



## Uncovering the Root Causes of Failures in Construction Projects with 5 Whys

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### ABSTRACT

Construction projects are complex and dynamic in nature and require meticulous planning and execution to meet time, cost, and quality targets. Despite advances in project management practices, many projects still experience challenges, resulting in delays, cost overruns, and quality issues. A systematic approach is essential to effectively address these issues. In this study, root cause analysis was used to investigate the underlying causes of these challenges in construction projects. In this direction, 5 Whys technique was utilized to investigate 67 issues identified in 5 different construction projects in and around Sakarya, Türkiye. The findings reveal that although time and cost overruns are common symptoms, their root causes are often linked to weaknesses in various project management knowledge areas. In particular, this study highlights the important role of procurement management, communication management, and risk management in contributing to project problems. By uncovering these key underlying factors, this research provides a structured framework for understanding the systemic challenges faced in the construction industry and suggests practical solutions to mitigate future problems. The study further demonstrates the effectiveness of root cause analysis in identifying root causes and guiding professionals towards sustainable project success, ultimately promoting a more efficient and effective construction industry. The study is expected to provide a systematic analysis of root causes and tackle the underlying causes rather than focusing on the common causes. The examples provided in this study reflect the causes from real construction projects, which can further help project managers to revisit their project management strategies.

### 1. Introduction

Time, cost, and quality are the three main objectives of construction project management (Ramkumar & Gopalakrishnan, 2014). In other words, successful construction projects are defined by their ability to meet planned schedules, stay within budget limitations, comply with all specified requirements, and thus, satisfy all relevant stakeholders (Majid,

2006). In a broader sense, successful construction projects are also expected to address additional objectives such as risk, safety, environmental performance, and sustainability, reflecting the growing complexity of modern construction practices (Atkinson, 1999; Silvius & Schipper, 2014). Nonetheless, a significant proportion of construction projects fail to meet these expectations, often experiencing delays and budget overruns that

endanger their success (Ballesteros-Perez et al., 2020). Several common problems contribute to these shortcomings, including delayed payments, cost overruns, and delays in project timelines. Other complicating factors include unforeseen changes in design during the construction phase, time constraints or the need for accelerated schedules, low productivity levels, ineffective project management and supervision, excessive overtime requirements, and compromised construction quality. These elements are often identified as the primary factors leading to project failures in the construction industry (Proverbs et al., 2000).

In sectors characterized by complexity, long-term nature, and dynamic structures such as the construction industry, it is essential to recognize that a significant proportion of problems or incidents are triggered by antecedent events (Hsu et al., 2017). This highlights the great importance of identifying the underlying causes that lead to symptoms rather than only addressing the surface appearances of the problem. A symptomatic approach, which focuses merely on alleviating immediate outcomes without addressing the underlying issue, can potentially exacerbate the situation. This is because the removal of the sole visible indicator of the problem, due to insufficient understanding and monitoring, complicates the detection and management of the issue (Andersen & Fagerhaug, 2006). Moreover, even if the primary or secondary causes are eliminated, the root cause of the problem may persist but reappear in a different form, leading to a new set of problems. Therefore, it is crucial to adopt a holistic approach that aims to identify and address the underlying deeper causes of the problem in order to prevent the recurrence of similar problems and provide sustainable solutions.

Root cause analysis technique constitutes a systematic and meticulous inquiry process aimed at elucidating the underlying etiology of a problem, thereby enabling the identification of corrective measures necessary to mitigate its recurrence. By retracing the causal chain of events from the point of failure to its origin, root cause analysis facilitates a comprehensive understanding of the mechanistic processes that precipitate a transition from a desirable to an undesirable state (Ong et al., 2015). This methodical approach seeks to elucidate not only what and how an event occurred but also the underlying reasons why it did, thereby providing a foundation for the development of targeted corrective measures that can prevent future occurrences of similar events (Rooney & Heuvel, 2004). In essence, the efficacy of root cause analysis lies in its ability to uncover the

underlying causal factors, which is a prerequisite for the specification of effective remedial actions that can prevent the reoccurrence of problems.

Numerous methodologies collectively referred to as root cause analysis methods have been developed to assist in the identification of the underlying causes of problems. These methods, which have emerged as general standards in the literature include the fishbone diagram, Pareto diagram, Kepner Tregoe, causal tree analysis, fault tree analysis, logic tree analysis, barrier analysis, human performance assessment, and 5 Whys technique (Al-Zwainy & Mezher, 2018; Gangidi, 2019). 5 Whys technique is one of the simplest but effective root cause analysis methods, which is based on the principle of repeatedly asking the "why" question to explore the root cause of a problem in depth (Gangidi, 2019). It enables the identification of underlying causal mechanisms, even if the root cause is initially unclear.

The repeatable nature of the 5 Whys technique facilitates the development of targeted interventions to prevent similar problems from occurring in the future. When used correctly, 5 Whys technique is both easy to implement and highly effective in uncovering the root cause of a problem or failure (Gangidi, 2019; Williams, 2001). It generates a series of alternative causes, each linked to the previous one, until the root cause is identified. Although the number "five" is not obligatory, the underlying assumption is that a sufficient number of repetitions of the "why" question eventually leads to the identification of the root cause (Mahto & Kumar, 2008). In practice, the questioning process may continue until a consensus on the root cause is reached, which may require more or less than five "why" questions.

This study aims to conduct root cause analysis of problems encountered in construction projects. A comprehensive review of completed projects in and around Sakarya city in Türkiye was carried out and interviews were conducted with project team members leading large size projects. The problems identified in these interviews were analyzed using the 5 Whys technique, and the underlying causes were investigated. In addition, apparent causes and root causes were categorized according to their respective knowledge areas. The objective is to identify the underlying causes of problems in construction projects and thus provide a framework for mitigating these problems. Following the root cause analysis, solutions are proposed for each problem.

The study is structured in five main sections. The first section provides an overview of the topic and its

importance. The second section reviews existing research on the topic. The third section provides a detailed description of the methodological approach. The fourth section presents the results obtained, and the final section discusses the implications of the findings and suggests future research directions.

## 2. Research Background

### 2.1. Fields of project management

The Project Management Institute (PMI), a leading global professional organization, has significantly advanced the field of project management by encouraging both its artistic and scientific aspects (Pinto, 1998). Central to this effort is PMI's development of the Project Management Body of Knowledge (PMBok) Guide, a widely recognized framework that standardizes and documents project management practices (Marcelino & Domingues, 2019). This comprehensive guide is recognized not only for its role in illuminating the fundamental principles of project management but also for its practical application within various industries to improve project management methodologies and achieve successful project outcomes (Takagi & Varajão, 2020). The influence of the PMBoK Guide spans numerous industries underlining its value as a critical tool for professionals looking to enhance their project management capabilities and results (Cardona-Meza & Olivar-Tost, 2017; Rosenberger & Tick, 2018).

