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Substantial Factors Causing Delays in Construction Projects: A Comparative Study Between Pakistan and Turkey

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ABSTRACT

This research explores the substantial factors causing delays in construction projects in Pakistan and Türkiye. The study begins with a comprehensive literature review of construction delay factors in developing and developed countries. In addition, focus group discussions and exploratory factor analysis identified causes of delays fall into nine main categories: builders & developers/client; contractors; consultants & designers; contract-related issues; finance; planning, designing & scheduling; material; labor & equipment; and external factors. This study employed the Methodology for Construction Delays and Resilience Framework (MCD&RF). Primary data was collected through a newly developed questionnaire, and two statistical methods were used to analyze the data: The Relative Importance Index (RII) and Spearman's rank correlation. This study discusses a comparative study between the two countries. The results shed light on the perspectives of builders & developers, constructors & contractors, and consultants & advisers in Pakistan and Türkiye suggesting factors contributing to construction delays. This study also highlighted the top ten significant construction delays in each country. A novelty of this research is the proposed mitigation strategy, which includes a theoretical framework known as Real-Time Connect—AI-driven cloud-based communication model aimed at modernizing Pakistan's construction sector. This framework outlines a strategy for promoting information exchange efficiency. Visualizes critical aspects of the project, focusing on enhancing construction coordination while minimizing errors and cost overruns.

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1. Introduction:

The construction sector substantially contributes to a country's economic growth. In recent years, both developed and emerging nations have given their construction industries significant encouragement, considering it to be a vital revenue generator for many countries since it is considered to spur growth in other sectors. All relevant economic stakeholders, including governments and businesses, know the construction sector's role in fostering economic development.

Haseeb et al. (2011) advocated that the efficiency of a construction sector relies on the timely completion of a construction project. Such projects must be accomplished within the assigned time, along with the cost parameters and clients' specific goals, as prescribed for feasibility. Likewise, several earlier studies (Durdyev et al., 2012; Haseeb et al., 2011; Oyegoke and Al Kiyumi, 2017) have identified delays in the construction sector as a prominent issue. According to Elhusseiny et al. (2021) and Shrivas and Singla (2020), construction delays are a prevalent problem affecting the progress of construction projects.

Construction delays can be defined as an extension of time to complete a project along with prescribed desired outcomes. Shahsavand et al. (2018) defined delay as the time overrun beyond the completion date outlined in a contract or agreed-upon project delivery. Fugar and Agyakwah-Baah (2010) have discussed that extensions of a project for whatever reason may also be called construction delays. These delays can result in a loss of revenue for the owner/developer for various reasons. For the contractor, it can lead to increased overhead costs, higher material costs due to inflation, increased labour costs, and others.

The construction sector faces several challenges in terms of survival and growth. However, construction delays are assumed to be the most significant problem for this sector, and they require attention from the government and concerned stakeholders in Pakistan's economy (Baig et al., 2022). Despite economic challenges, the Pakistani government has launched the Naya Pakistan housing initiative to stimulate construction. The Pakistani government also attempted to develop policies and initiatives to assist industrial stakeholders. The practical scheme inspired investors and Pakistanis who wanted to construct homes but couldn't afford them. Therefore, the government gave low-interest bank financing to the lower and middle classes and Pakistani investors.

Pakistan's construction sector contributes 2.5% of GDP, with 7% growth. According to the Pakistan Economic Survey, 7.61% of the workforce is employed in the sector. Between FY2019 and FY2020, the private sector's GFCF ascended by 20.6%. The private sector accounted for over 95% of GFCF. The construction sector enhances GDP by 380 billion PKR (State Bank of Pakistan, 2021). Likewise, the construction sector of Türkiye contributes even more significantly to its overall economic growth and generates considerable national income (Durdyev et al. 2012). The industry accounted for about 5.4% of the GDP and generated employment for 1.5 million individuals in 2020 (FIEC, 2022). Turkish construction companies have successfully increased their footprints in the international market. However, Kazaz et al. (2012) and Culfik et al. (2014) have also identified delays in construction projects in Türkiye. Several studies have examined the causes of project delays and have identified specific factors that vary by country, region, project type, procurement

methods, and relevant parties (Oyegoke and Al Kiyumi, 2017; Hampton et al., 2012; Yang et al., 2010; Lessing et al., 2017).

This study aims to fill existing knowledge gaps by investigating and comparing the causes of project delays in Pakistan and Türkiye. The reason for considering Türkiye for this study is that both countries share several similarities. Türkiye has a strong interest in Pakistan and has signed several working contracts with it, particularly in the construction industry. As a result, this study provides a comparative analysis of the construction sector in both countries.

This study has significant implications for Pakistan's construction sector. The construction sector is regarded as a barometer of economic growth in the modern world. This research provides substantial reasons for delays and mitigation strategies for the future. Furthermore, this comparison aims to highlight Pakistan's current position in construction activities, and the findings will assist policymakers in overcoming delays in the context of Pakistan.

This study identifies and categorizes significant delay causes into Nine major groups. The classifications include builders & developers, contractors, consultants & designers, contract-related issues, finance, planning & scheduling, material, labour & equipment; and external factors.

2. Literature review

The literature review aimed to find patterns and trends from previous studies that could shed insight into the project's delay. The review also aims to improve construction project management through insights and recommendations.

The prevalent global issue of construction delays and their impacts has been analysed by researchers using multiple approaches. This issue significantly impacts the construction sector and the economies of nations at large (Sambasivan & Soon, 2007). Arditi et al. (1985) identified Turkish construction delays, in this study looked at the elements influenced by national economic initiatives as well as those under the authority of the government and private contractors. The most major delay issues are resource constraints, financial difficulties for public agencies and contractors, organizational inadequacies, design work delays, frequent change orders, and significant additional labour. Sullivan and Harris (1986) mentioned that construction project delays could lead to significant financial losses and project setbacks. The timely completion of a construction project and factors such as cost, quality, and safety are crucial indicators of its success. A range of risks often accompanies the implementation of construction projects, with project delays being among the most prominent. The possibility and impact of delays can vary from one Project to another. Dlakwa and Culpin (1990) found that developing nations' construction projects experience cost and scheduling overruns. The study's preliminary findings suggest that the main issues in the construction sector were late contractor payments by agencies and price variations in materials, labour, and equipment.

Morris (1990) highlights the negative impact of delays and cost overruns in public sector investments on the capital-output ratio and investment efficacy. The results of internal factors within the public sector and government, such as poor project design and implementation, inadequate funding, bureaucratic indecision, and lack of coordination between enterprises, highlighted issues underlying causes for construction delays. The tendency to take on numerous underfunded projects and prioritize specific sectors (such as oil and natural gas) exacerbates the issue, particularly in infrastructure areas like railways, coal, and steel.

Assaf et al. (1995) determined fifty-six primary reasons for construction delays in Saudi Arabia, of which contractors, architects or engineers, and owners topped the list. The main factors are the creation and approval of drawings, delays in the contractor's work, payments, changes in the design, relationships between subcontractors, and the owner's protracted decision-making process. On the other hand, a comparative study by (Ogunlana et al., 1996) discovered that delays in the construction sector in developing economies were caused by three layers: shortages of the primary supply of resources in the construction industry's infrastructure, clients and consultants, and contractor incompetence or inadequacy.

Frimpong et al. (2003) explored delay factors which were responsible for the impediment of constructions within aquatic environments. They determined monthly payment issues from agencies, ineffective contractor management, difficulty in sourcing necessary materials, poor technical output, and rising material costs to be among the leading factors responsible for project delays and budget overruns. Harbuck (2004) stated that construction projects were generally held vulnerable to various reasons for delays that can broadly be categorized into three main categories: design mistakes, construction issues, and third-party issues.

