifying these critical factors through the Relative Importance Index (RII) method can help in addressing and preventing delays in Pakistan's construction projects, ensuring timely completion and better project outcomes in the future.

Keywords-time overrun; construction delays; critical factors; Pakistan; survey

I. INTRODUCTION

Time overrun is one of the most critical issues in the construction industry [1]. Construction time overrun is defined as a change between the project's actual contract period at the time of the tender and its final contract period when the project is completed. Time overrun can lead to problems in various aspects, such as budget overruns, low productivity, etc., which can result in poor-quality performance, and dissatisfaction among project stakeholders [2]. In [3], it is reported that in Pakistan, out of 65 projects, only 2 were completed on time, while the remaining 63 projects were delayed for various reasons [3]. In Saudi Arabia, approximately 70% of residential construction projects have experienced schedule overruns [4]. Delays are one of the most serious problems associated with construction projects, as they can lead to the initial estimated time and cost being exceeded. The only way to mitigate these delays is through proper identification and study of their causes [5]. The majority of projects in Pakistan have been completed after the defined time, while very little research has been conducted to identify the critical factors contributing to time overruns in building projects in Pakistan [6]. Many large residential projects are delayed due to numerous factors that play a critical role in controlling project timelines. Delays tend to occur during the execution phase, which is considered the most crucial stage in the construction life cycle, with various factors contributing to project delays. According to the Lahore Development Authority (LDA), approximately 50% of residential projects in Lahore city are halted due to poor project management and estimation.

II. LITERATURE REVIEW

A. Overview of Construction Industry

The construction industry involves various disciplines that collaborate with each other to meet the requirements of construction projects. This collaboration includes roles like architectural engineering design, construction and procurement engineering, as well as risk management, project management, and ensuring the sustainability of the project, among others. Construction can be categorized into different forms, including industry-specific, commercial buildings, and in-situ residential

construction projects [7]. In Pakistan, there is a significant ongoing construction activity, especially in residential construction projects, which are gaining popularity due to the increasing population in various parts of the cities. The construction field is the second-largest sector in Pakistan, contributing approximately 33% of the total GDP, making it the second-highest contributor after the agriculture sector. The construction industry is considered one of the most important and sustainable businesses, with consistent growth in the past decade. However, there are several risks associated with this domain, including geopolitical factors, resource availability, technology considerations, and sometimes economic impacts.

B. Overview of Pakistan's Construction Industry

The estimated market size of Pakistan's construction industry was $17.4 billion in 2022. According to projections for the 2024-2027 period, research indicates that there will be an increase of 5% to 10%, respectively. This growth will be supported by investments in various sectors, including transportation, electricity, housing schemes, telecommunications, and a focus on infrastructural projects. The key sectors within Pakistan's construction industry are further divided into subgroups, as per the Pakistan's Construction Association. These subgroups include industrial, energy and utility, residential, and infrastructure construction.

1) Industrial Construction

This sector is expected to experience significant growth in the near future, contributing to the economy of Pakistan. According to the vision for 2030, there are plans for extensive industrial construction throughout the entire region of Pakistan.

2) Energy and Utilities Construction

The energy and utilities sector is also anticipated to expand in the foreseeable future due to the increasing population in the country. This growth is necessary to meet the rising demands for energy and utilities in Pakistan.

3) Residential Construction

Residential construction is indeed one of the fastest-growing construction sectors in Pakistan. This growth is driven by the increasing population, which relies on residential areas for their accommodation needs. The construction of new residential units is essential to accommodate the expanding population in the future.

4) Infrastructure Construction

Infrastructure construction is also expected to increase in the future, particularly through public-private partnerships. This approach is aimed at stabilizing the country's economy and deriving more benefits from such construction methods. It signifies a collaborative effort to enhance and develop the infrastructure, which is essential for economic growth and overall prosperity.

C. Reasons of Delays in Construction Industry

1) Inexcusable Delays

These delays are attributable to situations where the contractor bears full responsibility for extending the project's duration. In these cases, the contractor is obligated to cover any damages resulting from their own actions. For example, this could occur due to a lack of proper equipment necessary for the job, a shortage of essential materials, or inadequate planning and allocation of labor during working hours.