PMBoK Guide, an authoritative reference developed by the PMI, outlines a framework for project management practices throughout the entire project lifecycle beginning with the initial proposal phase and culminating in final delivery and closure (Pinto, 1998; Rosenberger & Tick, 2018). This respected guide provides a meticulous organization of project management into 47 distinct processes categorized into 5 key areas: initiating, planning, executing, monitoring and controlling, and closing (Takagi & Varajão, 2020). Furthermore, the PMBoK describes 10 key knowledge areas that are essential for the

majority of projects, including integration, scope, schedule, cost, quality, human resource, communication, risk, procurement, and stakeholder management (Mesquida & Mas, 2014; Putri & Latief, 2022). The PMBoK Guide is universally recognized as the most important reference point for project management professionals, providing them with a robust, standardized methodology to navigate the complexities of project execution and delivery. Construction Extension to PMBoK Guide introduces two additional knowledge areas that are applicable to construction projects: Health, safety, security, and environment (HSSE) management and financial management (PMI, 2016).

Table 1 illustrates the interconnectedness of project management processes by mapping the five process groups (initiating, planning, executing, monitoring & controlling, and closing) to the twelve key knowledge areas defined in the PMBoK Guide. This mapping highlights the interdependence of these areas and emphasizes the holistic approach required for successful project management. Many knowledge areas, such as integration and communication management, are crucial across multiple process groups, showcasing the continuous involvement of these areas throughout the project lifecycle. This interdependency underscores the importance of considering the impact of decisions in one knowledge area on others. For instance, a delay in the scheduling process (schedule management) can cascade, affecting cost management and resource allocation. By understanding this interconnectedness, project managers can identify potential risks, optimize communication, and develop comprehensive training programs to ensure the successful execution of projects across all stages. The table provides a valuable framework for navigating the complexities of project management, emphasizing the need for a holistic approach that considers the interplay of various knowledge areas to achieve project objectives.

**Table 1:** Process groups and knowledge areas mapping (PMI, 2016)

Knowledge Areas	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring and Controlling	Closing
Integration Management	x	x	x	x	x
Scope Management		x		x	
Schedule Management		x		x	
Cost Management		x		x	
Quality Management		x	x	x	
Resource Management		x	x	x	x
Communications Management		x	x	x	
Risk Management		x		x	
Procurement Management		x	x	x	x
Stakeholder Management	x	x	x	x	
Health, Safety, Security, and Environment Management		x	x	x	
Financial Management		x		x	

## 2.2. Previous studies on root cause analysis in various industries

Root cause analysis has been frequently used to understand the root causes of accidents. It has been a widely used analytical method in various fields, including manufacturing, healthcare, and transportation industries to identify the underlying causes of problems and develop effective strategies for their prevention (Jin et al., 2024; Srivastava et al., 2024; Khodadadi-Mousiri et al., 2023; Zhang et al., 2023; Molan & Molan, 2021). In the manufacturing industry, root cause analysis has been employed to investigate accidents and prevent their recurrence, thereby enhancing workplace safety and reducing production losses (Teixeira & Cassiani, 2014; Mahmood et al., 2018). Similarly, the healthcare industry has utilized root cause analysis to identify the underlying factors contributing to patient falls, medication errors, and other adverse events leading to the development of targeted interventions to improve patient safety (Karkhanis & Thompson, 2020; Raja et al., 2023). The transportation industry, including air, rail, and road has also benefited from root cause analysis in understanding the factors leading to accidents and implementing preventive measures to reduce their occurrence (Kum & Sahin, 2015; Aderibigbe, 2017). Various techniques, such as fault tree analysis and fishbone diagrams, have been used to conduct root cause analysis in these sectors

providing valuable insights into the complex interplay of factors contributing to accidents and facilitating the development of effective strategies for their prevention.

Another group of studies have focused on the root causes of time and cost overruns, separately. Many studies have been conducted in the literature on delays in the construction industry. Gündüz et al. (2013) investigated the delays in Turkish construction projects and the reasons for these delays using the fishbone diagram method. Yang & Wei (2010) investigated the reasons for delays in public construction projects in Taiwan. It was understood that the main reason for the delays in the planning and design phase was the change in customer requests. Ramkumar & Gopalakrishnan (2014) conducted a survey to reveal the real reasons for delays in the construction industry. Delays are divided into three different categories: client, consultant, and contractor. Studies have also been conducted to find the reasons for cost increases in the construction industry. Rosenfeld (2014) conducted root cause analysis of the reasons for cost increases in construction projects. According to the results, the foremost reason is premature tender documents, the consecutive important reason is too many changes in owners' requirements or definitions, and the third reason is that the prices that won the bid were unrealistically low.

Certain studies have investigated the reasons for time and cost overruns together. Simushi & Wium (2020) examined the root cause of time and cost overruns in major projects in South Africa. It was revealed that the main reasons were lack of project-specific experience, decisions taken in the past, pressure on the project team, and changes from stakeholders. Le-Hoai et al. (2008) conducted a survey to examine the factors contributing to time and cost overruns in Vietnamese construction projects. The main reasons were put forward as slowness and lack of constraints, incompetence, design, market and forecasting, financial capacity, state, and worker. Famiyeh et al. (2017) investigated the reasons for delays and cost overruns in the construction industry in Ghana. Reasons for project overruns were attributed to financial challenges, unrealistic contract deadlines set by clients, unclear project scopes, client-driven alterations, consultants' underestimation of project expenses, and inadequate project supervision. Factors contributing to cost overruns encompassed customer financial difficulties, delays in remuneration for completed tasks, discrepancies in designs, absence of communication strategies, deficient feasibility studies and project analyses, inadequate on-site financial management, and fluctuations in material prices.

Some researchers have intended to reveal the root causes of failures specifically for the construction industry. Yeganeh et al. (2019) examined four construction projects in Iran to investigate the root causes of the problems. They identified the most important of the 26 problems, which were revealed as intense employer involvement in the design, poor planning, and decision-making. In their study using the fault tree analysis method, Shahhossein et al. (2018) researched the main reasons for failure in the construction industry. According to the results, financial problems and inadequacies in the tender process were listed as the main reasons for failure. Faiq et al. (2018) explored the reasons for failures in the Iraqi construction industry by using different project management processes (initiation, planning, design, contract, execution and monitoring, and proximate process group). They identified 35 main reasons for failure by using Ishikawa diagrams, Pareto diagrams, and 5 Whys techniques.