Lo et al. (2006) categorized 30 causes of delays in construction projects in Hong Kong into seven groups: client-related; engineer-related; contractor-related; human behaviour-related; project-related; external factors; and resource-related. To gauge the differing perceptions of construction professionals on these causes, the authors used the rank agreement factor (RAF), percentage agreement (PA), and percentage disagreement (PD). Sambasivan and Soon (2007) have thoroughly investigated Malaysian construction delays. The study highlighted that delays in a construction project can occur for a variety of reasons: including inadequate client funding; inadequate contractor experience; poor planning by contractors; poor site management by contractors; equipment failure and availability; a lack of materials; poor communication; and a labour shortage during construction. These delays resulted in cost and time overruns, disputes, arbitration, legal action, and total withdrawal.

Tumi et al. (2009) conducted a similar study in Libya, identifying 43 significant causes of project delays. Meanwhile, in Pakistan, Haseeb et al. (2011) employing a quantitative approach, examined the causes of delays in large construction projects in Pakistan. Their findings revealed that the primary factors were natural disasters, financial and payment issues, insufficient planning, inadequate site management, and a scarcity of materials and equipment. Kazaz et al. (2012) discovered that architectural and material changes were the most significant cause of delay, followed by financial factors, however, environmental issues to be the least important in the context of construction projects.

Kikwasi (2013) examined the causes of the delays in Tanzanian construction projects using a questionnaire survey study. The author lists several crucial factors, including numerous design revisions, late supplier payments, inadequate project management, a lack of cooperation among project stakeholders, and unskilled contractors as causes of construction delays. Kazaz et al. (2012) surveyed the Turkish construction industry to examine the issue of time overruns and determine their relative importance. The study considered 34 potential delay factors in the analysis. Gündüz et al. (2013) found in their extensive survey of 83 delays in Turkish construction projects that payment delays and cash flow issues were perceived as the most critical factors. The study determined the relative significance of each delay cause. Gardezi et al. (2014), emphasized that construction delays exist globally and are a pressing problem. Likewise, Pakistan is no exception to this phenomenon. Cost overruns, time extensions, litigations, and disputes were highlighted as the most persistent problems within the construction sector. Their study examined around 50 construction projects and provided a comprehensive list of construction delays.

A similar study from Bangladesh added political instability and inflation to the list of causes for the delays in construction projects. Their study emphasized how geographical characteristics and cultural disparities create hindrances, along with other contingent factors, such as the project's nature, organization size, level of experience, and technical proficiency (Mizanur et al., 2014). Emam et al. (2015) found the leading causes of building project delays in Qatar. They discovered that the main reasons for delays in the area were changes in design, poor planning and scheduling, changes in the project's scope, underestimating the project's schedule, and a lack of skilled workers.

Larsen, Shen, Lindhard, and Brunoe (2016) identified the significance of project managers in relation to their impact of the quality, time and expenditure. Their findings indicate unresolved or insufficient project finance to have the most impact on time, while for cost, it is errors or omissions in consultant material; and for quality, it is errors or omissions in construction work. The study's major finding is that project schedule, budget, and quality level are all highly influenced in different ways. As a result, a project manager cannot address such serious challenges by focusing exclusively on schedule or budget concerns; nor can they assume that time, money, and quality are all equally affected. In a separate study, Kim et al. (2016) analysed factors that lead to delays in Vietnam. Their survey identified six causes to be: the ability of the client and contractor, the ability of the consultant and contractor, external factors, the ability of the designers, and the ability of the supervisors.

Durdyev et al. (2017) conducted a research study to identify the various causes of delay that hinder the construction industry's performance in Cambodia, specifically in residential building projects. They found such delays to be ubiquitous, having a substantial influence on the industry's performance. Girginkaya Akdag and Maqsood (2019) also explored the constraints and motivations for applying the building information model in developing economies and proposed solutions for adopting and implementing BIM. Bajjou and Chafi (2020) studied the critical causes affecting project delays in Morocco's construction industry. In their research, they aimed to uncover the most significant factors that disrupted the completion of these projects.

Karim and Amin (2021) uncovered ten most significant causes of delays: financial constraints faced by the construction company, delays in final inspection and third-party certification, adverse weather conditions, terrorism threats in the construction site, payment delays, natural disasters such as floods or earthquakes, suspension or postponement of work activities, scarcity of construction materials, disagreements between sub-contractors on implementation schedules, and late approval and finalization of construction plans. These delays lead to several consequences, including time overruns, disputes, cost overruns, the need for arbitration, abandonment of projects, and even lawsuits.

Abduljawwad and Almaktoom (2021) examined contractor perceptions of construction delays. The authors developed a questionnaire to analyze Saudi Arabia's most crucial construction delay factors. The Relative Importance Index (RII) found that payment delays, project cost underestimation, legal issues, municipality permit obtaining, lack of communication between parties, completion time underestimation, owner and Consultant instruction delays, and poor supervision cause construction delays.

Sanni-Anibire et al. (2022) conducted an extensive study and discovered a lack of a comprehensive review of previous construction delay research. Such a study combined the latest information from prior studies to provide a broad overview that may be useful to individuals who are concerned. Their comprehensive meta-analysis labelled, "slow delivery of materials" "contractor's financial difficulties", "poor site organization & coordination between various parties", "delay in the approval of completed work", and "poor planning of resources and duration estimation/scheduling", as the foremost causes of construction project delays.

Gurgun et al. (2022) explored the application of technology to address construction project delays, with three study issues in mind. (1) Proper identification of technology, while attempt to provide solutions through the literature, (2) Analysis of the inevitable presence of delays, despite implementation of disruptive technologies, and (3) Comprehend foremost measures to combat the causes that delay construction projects. They identified a number of methods, i.e., planning, imaging, geospatial data collecting, machine learning, and optimization, which can be utilized to mitigate construction delays. The outcomes of the current study support trends and technical breakthroughs in addressing important reasons for delay.

Do et al. (2023) found and assessed the critical reasons that cause construction delays. This research discovered forty-five causes that contribute to construction delays. Six fundamental causes are discovered using the factor analysis technique, namely contract problems, inappropriate owner action, and contractor The identified challenges include a deficiency in expertise, obstacles arising from the owner/consultant, uncontrollable objective issues, and complications related to contractor bidding.

The above reviewed literature illustrates how thoroughly construction-related delays have been investigated. However, the present research identified a gap in extant review literature, stressing the importance of conducting step-by-step investigations into construction-related delays. Moreover, it would be beneficial to comprehend the situation and propose certain procedures for mitigating delays

3. Methodology

Methodology for the Construction Delays and Resilience Framework (MCD&RF) is the dominant methodology designed for this study. The following (MCD&RF) methodology consists of four crucial steps (Figure-1).