2) Excusable Delays

These delays are primarily caused by unforeseeable events that are beyond the contractor's control. In such cases, the contractor usually receives some leniency or understanding from the client. Examples of these events include incidents like fires at the site from unknown sources, natural disasters such as floods or earthquakes, and severe weather conditions.

D. Past Research Studies

Past researchers have conducted a research on time overrun factors in different kinds of construction projects in order to find out the most critical factors and the most important causes of the time overrun in the residential construction projects. Authors in [8] conducted a detailed survey on field engineers and identified the main causes of the time overrun in construction projects. The main identified causes were delay in payments, shortage of materials, changes and amendments in the selected materials, poor site management, and poor financial status of client. Authors in [9] identified 33 common factors which cause time overrun and divided them further into 8 subgroups. The research was conducted using the Relative Importance Index (RII) and the 5 identified main important factors for time overrun were poor site supervision, delays in decision making from client and contractor, changes in the design during the execution phase, the poor site investigation, and poor site management from the execution staff. Authors in [10] reported as the most critical causes in delays financial issues faced by contractors, inexperienced contractor selection for the project, severe weather conditions, lack of skilled workers at site, errors in time estimation of the project, and mistakes in design. Authors in [11] identified major risk factors in terms of external, internal and force majeure in the aviation construction projects which caused delays and time overruns during the construction phase. Authors in [12] figured out 29 direct and 32 indirect dispute causes, out of which direct dispute caused delays due to unrealistic contract duration, poor quality of work, lack of skilled labor, lack in payments from the client, indirect disputes, poor project planning and scheduling by the workers and contractor, poor estimation of the project, and contractor's lack of experience. Authors in [13] identified the most critical factors which cause time overruns in the construction projects in Vietnam using the quantitative approach. From the contractor's side, the main cause was the poor monitoring of the project and poor project management whereas from the owners side, financial problems caused delays in the construction activities. This research was evaluated through a question survey which was sent to professionals.

Table I summarizes the results of the recent research on the topic of time overruns and delays.

III. RESEARCH METHODOLOGY

The primary objective of the current research is to assess the factors leading to time overruns and delays in residential

construction projects in Pakistan. To achieve this, the following steps were taken: initially, the key factors were categorized, and the RII statistical technique was employed to evaluate them based on the responses collected from experienced professionals. The main purpose for selecting this technique was to get the values of each factor and rank them accordingly. Subsequently, a critical analysis was conducted to rank these factors, identifying the most critical ones. The primary goal of using this technique was to rank the factors through a statistical analysis of the data gathered from feedback and responses.

TABLE I. CRITICAL FACTOR CAUSING TIME OVERRUN IDENTIFIED BY RECENT RESEARCH

Ref.	Country	Findings
[14]	Jordan	The primary causes of delays in public construction projects are often associated with design changes, severe weather conditions, late material deliveries, variations in quantities due to inaccurate estimations, and the poor economic condition of the country.
[15]	Thailand	Material shortages, inadequate project planning, changes in project scope by clients and owners, and poor management by the execution team and contractor.
[16]	Ghana	Poor contract management, delays in material procurement, poor project performance by the project team, and increases in material prices.
[17]	Saudi Arabia	The author identified 56 main causes of delays in construction, with some of the most significant factors being delays in the approval and preparation of shop drawings, design changes during execution, poor relationships between contractors and subcontractors, and slow decision-making processes.
[18]	Nigeria	Delays caused by clients often include variations in project scope, decision-making issues, and cash flow problems. Delays attributed to the contractor may arise from poor project planning and scheduling, ineffective site management and execution, and delayed delivery of materials.

IV. DATA COLLECTION AND DATA ANALYSIS

In the initial phase, a questionnaire survey was designed and distributed to 89 professionals, including consultants, clients, and contractors, who were actively engaged in residential construction projects. The purpose of this survey was to gather data based on their personal responses. Once the data were collected through this comprehensive survey, they were analyzed using the RII to identify the most and the least critical factors that could impact the timely completion of residential projects. The outcomes of the distributed survey are presented in Table II and Figure 1.