In Türkiye, several studies have investigated the root causes of inefficiencies and failures in construction projects. Arditi et al. (1985) identified resource shortages, financial difficulties, organizational deficiencies, design delays, and frequent change orders as major causes of delays in public projects. Yılmaz (2015) analyzed site accidents and found that

unsafe behaviors accounted for 67% of incidents, most frequently resulting in eye, hand, and foot injuries. Focusing on environmental issues, Polat et al. (2017) identified 34 root causes of construction and demolition waste, with design changes and detailing errors being the most critical factors. RCA has also been applied to safety-critical contexts, as shown by Özbakır (2020) in the Sabiha Gökçen–Tavşantepe Metro Project, where inadequate training, inexperience, and negligence were identified as leading causes of rockfall hazards, and by Doğan et al. (2021), who analyzed a scaffolding accident and revealed structural and procedural shortcomings. Collectively, these studies highlight that inefficiencies, waste, and accidents in Türkiye's construction industry largely stem from systemic and managerial root causes, underscoring the value of RCA for preventive strategies.

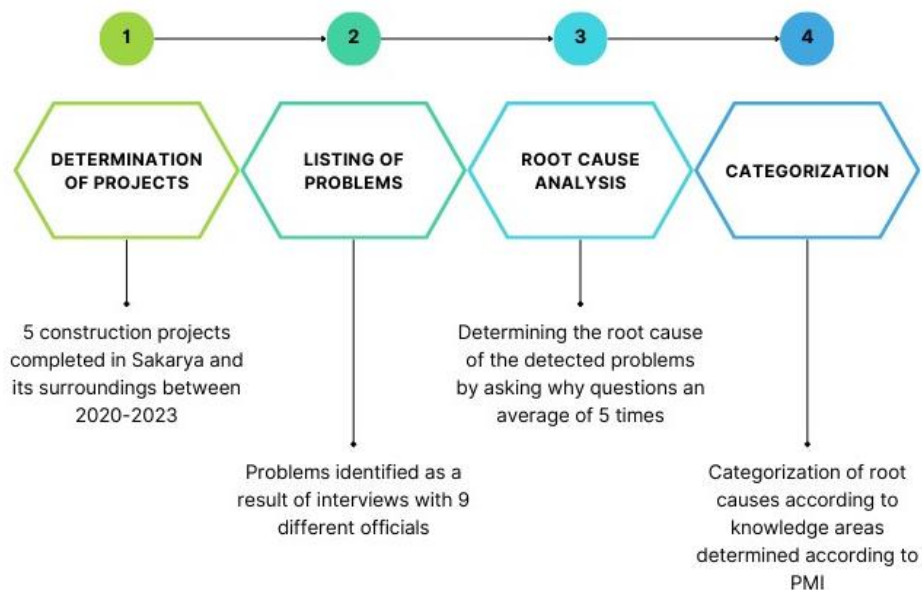
Root cause analysis has been used in a variety of industries, including manufacturing, healthcare, transportation, and construction. Studies have investigated accidents in manufacturing and healthcare, traffic incidents, and specifically within construction, delays, cost overruns, and project failures. These studies have utilized diverse root cause analysis techniques such as fault tree analysis, fishbone diagrams, and the 5 Whys technique. While offering valuable insights into specific problem areas, the existing literature often focuses on individual projects or specific types of problems within an industry. This study distinguishes itself from the existing literature in several key aspects. Firstly, rather than focusing on a specific problem, it conducts a comprehensive root cause analysis of a wide range of problems encountered in construction projects providing a broader perspective on the challenges faced by the industry. Secondly, it goes beyond simply identifying root causes by also categorizing both the apparent problems and root causes according to the PMI's knowledge areas. This mapping provides a structured framework for understanding the interconnectedness of project management processes and facilitates the development of targeted solutions. Thirdly, the study draws upon data from multiple projects and involves interviews with various project team members offering a more robust and generalizable understanding of the root causes of problems in construction projects compared to studies focusing on single projects or limited perspectives. By adopting this multifaceted approach, the study contributes a unique perspective to the root cause analysis literature and offers practical implications for improving project management practices in the construction industry.

### 3. Method

The flowchart of methodology is shown in Figure 1. The methodology consists of 4 stages. Stage 1 involved selecting the projects to be analyzed, focusing on five different construction projects in and around Sakarya, completed between 2020 and 2023, including a school, a warehouse, a shopping mall, a factory, and a fuel station. These projects were selected to reflect a range of scopes, durations, and budgets, thus providing a comprehensive basis for analysis. Stage 2 involved interviews with 9 professionals involved in these projects with roles ranging from civil engineer to architect to develop a detailed list of issues and provide a diverse perspective on the problems encountered. In Stage 3, root cause analysis was carried out using the 5 Whys technique, a method chosen for its simplicity and effectiveness in uncovering the underlying causes of the problems identified. This iterative questioning process was effective in getting to the root of each problem and facilitated the design of targeted responses. Finally, in Stage 4, these root causes were categorized according to the 12 knowledge areas

defined by the PMI, which provided a structured understanding of how these issues relate to project management practices, increasing the potential for preventive measures in future projects.

Prior to the interviews, participants were provided with a brief orientation on the concept of root cause analysis to ensure a common understanding of the approach. Through a guided brainstorming process, they were encouraged to discuss how problems could be observed at different levels and how iterative questioning could lead to the identification of their fundamental causes. After this orientation, participants described the problems they had encountered in practice, which were then systematically examined using the 5 Whys technique. This facilitated not only the identification of immediate issues but also the exploration of deeper structural factors. The results of these discussions were subsequently organized into categories aligned with the PMI knowledge areas, enabling the analysis to link observed field problems with established domains of project management knowledge and thus strengthening both the methodological rigor and the practical relevance of the findings.



**Figure 1:** Flowchart of methodology

#### 3.1. Determination of project

In this study, root cause analysis was conducted on the problems encountered during construction projects in the Sakarya province and its surroundings. To ensure a representative sample and identify common challenges faced across different types of construction structures, five distinct projects with

varying purposes were meticulously selected, including a school building, warehouse, shopping mall, factory, and fuel station project. The selection of these projects provided a varied sample of construction projects with different scopes, durations, and budgets, allowing for a more generalizable understanding of the root causes of problems in the

construction industry. Interviews were conducted with 9 different authorities working on the identified projects, and the problems they encountered were comprehensively listed. Subsequently, to delve into the root cause of each problem, the reasons were probed by asking the 'why' question approximately 5 times on average. This approach aimed to provide a comprehensive analysis of the issues faced by structures with varying purposes and to examine the similarities in the challenges encountered across different types of construction projects.