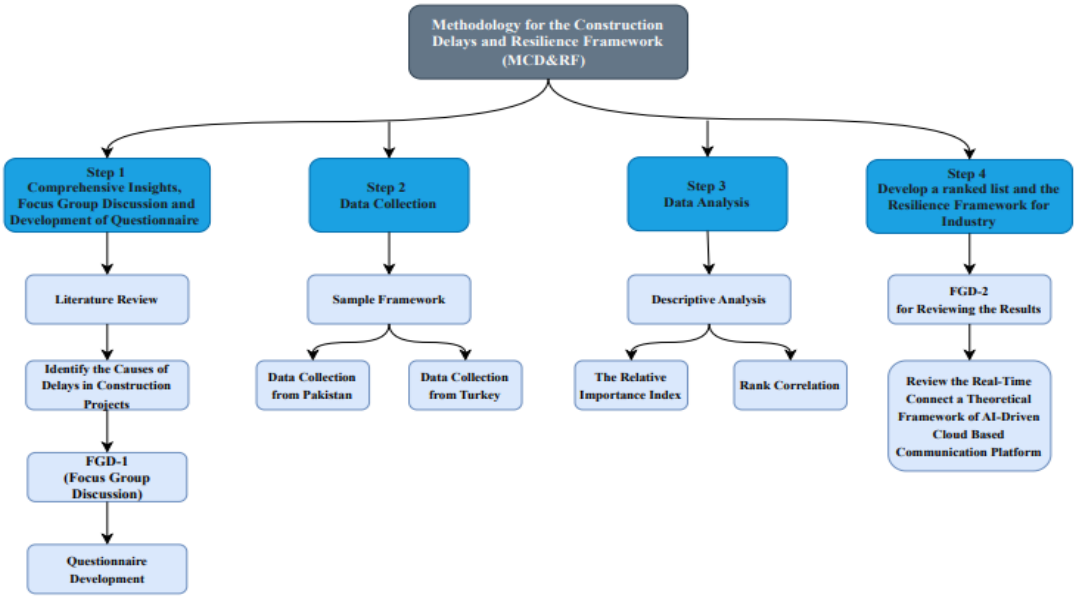

Figure-1: Methodology for the Construction Delays and Resilience Framework (MCD&RF).

Amílcar Arantes and Luis Miguel D. F. Ferreira (2021) developed a relevant and impressive methodology, namely Development of Delay Mitigation Measures (DDMM), for identifying the causes of delays and also providing the guidelines for the development of effective and practical delay mitigation measures in construction projects. Likewise, the **MCD&RF** is the extension of the DDMM. Moreover, this study mainly focuses on exploring the substantial causes of delays in

Pakistan and Türkiye, while providing a resilience framework in Pakistan. This study followed the below steps of MCD&RF.

3.1 Step1: Comprehensive Insight: Focused Group Discussion and Development of a Questionnaire

This step of MCD & RF involves gathering insights from previous research and industry professionals through Focus Group Discussions. These discussions play a key role in shaping a comprehensive questionnaire to analyze the realities of the construction industry. Upon completion, the questionnaire was distributed to participants as a precise tool for investigating delays in construction projects.

3.2 Step 2: Data Collection

This study sheds light on Pakistan and Türkiye's construction experiences with significant development delays. According to Casula et al. (2021), primary source data enhances academic comprehension and answers previously unresolved quantitative research issues. In this study, construction delays are investigated, and solutions are provided. Türkiye was chosen due to its vast real estate market, and several Turkish multinational construction companies are interested to up investments in Pakistan. The Sampling Framework of this study is essential to obtain the necessary data from a relevant population in a manner that is both cost-effective and efficient. Furthermore, it is important to note that collecting data from the entire population is an idealistic approach but not feasible, as stated by Bellagambi et al. (2020). Therefore, it is necessary to execute the study within a suitable timescale.

This study employed the stratified sampling technique for data collection, as the Focus Group Discussion recommended. Strata for these sectors are the following: *Builders & Developers, Consultants & advisors, and contractors & construction participants* are targeted in both countries. The estimated sample size for this research was approximately 1200 participants for each country. However the actual sample for this study is shown in Table 01.

Table-01 Respondents of the study

Respondent Group	**Number of responses**		**Frequency %**	
	Pakistan	**Türkiye**	**Pakistan**	**Türkiye**
Builders & Developers	395	368	**37.12%**	**36.95%**
Consultant & Advisor	243	213	**22.84%**	**21.39%**
Contractors & Constructors	426	415	**40%**	**41.67%**

3.3 Step 3: Data Analysis

Data analysis makes it possible to comprehend data meaningfully and comprehensibly (Vasishth et al., 2018). Previous studies relied on the Relative Importance Index (RII) and Spearman's Rank Correlation. Hence, the same two statistical techniques were applied to analyze survey data in this study.

3.3.1 The Relative Importance Index (RII)

The Relative Importance Index (RII) was employed to assess the evaluations provided by the participants. The utilization of this approach has been suggested in previous research (Kazaz et al. 2008; Olusegun and Michael 2011) as the suitable method of analysis for aggregating ratings of variables within a specified set. The study entailed the calculation of the RII, which serves as the indicative rating point for the combined ratings assigned to each variable within the subset. The relative importance index of each sub-factor was computed using the provided equation.

$$RII = \frac{\sum_{i=1}^{5} W_i X_i}{\sum_{i=1}^{5} X_i}$$

Wi is the rating of each element received from the respondents on a scale of 1 to 5, with 1 denoting "Strongly Disagree" and 5 denoting "Strongly agree," Xi is the percentage of respondents who scored, and i is the number of respondents in the order.

3.3.2 Rank Correlation

Rank correlation measures the degree of similarity or difference between ranked variables. Using this technique, the researcher identified and compared significant delay factors in the construction sectors of Pakistan and Türkiye. Xia (2020) explained that rank correlation is an ordinal measure used in quantitative study. Similarly, Dashora et al. (2022) argued that rank correlation is useful for analysing the interrelationships between sets of ordered variables. This statistical method allows for the measurement of numerous variables (Merino-Soto et al. 2022).

It has been employed to measure the strengths and directions of the connection between two sets of data (i.e., the delays caused in the construction sector of Pakistan and Türkiye) when ranked in order by each of their quantities. The authors, Muhwezi et al. (2014), utilized the abovementioned tool to evaluate the factors contributing to the delay of construction work. Similar analysis methods were employed by Hussain et al. (2018) to assess important delaying variables.

Consequently, the approach above has garnered significant attention in the realm of construction studies, as evidenced by its frequent utilization in scholarly works (Gündüz, 2013; Aziz, 2013).

$$r_s = \frac{(6\sum d^2)}{n(n^2-1)}$$

Where rs = Spearman's rank correlation coefficient between two parties, d = rank difference between factors, and n = number of pairs of rank.

3.4 Step 4: Develop a ranked list of substantial delays and the resilience framework model for the industry.

In this methodology, FGD-II was recommended to review the ranked list of substantial delays in the respective country. This FGD-II aims to get genuine industry feedback and share the options related to solutions to the highlighted delays, while also considering valuable suggestions to develop the resilience framework model for the concerned industry.

4. Results and Findings

Before evaluating the study's findings and conclusions, remember that this survey questionnaire has two main sections: Part I covers general questions, and Part II covers the leading causes of construction delays, as discussed in the first focused group discussion. Part I general questions aim to comprehend respondents of the industry. Thus, demographic analysis begins this section, followed by data analysis, which concludes the results and discussion.

4.1 Demographic analysis

Table-02: Descriptive analysis, respondent profile of questionnaire

Categories		Pakistan	Türkiye
Designation	Senior Management	21%	32%
	Operational Management	38%	35%
	Project Manager	24%	18%
	Other	17%	15%
Education	Undergraduate	24%	18%
	Graduate	40%	55%
	MPhil/MS	5%	10%
	PhD	0%	0%
	Professional Certification	31%	17%
	Other	0%	0%
Age	Less than 25 years	7%	3%
	25 to 35 years	21%	26%
	36 to 55 years	52%	58%
	More than 55 years	20%	15%
Working experience	1 to 5 years	4%	2%
	6 to 10 years	42%	44%
	11 to 15 years	38%	48%
	Over 15 years	16%	6%
Relevant sector of Real Estate Industry	Builders & Developers	37.12%	36.95%
	Consultant and Advisor	22.84%	21.93%
	Contractors & Construction	41%	41.67.00%

This section explores the sample data that was gathered from respondents in Pakistan's and Türkiye's construction sectors, providing insights into the professional and demographic characteristics of the sampled workforce in each country. In the context of Pakistan, 21% respondents had senior management roles, while in Türkiye, this percentage is significantly higher standing at 32%. Pakistani participants had a somewhat higher prevalence of operational management jobs 38% compared to their Turkish counterparts 35%. Additionally, Pakistan scored a higher percentage for project managers i.e., 24% compared to Türkiye 18%.