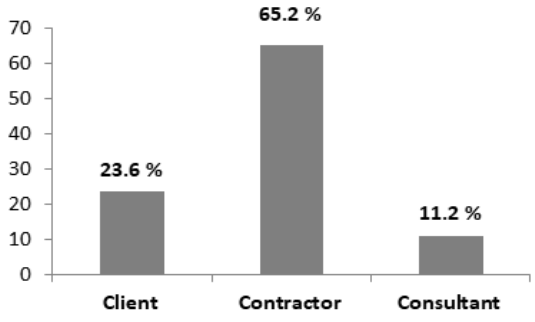

Fig. 1. Percentage of responses from clients, contractors, and consultants.

TABLE II. EXPERIENCE OF THE RESPONDENTS

Work Experience	Frequency	Percentage
More than 15 years	23	25.8
Less than 15 years	66	74.2
Total Respondents	89	100

The factors were ranked after a thorough analysis using the RII, where a higher RII value corresponded to a higher rank. A higher ranking number indicates that the factor has a more significant impact on causing time schedule overruns and delays in the project timelines. The formula for the RII is:

$$\text{RII} = \frac{\sum W}{(A \times N)} \quad (1)$$

The final results are exhibited in Table IV, and are further analyzed below.

TABLE III. RANKING OF CRITICAL FACTORS CAUSING TIME OVERRUN

Factors	RII	Rank
Fluctuation in material prices	0.913	1
Financial difficulties faced by contractor	0.904	2
Underestimation of project duration	0.831	3
Poor site management	0.819	4
Lack of experience of the selected contractor	0.790	5
Poor project management	0.784	6
Lack of communication among project parties	0.761	7
Shortage of skilled workers	0.755	8
Changes in design	0.740	9
Incompetent contractor	0.732	10
Poor project planning and management	0.729	11

A. Fluctuation in Material Prices

Fluctuation in prices is one of the major causes of the delays in the residential construction projects, with a RII value of 0.913. The timeline of the project is based on the availability of the materials and if the prices of the material increase, the project will get affected, while this can lead to work stoppage.

B. Financial Difficulties Faced by the Contractor

Financial issues faced by contractor have a RII value of 0.904. Usually, contractors undergo finance related issues due to which they are unable to make the payments to the sub-contractor and as a result project suffers delays [20].

C. Underestimation of Project Duration

Underestimation of project duration or errors in time estimation can cause problems in the project to be finished on time, so there must be a properly defined timeline for the project. The RII value for this factor is 0.831.

D. Poor Site Management

Poor site management causes delays in the project schedule because if the construction activities are not overlooked properly, there might be some problems due to which the project deadlines get extended. The value for RII is 0.784.

E. Lack of Experience of the Selected Contractor

Sometimes clients select contractors with not enough experience, usually for financial reasons, so the schedule of the project gets eventually disturbed. This factor has a RII value of 0.790.

F. Poor Project Management

Due to poor project management, the projects does not get completed on time. The RII value for this factor is 0.784.

G. Lack of Communication among Project Parties

Most of the time, lack of sufficient communication among project stakeholders causes a lot of problems during project life-cycle and timelines get affected. Different tools and techniques can be used for effective communication among project parties. The RII value of this factor is 0.761.

H. Shortage of Skilled Labor

Most of the time, the project team do not get enough labor to complete the project activities on time and due to this the project gets delayed and the overall objectives of the projects are not achievable. The obtained RII value was 0.755.

I. Changes in Design

Due to the lack of communication between the design department and the contractor, changes in design can cause problems in the time schedule. This factor has an RII value of 0.740. Changes in design in any stage of the project can make things very complex for all project stakeholders.

J. Incompetent Contractor

Incompetent contractors may not complete the project on time. Selection of a competent contractor is the responsibility of the client and the consultant. The RII value of this factor is 0.729.

K. Poor Project Planning and Management

Due to poor project planning and management of the execution work, the project team does not have enough time and capabilities to finish the project on time. This factor scored the lowest RII value of 0.729.

V. CONCLUSION

The main aim of this research was to find out the most critical factors which impact the residential construction projects in Pakistan. After the statistical analysis, we figured out the 11 most critical factors, which were, in descending order of importance, fluctuation in the prices of the material, financial difficulties faced by the contractor during the project life, underestimation of the project duration, inexperienced contractors, poor project management, lack of communication among project parties, shortage of site workers, changes in design, incompetent contractors, and poor project planning and management.

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