Table 2 illustrates the diversity of construction projects encompassed in this study, emphasizing the varying scopes, durations, and budgets associated with each project. This heterogeneity establishes a foundational basis for extrapolating the findings to a

wider array of construction projects. Specifically, the project budgets varied from \$1 million to \$3.5 million, while the project durations spanned from 6 to 24 months. Furthermore, the selected projects not only varied in scope, duration, and budget, but also represented both public and private sector practices, ranging from educational facilities to commercial and industrial structures. This diversity ensured that the study captured different technical requirements and regulatory considerations—such as, strict safety and environmental standards in the fuel station project or specialized industrial needs in the factory project. By incorporating such a variety of project types, the analysis provided a more representative basis for identifying common and distinct problems in the construction industry, thereby enhancing the generalizability of the findings.

**Table 2:** List of projects analyzed with 5 Whys technique

Project No	Project Name	Project Type	Project Duration (Month)	Project Budget (Million \$)
1	Adapazarı Imam Hatip High School	School	24	2.5
2	Eksen Tobacco Factory	Warehouse	8	1
3	Teolika Business Center	Shopping mall	18	3.5
4	Güney Furniture Factory	Factory	12	3.2
5	Shell Additional Service Building	Fuel Station	6	1.5

### 3.2. Listing the problems

Following the project selection, interviews were conducted with 9 different authorities involved in the chosen projects. These authorities included civil engineers, mechanical engineers, geological engineers, electrical engineers, a finance manager, and an architect. Their roles and positions within the projects varied, providing a range of perspectives on the challenges encountered. During the interviews, a structured approach was employed to elicit information about the problems encountered during each project. The authorities were asked to provide detailed descriptions of any issues faced, including delays, cost overruns, quality concerns, and other challenges that impacted the project's success. This approach aimed to capture a comprehensive list of problems encountered in the construction projects under study. The interview data were carefully recorded and analyzed to ensure the accurate identification and categorization of problems. This step provided the foundation for the subsequent root cause analysis.

Table 3 presents a detailed overview of the professional characteristics of the authorities interviewed for this study, highlighting the diversity of expertise and experience that informed the identification of problems within the construction projects analyzed. The years of experience among the interviewees vary significantly, from 3 years to 40 years, indicating a broad spectrum of insights—from the perspectives of relatively newer professionals to those with extensive industry experience. This variation in experience levels is crucial, as it allows for a rich dialogue regarding the challenges faced in construction, with more seasoned professionals likely contributing historical context and lessons learned, while less experienced individuals may highlight contemporary challenges and innovative solutions. Additionally, the positions held by these professionals—ranging from project manager to advisor and architect—demonstrate the different roles and responsibilities within the construction process, further enriching the analysis. Such a diverse assembly of perspectives ensures a robust examination of the root causes of the issues encountered in construction projects, thereby

enhancing the reliability and depth of the findings presented in this study.

**Table 3:** List of officials interviewed

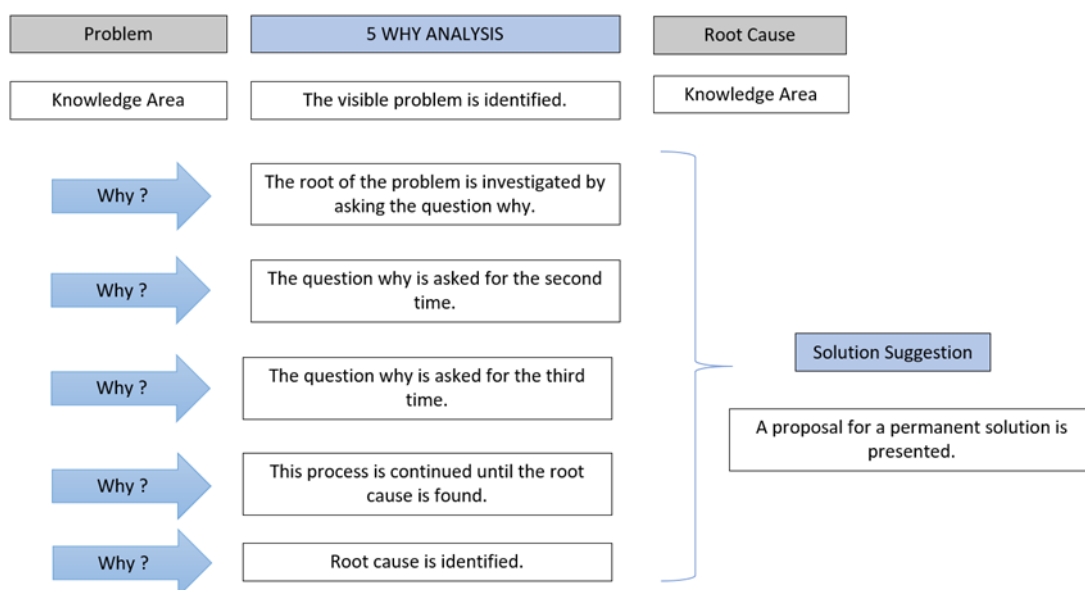
No	Profession	Experience (Year)	Position
1	Civil Engineer	8	Project Manager
2	Civil Engineer	6	Control Engineer
3	Civil Engineer	4	Construction Manager
4	Mechanical Engineer	10	Owner
5	Geological Engineer	3	Construction Manager
6	Electrical Engineer	40	Advisor
7	Mechanical Engineer	20	Advisor
8	Finance Manager	15	Advisor
9	Architect	30	Architect

### 3.3. Conducting the root cause analysis

To identify the underlying causes of the listed problems, the 5 Whys technique was employed. This iterative questioning technique aimed to delve deep into the causal chain of events leading to each identified problem. The process involved repeatedly asking “why” to the initial problem statement, with each “why” question seeking to uncover a deeper cause. This approach continued until a root cause that could not be further explained was identified.

Figure 2 illustrates the phases of the 5 Whys technique, a root cause analysis technique. The process commences with interviews of authorities to

define the initial problem or perceived issue. Subsequently, the apparent problem is investigated through iterative questioning, employing "why" as the primary inquiry. This process is repeated, typically five times, to progressively delve deeper into the causal chain until the root cause is identified. Furthermore, both the initial problem and the identified root cause are categorized according to the knowledge areas defined by the PMI. Finally, the analysis culminates in the proposition of a solution specifically targeted at addressing the root cause of the problem.



**Figure 2:** Illustration of the 5 Whys technique.

### 3.4. Categorization

Once the root causes of the problems were identified, the apparent problems and root causes were categorized according to the 12 knowledge areas defined by PMI in the PMBoK Guide. This categorization provided a structured framework for understanding the interconnectedness of project management processes and facilitated the development of targeted solutions. The categorization helped to identify the knowledge areas most frequently associated with problems and their root causes, enabling a more targeted approach to improving project management practices. It also provided insight into the specific processes and activities that contribute to project challenges in each knowledge area.