When it comes to education, the majority of those who responded in both countries hold graduate degrees. In Pakistan, 40% of respondents had bachelor's degree, but 55% in Türkiye. Furthermore, 31% Pakistani respondents had professional certifications compared to 17% Turkish respondents.

Age-based comparisons of the sampled groups reveal majority respondents in both nations within the age range of 36 to 55 years. In contrast, Pakistan exhibits a greater percentage of individuals aged 55 and above 20% compared to Türkiye 15%. There are noteworthy trends when individuals are categorized based on their work experience. In both countries, a sizable proportion of participants have a professional background spanning 6 to 10 years, with Pakistan accounting for 42% and Türkiye for 44%. In contrast, Türkiye has a higher proportion of individuals with 11 to 15 years of professional experience, 48%, compared to Pakistan, 38%.

The sample data depicts the main industries in each country's construction sector. In Pakistan, 41% and Türkiye 41.67%, a sizable share of the tested workforce is comprised of contractors and construction. Developers and builders in Türkiye 36% and Pakistan 37%. Furthermore, advisors and consultants are essential; Türkiye is at 21% and Pakistan is at 22.%.

This analysis provides important information about the professional and demographic characteristics of sampled respondents in the Pakistani and Turkish real estate sectors, providing the groundwork for future research and comparison within the larger context of each country's construction sector.

4.2 Factor Extracted

This study employs two statistical analytic approaches: the Relative Importance Index (RII) and Spearman's Rank Correlation. The first approach is the Relative Importance Index (RII), which measures the perceived significance of different factors among respondents, and the second is a rank correlation, a non-parametric test, which was used to determine the extent to which two different sets of rankings agree with each other.

After reviewing the literature and conducting a focus group discussion (FGD-I) with industry experts and a pilot survey, we identified 69 key delay reasons divided into nine major categories. Table 03 below provides a comprehensive data analysis of delays in both countries' construction projects.

Table-03: List of Delay Causes

Category	Causes of delays	Country	Builder and developer		Consultant & Advisor		Contractors & Constructors		OverAll	
			RII	Rank	RII	Rank	RII	Rank	RII	Rank
Client/ Builder/ Owner	Delays in the project occurred because the client influenced the project's progress	Pakistan	79.8%	64	89.8%	6	81.5%	32	83.7%	40
		Turkey	62.1%	69	89.2%	4	90.9%	3	80.7%	56
	Delays occurred due to contract modification by the client	Pakistan	79.6%	65	74.4%	69	70.2%	67	74.7%	68
		Turkey	77.6%	61	80.5%	69	80.1%	64	79.4%	67
	Owner changing order process (issuing approval) caused delays.	Pakistan	81.9%	60	80.6%	59	74.4%	60	78.9%	61
		Turkey	78.8%	55	84.1%	32	83.2%	32	82.0%	40
	Unclear client's brief	Pakistan	88.3%	27	89.5%	8	83.8%	15	87.2%	14
		Turkey	80.7%	38	84.7%	24	81.1%	50	82.2%	39
	Slowness of the owner's decision-making process	Pakistan	81.8%	61	83.0%	47	77.5%	52	80.7%	56
		Turkey	83.6%	24	85.7%	15	87.1%	7	85.5%	11
	Unrealistic contract duration imposed by the client	Pakistan	88.3%	29	84.0%	36	82.9%	18	85.0%	28
		Turkey	83.0%	26	83.4%	41	81.7%	40	82.7%	35
	Client delays affect the project's finances and economic ability.	Pakistan	89.9%	22	86.7%	24	81.9%	28	86.2%	19
		Turkey	84.2%	22	85.1%	19	83.7%	30	84.3%	22
	Poor communication and coordination by owner and other parties	Pakistan	91.5%	12	83.6%	42	79.9%	42	85.0%	27
		Turkey	80.3%	41	84.8%	22	81.4%	44	82.2%	38
	Suspension of work by owner	Pakistan	86.8%	39	85.4%	28	79.3%	45	83.9%	39
		Turkey	80.1%	43	84.4%	28	80.6%	56	81.7%	44
	An uncooperative owner/builder attitude with contractors is the cause for the delays in construction of project	Pakistan	88.3%	27	79.0%	62	69.7%	68	79.0%	60
		Turkey	84.0%	23	84.5%	27	85.7%	19	84.7%	20
	Unreasonable project time frame	Pakistan	87.7%	34	83.5%	44	75.6%	58	82.3%	48
		Turkey	82.6%	31	82.8%	51	80.4%	57	82.0%	41
	Delay in the settlement of contractor claims	Pakistan	80.6%	63	79.2%	61	73.1%	62	77.6%	64
		Turkey	77.7%	60	82.4%	55	81.4%	46	80.5%	60
	Change of requirement/specification	Pakistan	83.2%	56	89.1%	11	82.4%	22	84.9%	30
		Turkey	79.2%	53	87.1%	10	86.5%	10	84.3%	23
	Excessive bureaucracy is the hurdle causing the delays for the owner	Pakistan	91.8%	11	82.2%	52	88.4%	1	87.5%	13
		Turkey	85.8%	12	83.8%	36	88.9%	5	86.2%	9
	Late handover of the site	Pakistan	85.9%	44	85.3%	30	81.7%	31	84.3%	34
		Turkey	79.3%	52	82.0%	59	80.7%	54	80.7%	58
	Regular interference from the client is the cause of delays in construction Project	Pakistan	78.7%	67	76.6%	65	66.9%	69	74.1%	69
		Turkey	78.0%	58	81.5%	66	83.6%	31	81.0%	51
	Delay in obtaining permits/NOC	Pakistan	92.1%	7	88.6%	14	85.0%	7	88.5%	8
		Turkey	88.2%	5	86.4%	13	88.2%	6	87.6%	6
Contractor	Poor understanding of scope of work during tendering	Pakistan	84.5%	50	88.5%	16	82.9%	18	85.3%	26
		Turkey	81.3%	36	88.3%	6	86.2%	12	85.2%	15
	Inadequate planning and scheduling of project	Pakistan	92.1%	6	89.6%	7	83.5%	16	88.4%	10
		Turkey	85.9%	10	85.4%	16	84.5%	28	85.3%	14

	Inadequate experience of contractor	Pakistan	85.6%	47	89.5%	9	82.4%	21	85.8%	23
		Turkey	79.4%	51	84.3%	29	80.4%	57	81.4%	47
	Unfamiliarity with government regulations and laws	Pakistan	86.9%	36	84.4%	33	80.8%	36	84.1%	37
		Turkey	71.8%	67	84.1%	32	85.4%	21	80.5%	62
	Lack of coordination On-site	Pakistan	86.9%	36	83.7%	39	87.8%	3	86.1%	21
		Turkey	80.7%	39	82.7%	52	81.4%	44	81.6%	45
	Poor Managerial Skills	Pakistan	89.3%	24	84.0%	36	78.3%	48	83.9%	38
		Turkey	83.6%	24	84.3%	29	85.7%	18	84.6%	21
	Poor communication and coordination by a contractor with other parties	Pakistan	91.5%	12	83.7%	39	77.1%	54	84.1%	36
		Turkey	85.5%	16	83.8%	38	81.6%	42	83.6%	28
	Delays in sub-contractors' work	Pakistan	85.0%	49	84.4%	34	80.0%	41	83.1%	42
		Turkey	79.7%	48	83.0%	49	81.3%	47	81.3%	48
	Lack of High-Technology in construction project	Pakistan	92.2%	4	90.5%	2	83.9%	11	88.9%	3
		Turkey	88.4%	4	88.1%	7	85.9%	15	87.5%	7
	Frequent change of sub-contractors because of their inefficient work	Pakistan	86.8%	40	81.3%	57	74.1%	61	80.7%	57
		Turkey	80.0%	45	82.0%	59	81.1%	51	81.0%	52
	Conflicts in sub-contractors schedules in the execution of a project	Pakistan	82.8%	58	83.8%	38	78.7%	46	81.8%	53
		Turkey	78.6%	56	83.1%	46	80.3%	59	80.7%	57
	Delay in preparation and approval of drawings during construction work	Pakistan	92.1%	5	90.3%	4	83.4%	17	88.6%	7
		Turkey	86.1%	8	83.3%	43	85.6%	20	85.0%	18
	Delays occurred due to Difficulty in coordination between the different parties	Pakistan	83.7%	55	82.6%	48	82.1%	27	82.8%	44
		Turkey	79.2%	53	83.1%	46	80.1%	63	80.8%	55
	The conflict between contractor and consultant	Pakistan	86.8%	40	82.4%	49	76.0%	57	81.7%	54
		Turkey	81.0%	37	82.7%	52	80.2%	62	81.3%	49
	Absence of consultants site staff	Pakistan	79.2%	66	75.9%	68	72.9%	63	76.0%	67
		Turkey	76.6%	64	82.3%	56	80.2%	61	79.7%	65
	Incomplete documents by the consultant	Pakistan	85.8%	45	87.7%	20	80.2%	39	84.6%	33
		Turkey	82.4%	32	84.8%	22	84.1%	29	83.8%	27
	Delay in performing inspection and testing by consultant	Pakistan	86.9%	36	82.4%	49	78.5%	47	82.6%	45
		Turkey	79.6%	49	82.6%	54	81.3%	49	81.1%	50
Contract-related Issues	Inflexibility (rigidity) of consultant	Pakistan	84.5%	51	76.6%	65	77.6%	50	79.5%	59
		Turkey	77.6%	61	81.9%	61	79.5%	66	79.7%	66
Contract	Mistakes and discrepancies in the contract document	Pakistan	89.0%	25	86.0%	25	79.5%	44	84.8%	31
		Turkey	81.9%	34	80.8%	68	85.2%	23	82.6%	36
	Inadequate contractor experience	Pakistan	88.0%	33	86.0%	25	81.9%	28	85.3%	25
		Turkey	79.8%	47	83.1%	46	78.8%	68	80.6%	59
	Legal disputes and inappropriate methods of dispute resolution	Pakistan	91.0%	18	88.6%	14	84.0%	10	87.9%	12
		Turkey	81.6%	35	85.1%	19	82.0%	35	82.9%	32
	Change orders by the contractor	Pakistan	83.9%	53	83.6%	42	77.6%	50	81.7%	55

		Turkey	79.6%	49	82.2%	57	81.0%	53	80.9%	54
	Rework due to errors during construction	Pakistan	88.2%	32	87.7%	20	82.3%	23	86.1%	22
		Turkey	85.6%	15	83.9%	35	85.9%	15	85.2%	16
Financial	Delay of payments	Pakistan	91.1%	16	90.7%	1	88.3%	2	90.0%	1
		Turkey	85.8%	12	91.5%	1	92.0%	1	89.8%	1
	A Poor financial condition during implementation phase	Pakistan	91.9%	10	88.6%	13	83.8%	14	88.1%	11
		Turkey	87.1%	6	87.1%	10	84.7%	27	86.3%	8
	Inflation and economic conditions	Pakistan	92.4%	3	88.5%	16	84.6%	8	88.5%	9
		Turkey	91.7%	1	86.8%	12	86.2%	12	88.2%	4
	Fluctuation in exchange rates	Pakistan	92.8%	1	89.3%	10	84.3%	9	88.8%	5
		Turkey	88.8%	3	87.8%	9	86.5%	10	87.7%	5
Planning, Designing and Scheduling	Unstructured Design process	Pakistan	87.1%	35	87.1%	23	80.8%	37	85.0%	29
		Turkey	82.7%	30	87.9%	8	86.6%	9	85.7%	10
	Ineffective utilization of automation	Pakistan	92.6%	2	90.5%	3	87.0%	4	90.0%	2
		Turkey	90.5%	2	90.7%	2	86.8%	8	89.4%	2
	Designer non-involvement/unavailability during construction phase	Pakistan	76.5%	68	80.7%	58	82.3%	26	79.8%	58
		Turkey	76.4%	65	83.2%	44	80.7%	54	80.1%	64
	Inadequate information provided to Designer	Pakistan	86.0%	43	83.7%	39	81.1%	34	83.6%	41
		Turkey	80.1%	43	83.6%	40	81.9%	37	81.8%	42
	Delays in the project occurred due to Miscommunication	Pakistan	91.5%	14	82.2%	52	74.7%	59	82.8%	43
		Turkey	85.9%	9	82.9%	50	81.8%	39	83.6%	30
	Inadequate Project Monitoring	Pakistan	88.8%	26	84.7%	31	80.4%	38	84.6%	32
		Turkey	82.9%	28	83.8%	36	80.3%	60	82.3%	37
Material	Delay in material delivery	Pakistan	70.4%	69	81.9%	55	82.3%	24	78.2%	63
		Turkey	68.5%	68	90.2%	3	89.6%	4	82.8%	34
	Delay in manufacturing special building materials	Pakistan	90.6%	21	84.6%	32	81.0%	35	85.4%	24
		Turkey	82.9%	27	84.1%	32	81.5%	43	82.9%	33
	Late procurement of materials	Pakistan	89.6%	23	87.3%	22	81.5%	32	86.1%	20
		Turkey	80.2%	42	84.6%	26	79.5%	66	81.4%	46
	Late in selection of finishing materials due to availability of many types in market	Pakistan	85.0%	48	83.3%	45	78.2%	49	82.2%	49
		Turkey	77.4%	63	81.7%	63	78.7%	69	79.3%	69
	Lack of material in the market	Pakistan	90.8%	20	84.3%	35	77.4%	53	84.2%	35
		Turkey	85.1%	17	84.3%	29	82.0%	36	83.8%	25
	Inaccuracy in ordering materials	Pakistan	82.8%	58	76.0%	67	71.9%	65	76.9%	66
		Turkey	77.8%	59	81.8%	62	81.9%	37	80.5%	61
Labour	Low efficiency of equipment	Pakistan	91.9%	9	88.8%	12	85.8%	6	88.8%	4
		Turkey	86.2%	7	89.1%	5	91.6%	2	89.0%	3
	Bad performance of subcontractors and nominated parties	Pakistan	85.7%	46	82.1%	54	79.9%	42	82.6%	46
		Turkey	82.8%	29	81.6%	64	81.1%	51	81.8%	43
	Poor technical performance and shortage of technical staff	Pakistan	91.1%	16	79.8%	60	76.7%	55	82.5%	47
		Turkey	84.9%	19	83.4%	41	82.4%	34	83.6%	29
	Low skilled Labor	Pakistan	92.0%	8	90.2%	5	83.9%	13	88.7%	6