## 4. Results and Discussion

The 5 Whys technique was systematically applied to all 67 identified problems. By engaging in an iterative questioning process, with an average of 5 iterations per problem, the root causes were determined, and corresponding solutions were proposed. To provide a comprehensive understanding of the methodology, detailed root cause analyses for two of the problems were explicitly described within the main body of the study. The analyses of the remaining 65 problems were presented in the appendix section ensuring that

all identified issues were thoroughly addressed and their root causes were systematically investigated.

### 4.1. Explanation

Figure 3 provides a detailed illustration of the 5 Whys technique applied to a quality management problem encountered within a construction project. The initial problem was identified as "surface defects on concrete post-pouring". The analysis indicated that the defects in the concrete structure originated from cold joints, which resulted from interruptions in the mixing process during pouring. This disruption was attributed to the delayed arrival of concrete mixers to the construction field. Subsequent inquiry uncovered that the delay was caused by unidentified parked vehicles obstructing the entrance to the concrete pouring area, thereby preventing mixer access. Through the 5 Whys technique, the root cause of the problem was successfully identified. While the initial manifestation appeared to be a quality management problem, the analysis revealed that the underlying root cause stemmed from a deficiency in risk management planning. Specifically, the failure to anticipate and mitigate the risk of access disruption posed by parked vehicles ultimately led to the observed concrete defects. Consequently, a solution was proposed to address this root cause: "Planning should be done to ensure that the entrance routes allow for regular traffic during concrete pouring."

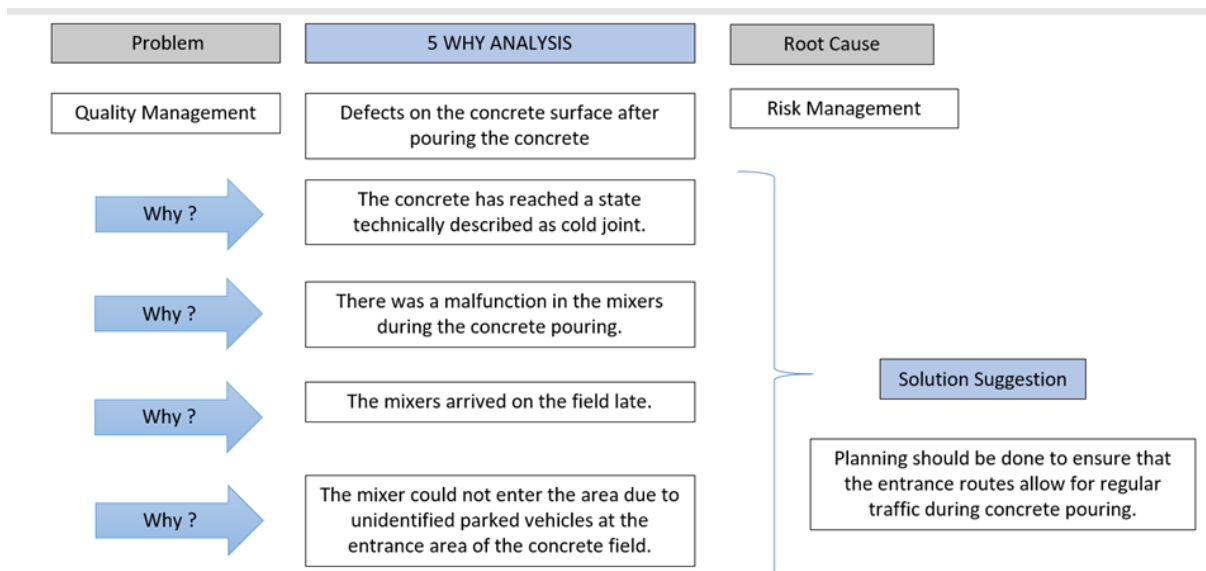
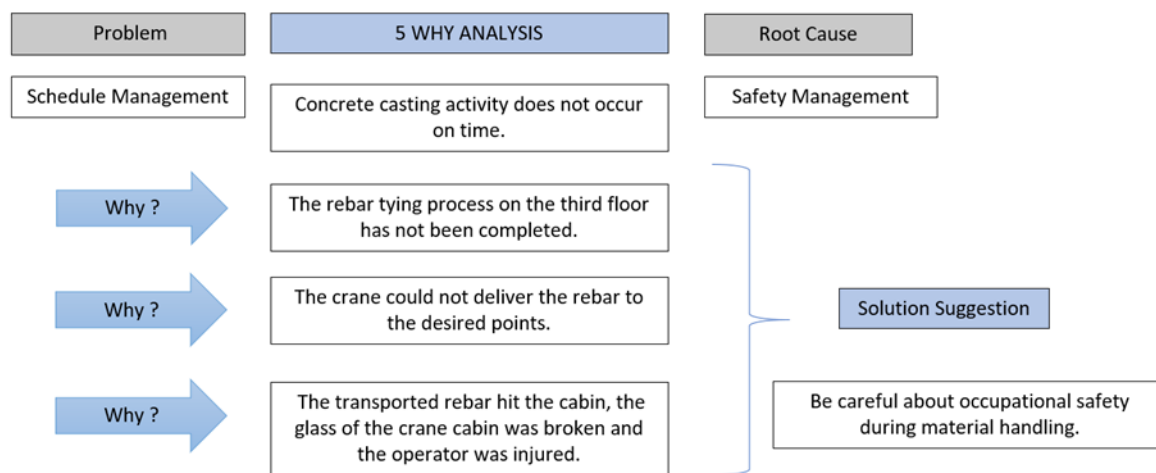


Figure 3: Results of the 5 Whys technique for case 1.

Figure 4 details another example of the 5 Whys technique applied to a construction project. The initial problem, identified as a delay in the concrete pouring process, was categorized as a schedule management problem. Upon investigation using the 5 Whys technique, it was revealed that the rebar tying process on the third floor had not been completed, consequently hindering the concrete pouring schedule. Further inquiry determined that the incomplete rebar tying was due to the crane's inability to deliver the rebar to the designated locations. This failure was attributed to an incident where transported rebar collided with the crane cabin, resulting in

damage to the cabin's glass and injury to the crane operator. Thus, the root cause of the concrete pouring delay was ultimately identified as a lapse in occupational health and safety procedures during material handling. While the initial problem appeared to be a schedule management concern, the analysis revealed that the underlying root cause stemmed from an occupational health and safety management deficiency. This highlights the critical importance of prioritizing occupational safety measures, particularly during material handling operations, to prevent delays and ensure worker well-being.