		Turkey	84.2%	20	85.2%	18	85.9%	15	85.1%	17
	Poor equipment productivity	Pakistan	88.3%	29	85.5%	27	86.2%	5	86.7%	17
		Turkey	85.7%	14	84.7%	24	86.0%	14	85.5%	12
	Low labor productivity	Pakistan	91.4%	15	85.4%	28	83.9%	11	86.9%	16
		Turkey	84.2%	20	84.9%	21	83.1%	33	84.1%	24
	Lack of awareness of project workers on occupational safety and health	Pakistan	82.9%	57	77.4%	64	71.9%	66	77.4%	65
		Turkey	78.2%	57	81.3%	67	81.7%	40	80.4%	63
	Lack of workforce motivation	Pakistan	83.9%	53	78.3%	63	72.8%	64	78.3%	62
		Turkey	82.2%	33	83.2%	44	85.2%	24	83.5%	31
	Inexperienced inspectors	Pakistan	86.1%	42	83.2%	46	76.7%	55	82.0%	50
		Turkey	79.9%	46	81.6%	64	81.3%	48	80.9%	53
External	Unforeseen weather conditions	Pakistan	81.6%	62	82.3%	51	81.9%	28	81.9%	51
		Turkey	80.5%	40	85.4%	16	85.4%	21	83.8%	26
	Subsurface soil condition (geological problem/water table problem, etc.)	Pakistan	83.9%	52	81.5%	56	80.2%	39	81.9%	52
		Turkey	76.0%	66	82.2%	57	79.8%	65	79.3%	68
	Delays occurred due to obtaining permit/approval from the municipality/different government authorities	Pakistan	91.0%	19	88.0%	19	82.6%	20	87.2%	15
		Turkey	85.1%	17	86.4%	13	84.8%	25	85.4%	13
	Changes in government regulations, laws, and policies	Pakistan	88.3%	29	88.3%	18	82.3%	24	86.3%	18
		Turkey	85.9%	10	83.8%	38	84.8%	26	84.8%	19

Primarily, this study includes identifying, assessing, and categorizing the nine main groups Client/Builder/Owner, Contractor, Consultant, Contract related causes, Finance, Planning and Scheduling, Material, Labour & Equipment, and External under which project delays in the construction industry in Pakistan and Türkiye are caused. To achieve this, each group's (Builders & developers, Consultant & Advisor, and Contractors & Constructors) responses are used to calculate and rank the RII of the 69 project delay causes.

Table-04 depicts the Turkish industry's results on construction project delays. All these responses comprised from following stakeholders amongst the Turkish construction sector: i. Builders & Developers, ii. Consultants & Advisors, and iii. Contractors & Constructors. This section highlighted the top ten causes of delay and their Relative Importance Index (RII) and rankings. The RII score represents the perceived relevance of each delay element, with higher values indicating more significant importance. In each stakeholder group, the rank column shows the priority order of each delay reason. The table provides substantial insights into the primary challenges faced by the Turkish construction business and aids in identifying areas that can be improved to reduce delays in future projects.

Table-04: Significant causes of Construction Delays in Türkiye according to the leading stakeholders in the sector.

Builder and developer			**Consultant & Advisor**			**Contractors & Constructors**		
Causes of Delays	**RII**	**Rank**	**Causes of Delays**	**RII**	**Rank**	**Causes of Delays**	**RII**	**Rank**
Inflation and economic conditions	0.91685	1	Delay of payments	0.91549	1	Delay of payments	0.9200	1
Ineffective utilization of automation	0.90543	2	Ineffective utilization of automation	0.90704	2	Low efficiency of equipment	0.9161	2
Fluctuation in exchange rates	0.88804	3	Delay in material delivery	0.90235	3	Delays in the project occurred because the client influenced the project's progress	0.9094	3
Lack of High-Technology in construction project	0.88424	4	Delays in the project occurred because the client influenced the project's progress	0.89202	4	Delay in material delivery	0.8959	4
Delay in obtaining permits/NOC	0.88152	5	Low efficiency of equipment	0.89108	5	Excessive bureaucracy is the hurdle causing delays for the owner	0.8892	5
A Poor financial condition during implementation phase	0.87120	6	Poor understanding of scope of work during tendering	0.88263	6	Delay in obtaining permits/NOC	0.8824	6
Low efficiency of equipment	0.86196	7	Lack of High-Technology in construction project	0.88075	7	Slowness of the owner's decision-making process	0.8708	7
Delay in preparation and approval of drawings during construction work	0.86087	8	Unstructured Design Process	0.87887	8	Ineffective utilization of automation	0.8684	8
Delays in the project occurred due to Miscommunication	0.85924	9	Fluctuation in exchange rates	0.87793	9	Unstructured Design process	0.8660	9
Inadequate planning and scheduling of project	0.85870	10	Change of requirement/specification	0.87136	10	Change of requirement/specification	0.8646	10

Table-04 depicted that three stakeholder groups, namely builders & developers, consultants & advisers, and contractors & constructors, identified the primary factors contributing to construction project delays in Türkiye.

The ranking is based on the Relative Importance Index of each delay element.

Builders and developers face economic uncertainty, as inflation and economic conditions rank highest, with RIIs of (0.91685). Poor automation application follows (RII: 0.90543), Exchange rate fluctuations (RII: 0.88804), showing the construction industry's inability to fully utilize technology (RII: 0.88424), Permit/NOC delay (RII:0.88152), A Poor financial condition during implementation phase (RII: 0.87120), Low efficiency of equipment (RII: 0.86196), Delay in

preparation and approval of drawings during construction work (RII: 0.86087), Delays in the project occurred due to Miscommunication (RII: 0.85924), and Inadequate planning and scheduling of project (RII: 0.85870) important causes of delays. These elements show that builders' main concerns are internal technology adoption, bureaucratic inefficiencies, and economic instability.

Financial delays in the payment cycle caused the biggest bottleneck for consultants and advisers (RII: 0.91549). High automation inefficiency (RII: 0.90704) indicates widespread technological issues in the sector. Material delivery delays (RII: 0.90235), client interference with project progress (RII: 0.89202), Low equipment efficiency (RII: 0.89108), hinder progress and contribute towards poor scope understanding during tendering (RII: 0.88263). Lack of High-Technology in construction project (RII:0.88075), Unstructured Design Process (RII: 0.87887), Fluctuation in exchange rates (RII: 0.87793), Change of requirement/specification, (RII: 0.87136) and are also major concerns.

Likewise, even for contractors and construction professionals, financial issues like payment delays (RII: 0.9200) caused project delays. Additionally, equipment efficiency being low (RII: 0.9161), makes operational inefficiencies significant. Client impact on project progress (RII: 0.9094), material delivery delays (RII: 0.8959), bureaucratic policies (RII: 0.8892), permit/NOC delays (RII: 0.8824), and slow owner decision-making (RII: 0.8708), Ineffective utilization of automation (RII: 0.8684), Unstructured Design process (RII:0.8660) and change of requirement/specification (RII: 8646) are vital causes.

Consensus existed amongst all stakeholders regarding payment delays, inefficient technology use, and logistical issues like material delivery delays and permit acquisition. Though each group has its own issues, most respondents held operational and financial factors responsible for construction delays. Thus, solving these issues could boost the construction industry's performance.

Likewise, the reasons for Project delays in Pakistan's construction sector are shown in Table-5. All responses are based on the following Pakistani construction stakeholders: i. Builders & developers, ii. Consultants & Advisors, iii. Contractors & consultants. This section listed the top ten causes of delay and their RII rankings.

Builder and developer			**Consultant & Advisor**			**Contractors & Constructors**		
Causes of Delays	**RII**	**Rank**	**Causes of Delays**	**RII**	**Rank**	**Causes of Delays**	**RII**	**Rank**
Fluctuation in exchange rates	0.92759	1	Delay of payments	0.90700	1	Excessive bureaucracy is the hurdle causing delays for the owner	0.8840	1
Ineffective utilization of automation	0.92608	2	Lack of High-Technology in construction project	0.90535	2	Delay of payments	0.8831	2
Inflation and economic conditions	0.92354	3	Ineffective utilization of automation	0.90453	3	Lack of coordination On-site	0.8779	3
Lack of High-Technology in construction project	0.92152	4	Delay in preparation and approval of drawings during construction work	0.90288	4	Ineffective utilization of automation	0.8704	4
Delay in preparation and approval of drawings during construction work	0.92132	5	Low skilled Labor	0.90206	5	Poor equipment productivity	0.8624	5
Inadequate planning and scheduling of project	0.92101	6	Delays in the project occurred because the client influenced the project's progress	0.89794	6	Low efficiency of equipment	0.8579	6
Delay in obtaining permits/NOC	0.92051	7	Inadequate planning and scheduling of project	0.89630	7	Delay in obtaining permits/NOC	0.8502	7
Low skilled Labor	0.92000	8	Unclear client's brief	0.89547	8	Inflation and economic conditions	0.8460	8
Low efficiency of equipment	0.91949	9	Inadequate experience of contractor	0.89465	9	Fluctuation in exchange rates	0.8432	9
A Poor financial condition during implementation phase	0.91899	10	Fluctuation in exchange rates	0.89300	10	Legal disputes and inappropriate methods of dispute resolution	0.8399	10

Table-05: Significant causes of Construction Delays in Pakistan according to the leading stakeholders in the sector.

The Relative Importance Index (RII) ranks all causes, emphasizing their importance to each stakeholder group.

The fluctuation in exchange rates (RII: 0.92759) served as the leading cause of delays for builders and developers. The poor use of automation (RII: 0.92608) comes in second, indicating difficulties with technological adoption. Inflation and economic conditions are ranked third (RII: 0.92354), demonstrating how broader economic trends affect project schedules. Other significant causes include a lack of high-technology in construction projects (RII: 0.92502), delays in drawing preparation and approval (RII: 0.92101), insufficient project planning and scheduling (RII: 0.92101), delays in obtaining permits/NOC (RII: 0.92051), and a lack of skilled labour (RII: 0.92000). The ranking also reflects low equipment efficiency (RII: 0.91949) and poor financial conditions during the implementation phase (RII: 0.91899), demonstrating the impact of both technical and financial constraints.

Financial difficulties are the primary cause of payment delays for consultants and advisers (RII: 0.90700). Second and third place go to a lack of high-technology and ineffective utilization of automation in construction projects, respectively (RII: 0.90535) (RII: 0.90453), emphasizing ongoing technological limitations. Other major causes include human resources and client issues, such as delays in drawing preparation and approval (RII: 0.90288), low-skilled labour (RII: 0.90206), and client influence on project progress (RII: 0.89794). Additional factors include inadequate project planning and scheduling (RII: 0.89630), an unclear client brief (RII: 0.89547), and a lack of contractor experience (RII: 0.89465). Exchange rate fluctuations (RII: 0.89300) are also among the top ten indicators of larger economic concerns.

Excessive bureaucracy (RII: 0.8840) is the leading cause of delays for contractors and constructors, emphasizing the challenges posed by legal procedures. The second highest ranking is for payment delays (RII: 0.8831), reflecting the groups' shared financial concerns. Third, operational inefficiencies in project management, particularly a lack of on-site coordination (RII: 0.8779). Other significant causes include inefficient automation use (RII: 0.8704), low equipment productivity (RII: 0.8624), and low equipment efficiency (RII: 0.8579). Delays in obtaining permits/NOC (RII: 0.8502), inflation and economic conditions (RII: 0.8460), exchange rate fluctuations (RII: 0.8432), legal disputes, and inappropriate methods of dispute resolution (RII: 0.8399) indicate that economic, legal, and procedural factors all contribute to delays.

Administrative difficulties, technological inefficiencies, and financial problems are the most common causes of delays across all stakeholder groups. Payment delays, ineffective use of automation, and exchange rate fluctuations are all recurring elements that entails the need for improved financial stability, better technology integration, and simplified bureaucratic procedures to effectively deal construction delay challenges in Pakistan.

Furthermore, this research aims to conduct a comparative analysis of Pakistan's construction sector and Türkiye's construction sector. As a result, the aggregate RII for each reason is calculated by combining all participant perspectives. The top ten most significant construction project delays in the Turkish and Pakistani construction sectors are presented in Table-06.

Table-06: The Significant top 10 causes of delays in the Pakistan and Türkiye construction projects (based on overall).

Pakistan			**Türkiye**		
Causes of delays	Overall		Causes of delays	Overall	
	RII	Rank		RII	Rank
Delay of payments	0.9005	1	Delay of payments	0.8977	1
Ineffective utilization of automation	0.9003	2	Ineffective utilization of automation	0.8936	2
Lack of High-Technology in construction project	0.8888	3	Low efficiency of equipment	0.8897	3
Low efficiency of equipment	0.8885	4	Inflation and economic conditions	0.8820	4
Fluctuation in exchange rates	0.8879	5	Fluctuation in exchange rates	0.8769	5
Low skilled Labor	0.8870	6	Delay in obtaining permits/NOC	0.8759	6
Delay in preparation and approval of drawings during construction work	0.8860	7	Lack of High-Technology in construction project	0.8748	7
Delay in obtaining permits/NOC	0.8854	8	A Poor financial condition during implementation phase	0.8631	8
Inflation and economic conditions	0.8848	9	Excessive bureaucracy is the hurdle causing the delays for the owner	0.8618	9
Inadequate planning and scheduling of the project	0.8842	10	Unstructured Design process	0.8572	10

Table-06 lists the top ten causes of construction delays in Pakistan and Türkiye, based on the overall ranking. Ten causes emerged from five out of the nine categories: In Pakistan. Three causes from financing; two from labour; three from contractors; one from planning, design, and scheduling; and one from the client/builder/owner categories. Similarly, in the Turkish industry, ten causes emerged from five out of nine categories*:* these are four causes from financing: one from labor, one from contractors, two from planning, designing, and scheduling, and two from the client/builder/owner.

The table above compares the Pakistani and Turkish construction sectors. Both countries to a greater extent experience similar difficulty that must be addressed. According to industry professionals, payment delays are the leading cause of delays in construction projects in both countries. Payments to stakeholders are delayed for a variety of reasons. Various issues and conditions disrupt the scheduled payment on time. Digitalization is the most crucial mitigation step, enabling timely progress tracking and timely payment.

Interestingly, industry specialists in both countries agree that automation has the potential to resolve a wide range of problems. Automation is growing throughout all valuable industries. The construction industry is the slowest to automate. As a result, emerging countries receive minimal benefit from the productive sector.

Industry experts in both countries agree that low equipment efficiency causes project delays when compared to international standards. Maximizing productivity requires a wide range of high-tech equipment. In today's world, this sector requires various advanced high-technology equipment for success. For instance, Autonomous Construction Vehicles, Advanced Tunnel Boring Machines (TBMs), Concrete Pumps with Telescopic Arms, Telematics Systems, Laser Scanning and LIDAR, Heavy-Duty Drones for Lifting, Energy-Efficient Heating and Cooling Systems (HVAC), Smart Concrete Mixers, Smart Cranes with AI Control. For this, multiple government initiatives to finance significant funds to purchase quality equipment worldwide. Infrastructure is needed to establish diverse industries, especially in Pakistan, that manufacture construction machinery for this emerging sector instead of importing it. Moreover, the dearth of technology experts and literate workers who know how to run high-quality equipment, poses a serious challenge to the construction industry in Pakistan, calling for rigourous human capacity building.