**Figure 4:** Results of the 5 Whys technique for case 2.

A comprehensive analysis of construction projects, conducted through interviews with officials, identified 67 problems. 5 Whys technique was employed to determine the underlying factors contributing to each issue. The visible problems were predominantly related to schedule management (46) followed by cost management (14), procurement management (3), quality management (3), and HSSE management (1). The root causes revealed a broader spectrum of contributing factors. The list included procurement management (14), communication management (12), risk management (11), stakeholder management (8), schedule management (7), financial management (5), quality management (3), HSSE management (3), scope management (2), and resources management (2).

#### 4.2. The root cause matrix

Table 4 presents a matrix illustrating the relationship between apparent problems encountered in

construction projects and their underlying root causes, categorized according to the 12 knowledge areas defined by the PMI within the PMBoK Guide. A total of 67 problems were identified across various projects, with the majority of apparent problems falling under schedule management (46), followed by cost management (14). However, the root cause analysis revealed that the origins of these issues were more broadly distributed with procurement management (14), risk management (11), and communication management (12) emerging as significant contributing factors. Notably, schedule management-related issues were often linked to deficiencies in procurement, risk, and communication management, suggesting that delays are frequently rooted in external dependencies, insufficient risk mitigation, and ineffective communication. Similarly, cost management problems were often associated with issues in cost management itself, procurement, and communication, indicating that

cost overruns can stem from inaccurate estimations, supplier-related issues, and communication breakdowns. The table highlights the interconnected nature of these knowledge areas and emphasizes the importance of a holistic approach to project management. By understanding the root causes of problems, project managers can develop more targeted interventions and improve their ability to proactively mitigate potential risks across various knowledge areas, leading to improved project success.

In addition, Table 4 provides important insights into how apparent problems and their root causes are distributed across the PMI knowledge areas. While schedule and cost management problems appear most

frequently at the apparent level, the root cause analysis demonstrates that their origins often lie in other domains such as procurement, risk, and communication management. For example, although cost management-related issues were frequently reported as apparent problems, no root causes were categorized under cost management. This suggests that cost overruns are usually symptoms of deeper problems such as inaccurate procurement practices, insufficient risk mitigation, or ineffective communication rather than weaknesses in cost management itself. Similarly, integration management did not emerge as a root cause, which indicates that integration-related difficulties in projects are generally secondary effects of problems originating in other knowledge areas.

**Table 4:** Problems and root causes matrix

		ROOT CAUSES												
		Schedule	Procurement	Risk	Stakeholders	Cost	Scope	Quality	HSSE	Communications	Financial	Integration	Resources	TOTAL
<b>PROBLEMS</b>	Schedule Management	1	12	10	7		2	2	10	2				46
	Procurement Management									3				3
	Risk Management													0
	Stakeholders Management													0
	Cost Management	4	2		1		2	1	2				2	14
	Scope Management													0
	Quality Management	2		1										3
	HSSE Management							1						1
	Communications Management													0
	Financial Management													0
	Integration Management													0
	Resources Management													0
	<b>TOTAL</b>	<b>7</b>	<b>14</b>	<b>11</b>	<b>8</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>12</b>	<b>5</b>	<b>0</b>	<b>2</b>	<b>67</b>

**4.3. Summary of the problems**

The analysis of the reported issues reveals a concentration of problems primarily within the domains of schedule and cost management, a

common theme observed within the construction industry. Schedule management emerges as the most significant challenge, with a staggering 46 reported instances. This indicates widespread difficulties in

adhering to project timelines and achieving timely delivery, a phenomenon that can have detrimental effects on project success. According to PMI (2021), schedule management is a critical success factor directly linked to project cost, stakeholder satisfaction, and overall project viability. Given that the construction industry is a race against time, as delays in completion jeopardize a company's position in the market and sometimes even incur penalties, the importance of time management cannot be overstated (Kog at al., 1999). Cost management follows closely, with 14 reported issues, highlighting the pervasive struggles faced by construction firms in managing financial resources and budgetary constraints. These financial pressures can lead to difficult decisions, impacting project scope, quality, and ultimately, the bottom line. While these two areas appear to be the most visible symptoms of project challenges, it is crucial to recognize that focusing only on these symptoms can hide deeper, underlying issues, leading to ineffective solutions and a continuation of the problem cycle. Construction firms often prioritize addressing these readily apparent issues, driven by the immediate need to mitigate delays and cost overruns. However, this reactive approach may fail to address the fundamental root causes, ultimately hindering long-term project performance and organizational learning.

#### 4.4. Summary of root causes

A deeper investigation into root causes reveals a more complex and nuanced picture with underlying issues extending beyond the immediately apparent problems of schedule and cost overruns. While construction firms often prioritize addressing these apparent symptoms, a closer examination shows that the root causes are more diverse and less directly linked to these surface issues. Analysis of the root cause data reveals a surprising finding: only 7 of the identified root causes are directly related to schedule management, and none are directly related to cost management. This challenges the traditional focus only on these two areas and highlights the need for a more comprehensive approach to problem solving. Instead, root causes are spread across several project management areas including risk management, communication management, stakeholder management, and procurement management. This interdependence underscores the complexity of project challenges and the potential for cascading effects, where a seemingly minor issue in one area

can trigger a chain of negative consequences throughout the project lifecycle. This highlights the critical need for a comprehensive analysis of the underlying causes rather than a superficial focus on visible symptoms. Failure to acknowledge and address these fundamental issues can perpetuate a cycle of project delays, cost overruns, and quality compromises despite efforts to manage the visible symptoms of these issues. As outlined in the PMBoK, applying best practices in schedule and integration management is crucial to mitigate these deep-rooted issues and drive sustainable improvements in project performance (PMI, 2021).

#### 4.5. The number of whys

With the 5 whys technique, the root cause of a problem is identified by asking why questions 5 times on average. Figure 5 shows the number of times the 'Why' question was asked when getting to the root causes of the problems. The data obtained from the study conducted on a total of 5 different construction projects using the 5 Whys technique reveal that the root causes of the 67 problems identified were most frequently identified after asking the 'Why' question three to five times. Specifically, 37.30% of root causes were found after four prompts, 31.50% after five prompts, and 28.30% after three prompts. This suggests that the underlying causes of most problems are moderately complex to complex. Only a small percentage, 2.90%, required only two queries, and none were found after a single 'Why'. These findings emphasize the need for thorough and persistent questioning to effectively identify root causes in construction projects and demonstrate the value of the 5 Whys technique in addressing complexities in this area.