In-times of economic crises, in both the countries, sentiments of Industry professionals towards fluctuating currency rate significantly harms this sector, more so in Pakistan. Moreover, concerns associated with the currency rate, vehemently causing internal investors to lose trust, as well as failure to attract foreign investments in Pakistan. To attract domestic and global investors, the government has to encourage this sector with strong policies and economic stability. It is another area of study that looks at the opportunities the government provides for investors.

Pakistan's industry experts believed that the unavailability of advanced technologies is what causing its remoteness from emerging economies. Similar issue persists in the Turkish construction industry where inept technology seems to contribute towards construction delays. Furthermore,

fluctuating currency rates and increasing inflation were acknowledged by the Pakistani business community to severely enforce construction delays.

In Pakistan, Delays in the preparation and approval of drawings during construction can significantly impede progress, disrupt schedules, and raise costs. This issue emphasizes the importance of efficient design processes, clear communication, and timely decision-making to ensure smooth project execution. Likewise, Bureaucratic Red Tape complicating the approval process cause longer wait times.

The construction stakeholders in Pakistan also held poor management, coordination, and project planning & scheduling accountable for construction delays. Thus, understanding this comparison is essential to effectively address obstacles and implement targeted actions to increase the productivity and efficacy of construction projects in Pakistan.

Based on our findings, several mitigation strategies are proposed for the construction sector, which were concluded after FGD II. The Focus Group Discussion specifically recommended further research to develop a theoretical framework that integrates digital transformation to modernize Pakistan's construction industry. This newly suggested model addresses various challenges within the sector and provides a systematic procedure to facilitate management by ensuring a seamless flow of information and visual presentations, helping to illustrate all key aspects of the study. Additionally, these mitigation proposals outline pathways for the construction industry to achieve growth and advancement. In summary, the sector's gradual transition into digitization is the most crucial innovation needed.

5. Recommendations of the Study

These suggested recommendations are discussed in FGD-II to address significant causes of delays in construction projects. These recommendations are mitigation strategies that aid policymakers in Pakistan's construction sector.

5.1 Mitigate strategies for construction delays:

There are some recommendations for Pakistan's construction sector. These strategies can help in overcoming construction delays, while simultaneously benefiting the Government and Industry experts in preparing policies for this sector for effective execution of construction projects.

5.1.1 Policy framework*:* To stabilize the project's timeline and costs, policy-making is required to deal with the impact of economic instability, that combats deteriorating exchange rates, Rising Inflation, High Interest Rates, Energy Shortages, Fiscal Deficit, and Government Spending. Concrete policies are mandated to regulate price mechanisms, encourage local production, and cheaper provision of building materials to confront inflation. Moreover, public finance initiatives are called upon to subsidize interest rates, issue construction bonds, and formulate loan financing schemes to close financing gaps. Likewise, growing investments in renewable energy sources, energy-efficient devices, and energy efficiency incentives can help to manage energy scarcity and prices. Moreover, simplifying regulatory environments, increasing anti-corruption mechanisms, and developing digital service permits can help tackle the problem of red tape. Partnerships with businesses and the private sector, appropriate resource utilization, and investment tax credit incentives can all help to alleviate fiscal constraints. In addition,

government must prioritize technical education to develop human resource professionals customized to cater the needs of modern construction practices.

5.1.2 Modernize Payment Procedures: Payment delays was noted as one of the primary causes of delays in construction projects. Various factors can cause delays in payment to contractors and other stakeholders. As a result, there is a need for digitization in the sector where payment procedures must be smooth, and construction delays will be reduced accordingly.

5.1.3 Simplify and Expedite Permitting Processes: By lowering administrative barriers by enacting the precise legal framework, it is possible to streamline the processes and reduce the time required to get permits from relevant authorities. The permission process can also be streamlined by implementing online application submission platforms. Online portals will ease the processes, increase transparency, and enhance collaboration across agencies.

5.1.4 Expand Automation Procedures*:* Modern automation technology can increase output and decrease delays IF adequately used. Surprisingly, experts in the Pakistani construction industry are confident that automation will help this industry. However, this is when we trained the industry for automation, and academia has to focus on developing the human capital for this innovative sector.

5.1.5 Upgrade Equipment*:* From the discussion above it was evident that construction industry is in dire need of regular maintenance and upgradation of plant and equipment. Pakistan's government is responsible for facilitating appropriate policies and measures for the construction companies to arrange equipment from all over the world and encourage other large-scale industries to support the construction sector by providing them with high-tech equipment. If we could upgrade the equipment locally, it would be better for this industry and the economy of Pakistan.

5.1.6 Adopt High-Technology Solutions: We may increase production and reduce delays by encouraging high-tech solutions like Building Information Modelling (BIM), cutting-edge building materials, and employing creative construction techniques. Incentivizing the use of technology and stakeholder collaboration can help the construction industry adopt these technologies.

5.1.7 Strengthen Planning and Scheduling: Reducing delays can also be achieved by improving project planning and scheduling procedures to guarantee reasonable deadlines and appropriate resource allocation. With project management tools, it is possible to identify such problems early and make prompt adjustments by carrying out exhaustive feasibility studies, creating comprehensive project schedules, and routinely monitoring progress. However, in the modern era, Pakistani experts have suggested advanced cloud-based solutions to improve project planning and scheduling, and after that, it would be transformed into blockchain technology.

5.1.8 Facilitate Transparency and Collaboration: Encourage open communication and collaboration among project stakeholders, such as government agencies, contractors, and consultants, to avoid delays. We recommend establishing proper communication channels and scheduling regular meetings to make quick adventure project decisions. In today's world, sophisticated collaboration at all stages is possible

through digitization, so the sector should digitize to facilitate transparency. This study recommends a *Real-Time Connect AI Cloud-Based System* for Pakistan's Construction Sector.

5.1.9 Digitalization Framework for the Construction Sector: Following an assessment of the primary causes of construction delays, this study advocated digitizing the industry. For this reason, a new theoretical framework is suggested for conducting research in the domain of Modernizing Pakistan's Construction Sector Through Digital Transformation, which would address engineering, architecture, building, and other issues. This model will improve administration by giving symmetrical information and visuals depicting key project features. It will also verify that all building components are compatible throughout construction. This model will significantly enhance the Project's financial representation and cost reliability. This newly suggested model for the construction industry would facilitate better coordination with fewer errors, resulting in a smooth and symmetrical flow of information, reducing delays and costs. This suggested AI-based model shows how ADT's collaborative method distinguishes between homogeneous data and faraway locations. This paradigm emphasizes integration and hierarchy when merging technologies to improve efficiency. It also investigates the usefulness of a machine learning-based ANN system for identifying risks, which may quantify project delays.

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6. Conclusion:

Construction is highly considered for its impact on economic growth. Developed and emerging countries value their construction industry as a vital revenue source, and it supports other industrial growth. The paper explored the significant causes of construction delays in Pakistan and Türkiye, and also suggested mitigation techniques in the following section. The development of a Real-Time Connect, an AI-driven cloud-based communication model was recommended to help stakeholders reduce the risk of operational disruptions for various reasons.

Moreover, the government takes into consideration the mitigation strategies proposed for this sector, devising strong laws, and unwavering commitment. This study identified substantial causes of delays in Pakistan and Türkiye. Moreover, it suggested mitigation strategies that could have an impact, particularly on Pakistan's construction sector. Furthermore, research found that Pakistan has failed to recognize this transformation, which Türkiye understood. Singapore, Malaysia, Dubai, Türkiye, and other countries all based their economies around real estate, and Pakistan too has a conducive atmosphere for attracting foreign direct investment in the real estate sector. However, before all this can happen, the government must make it easy for the private sector to invest in Pakistan's real estate industry.

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