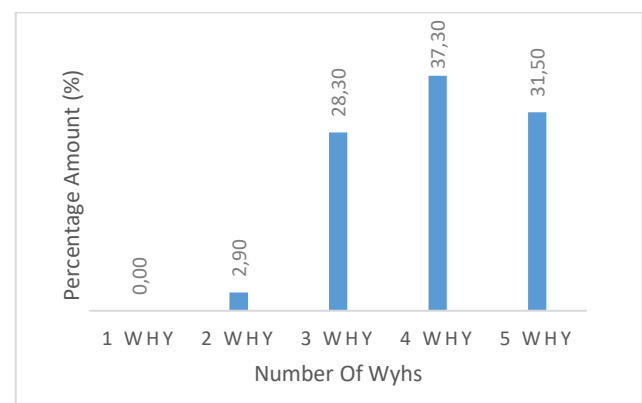


Figure 5: Number of Whys asked to find the root cause.

## 5. Conclusion

This study's findings underscore the efficacy of root cause analysis, specifically the 5 Whys technique, in identifying the underlying causes of problems encountered in construction projects. Through interviews with project team members across diverse project types in and around Sakarya, Türkiye, 67 initial problems were identified. Although the apparent causes were primarily concentrated in schedule management and cost management, the root cause analysis revealed a more nuanced distribution of root causes.

The results indicate that while schedule and cost overruns are frequent symptoms, their origins often lie in deficiencies across various project management knowledge areas. Notably, procurement management, communication management, and risk management emerged as significant contributors to the identified problems. This highlights the importance of a holistic approach to problem-solving, as merely addressing the visible symptoms without investigating the underlying causes can lead to recurring issues and hinder project success.

Identifying and addressing the root causes, on the other hand, can prevent recurrence and improve overall project performance. The 5 Whys technique, despite its simplicity, proved to be an effective tool for dissecting the causal chain of events and revealing the underlying factors contributing to project challenges. By focusing on the root causes, project teams can develop targeted solutions that address the underlying issues rather than just treating the symptoms.

The insights gained from this study can assist construction professionals in proactively identifying and mitigating potential risks. By strengthening procurement processes, fostering effective communication channels, and implementing robust risk management strategies, project teams can minimize the likelihood of encountering common problems. This, in turn, can lead to improved project outcomes and enhanced overall performance.

It is evident that the visible causes of problems may be concentrated in two main areas, namely schedule and cost management. However, a closer examination reveals that the root causes are actually distributed across various domains. To truly resolve these issues, it is essential to identify the root causes and implement corrective measures and improvements in those areas to prevent the recurrence of similar problems in the future. By doing so, project teams can

ensure that they are addressing the underlying issues rather than just treating the symptoms.

Future research could expand on this study by incorporating a larger sample size and exploring the application of other root cause analysis techniques in the construction industry. Investigating the effectiveness of different root cause analysis methods in various project contexts could provide valuable insights for practitioners and help to further refine the approach to root cause analysis in construction projects. It is worth mentioning that this is a regional study carried out in Sakarya and its surroundings, and the findings may differ in other regions because of variations in project types, stakeholder practices, and local economic conditions.

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## Appendix

No	Analysis of the Problem	Problem	Root Cause
1	Issue: Iron workers demand non-contractual wages. 1. For the iron they removed from the elevator shaft 2. Because they thought that there was no iron in the elevator shaft in the project 3. Only the foreman inspected the project. <b>Suggested solution:</b> It is necessary to provide the necessary communication in the field.	Cost Man.	Communications Man.
2	Issue: Ceramic production delayed 1. Problems with the installation have not been solved. 2. The plumber hasn't come to work for 3 days. 3. He got wet and sick from the water coming from the plumbing pipes. <b>Suggested solution:</b> While planning, the risks that may occur should be considered, and a wiggle room should be left.	Schedule Man.	Risk Man.
3	Issue: There is more money being spent on telescopic handler than was foreseen in the expenditures. 1. Incoming materials are placed away from the area to be used. 2. Each master is not guided by his own material. 3. The duties of the foremen were not clarified. <b>Suggested solution:</b> Incoming material should be stored in places that do not require second transportation within the construction site, in a way that can be easily counted and retrieved.	Cost Man.	Scope Man.
4	Issue: Work is behind schedule. 1. Excavation work stopped 2. Reinforced concrete beam revealed at the excavation site 3. No such detail was specified in the project 4. Since previous projects were not available <b>Suggested solution:</b> All existing projects should be obtained and examined.	Schedule Man.	Communications Man.
5	Issue: Work is behind schedule 1. Arch reinforcement fabrication delayed. 2. Reinforcement construction was stopped for a day by the occupational safety expert 3. Workers did not wear seat belts <b>Suggested solution:</b> Workers should be constantly warned to wear seat belts.	Schedule Man.	HSSE Man.
6	Issue: Work is behind schedule. 1. Foundation concrete pouring delayed 2. Raft foundation reinforcements were not made on time. 3. Masters did not work for three days. 4. Due to heavy downpour, there was no work. <b>Suggested solution:</b> When planning, the risks that may occur should be considered, and plenty of time should be left.	Schedule Man.	Risk Man.
7	Issue: Work is behind schedule. 1. Excavation works stopped 2. It was understood that the tunnel floor could be opened by blasting, not excavation. 3. They do not have enough knowledge about the ground. 4. Because the soil type varies from place to place <b>Suggested solution:</b> Ground survey should be done in more detail.	Schedule Man.	Communications Man.
8	Issue: Work is behind schedule. 1. Excavation works stopped 2. The tip of the excavator broke 3. The tip of the excavator is worn out 4. Due to the fact that the breaker bit is used for a long time and on hard ground <b>Suggested solution:</b> Additional tools should be procured to prevent disruption of work.	Schedule Man.	Procurement Man.
9	Issue: Work is behind schedule. 1. Bolt fabrication delayed 2. Drilling injection delayed 3. Injection molding machine malfunctioned 4. Due to lack of maintenance <b>Suggested solution:</b> Maintenance of the tools used should be done on time.	Schedule Man.	Quality Man.
10	Issue: Work is behind schedule. 1. Shoring fabrication delayed 2. Excavation delayed 3. Staff abandoned the work 4. Operator with sick child has no alternative. <b>Suggested solution:</b> Alternative personnel should be available to do the work.	Schedule Man.	Risk Man.
11	Issue: Work is behind schedule. 1. Excavation delayed. 2. Because of the delayed production 3. Not enough pipes in the field 4. Since the number of pipes to be used is decided in the field 5. Since it varies according to the strength of the soil <b>Suggested solution:</b> Ground survey should be done in more detail.	Schedule Man.	Communications Man.
12	Issue: Work is behind schedule. 1. Shotcrete fabrication delayed	Schedule Man.	Procurement Man.

	<ol style="list-style-type: none"> <li>2. Felt production is delayed.</li> <li>3. The membrane application was delayed.</li> <li>4. Insulation manufacturing team fails membrane pressure test</li> <li>5. Problems in the welded areas because the welding machine is not working properly</li> </ol> <p><b>Suggested solution:</b> The supplier should be changed in case of need.</p>		
13	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Arch concrete fabrication delayed</li> <li>2. Arch mold production was delayed.</li> <li>3. Workers quit wor</li> <li>4. Because they did not receive their salaries on time</li> </ol> <p><b>Suggested solution:</b> Project resources should be used within a plan.</p>	Schedule Man.	Financial Man.
14	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Column reinforcement fabrication delayed</li> <li>2. Column applications were not given.</li> <li>3. Mappers could not work due to weather conditions.</li> </ol> <p><b>Suggested solution:</b> Project planning should be made according to weather conditions.</p>	Schedule Man.	Risk Man.
15	<p>Issue: Overtime wages are higher than expected.</p> <ol style="list-style-type: none"> <li>1. Concrete poured at night</li> <li>2. The plant could not deliver the concrete on time.</li> <li>3. Concrete batching plant malfunctioned</li> </ol> <p><b>Suggested solution:</b> The supplier should be warned.</p>	Cost Man.	Procurement Man.
16	<p>Issue: Concrete was overpaid.</p> <ol style="list-style-type: none"> <li>1. More concrete was spent than planned.</li> <li>2. Concrete was poured up to the excavation margin.</li> <li>3. Molders did not make molds where the amputation ended.</li> </ol> <p><b>Suggested solution:</b> Application should be checked properly.</p>	Cost Man.	Quality Man.
17	<p>Issue: Concrete could not be poured.</p> <ol style="list-style-type: none"> <li>1. The craftsmen couldn't make the molds.</li> <li>2. Iron workers could not make the iron ready for the mold maker.</li> <li>3. Workers were unable to work for two days.</li> <li>4. Workers poisoned by food</li> </ol> <p><b>Suggested solution:</b> The supplier should be changed.</p>	Schedule Man.	Procurement Man.
18	<p>Issue: Work delivery time was delayed.</p> <ol style="list-style-type: none"> <li>1. Ceramic production was delayed.</li> <li>2. The color of the ceramics ordered was not liked.</li> <li>3. The architect decided on two ceramics just by looking at the colors on the project.</li> </ol> <p><b>Suggested solution:</b> Interaction of project stakeholders should be increased.</p>	Schedule Man.	Stakeholders Man.
19	<p>Issue: One of the workers fell off the scaffolding.</p> <ol style="list-style-type: none"> <li>1. A missing anchor in the scaffolding was not noticed.</li> <li>2. He didn't listen to the speech the previous day and started working on the field early in the morning.</li> </ol> <p><b>Suggested solution:</b> Occupational safety awareness of companies should be increased.</p>	HSSE Man.	HSSE Man.
20	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. 4th floor wall construction was delayed.</li> <li>2. The wall collapsed when the material for the columns hit the wall while being transported.</li> <li>3. The consultant stopped the construction of the wall because they did not use lamellae in the walls.</li> <li>4. The material ran out, but the workers didn't report it so as not to be idle.</li> </ol> <p><b>Suggested solution:</b> Awareness of the teams should be raised and regularly monitored.</p>	Schedule Man.	Communications Man.
21	<p>Issue: Cost spent on transportation is higher than expected.</p> <ol style="list-style-type: none"> <li>1. Due to each master requesting materials at different times</li> <li>2. Because he decided during the day that the material was missing</li> <li>3. Since they did not proceed in a planned way</li> </ol> <p><b>Suggested solution:</b> Craftsmen should identify their missing materials in advance and request one-day transportation.</p>	Cost Man.	Schedule Man.
22	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Ceramic production has not started.</li> <li>2. The installation process was not finished.</li> <li>3. Plumber did not show up on time.</li> <li>4. His car crashed.</li> <li>5. Due to hidden icing</li> </ol> <p><b>Suggested solution:</b> Conduct a comprehensive risk analysis and reflect its effects on the work program.</p>	Schedule Man.	Risk Man.
23	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Ceramic production did not take place.</li> <li>2. There was no ceramic adhesive.</li> <li>3. The supplier could not bring the requested material on time.</li> </ol> <p><b>Suggested solution:</b> The supplier should be changed.</p>	Schedule Man.	Procurement Man.
24	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Walling delayed</li> <li>2. Material went to the wrong construction site.</li> <li>3. The driver did not receive information from the company.</li> </ol> <p><b>Suggested solution:</b> Exchange of information must be clearly specified.</p>	Schedule Man.	Communications Man.
25	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Fire department approval is delayed.</li> <li>2. Building inspection approval is delayed.</li> <li>3. The architect's approval was delayed.</li> </ol>	Schedule Man.	Procurement Man.

	<p>4. The blueprints arrived late. 5. Lack of personnel</p> <p><b>Suggested solution:</b> The supplier should be changed.</p>		
26	<p>Issue: Work is behind schedule.</p> <p>1. No control approval for the electrical project. 2. The project did not reach the control engineer. 3. The email ended up in the spam box, and the engineer who drew the project did not receive confirmation that the project had arrived. 4. Poor communication on both sides</p> <p><b>Suggested solution:</b> Confirmation should be obtained whether the mails have been received or not.</p>	Schedule Man.	Communications Man.
27	<p>Issue: Work is behind schedule.</p> <p>1. Protection concrete poured late 2. Waterproofing was done late. 3. Lean concrete poured late 4. Trouble at the concrete batching plant</p> <p><b>Suggested solution:</b> Considering the problems that may arise with the suppliers, the program can be left with plenty of space.</p>	Schedule Man.	Procurement Man.
28	<p>Issue: Deck construction behind schedule</p> <p>1. Delay in rebar manufacturing 2. Static projects are being revised. 3. Performance analysis for the building 4. Concrete quality did not provide the desired strength.</p> <p><b>Suggested solution:</b> Concrete company should be changed or warned.</p>	Schedule Man.	Procurement Man.
29	<p>Issue: Tender file submission period is extended.</p> <p>1. Approximate cost file exceeds planned time. 2. Architectural projects are being revised. 3. Changing demands by the administration 4. There are gaps in the list of needs. 5. Change of use of the building</p> <p><b>Suggested solution:</b> Stakeholders' requests should be clarified.</p>	Schedule Man.	Stakeholders Man.
30	<p>Issue: Crane Problem in the field</p> <p>1. Crane does not transfer material to the desired distance. 2. Crane Operator cannot get the required load on the crane. 3. Crane specifications do not meet the nature of the work. 4. Investor did not comply with advisor's demands. 5. He found the cost of the requested crane high.</p> <p><b>Suggested solution:</b> Budgets should be organized according to the nature of the work.</p>	Procurement Man.	Financial Man.
31	<p>Issue: Unable to program concrete</p> <p>1. Concrete does not arrive at the construction site at the desired time and quantity. 2. Concrete supply company unclear 3. Municipality has not identified the supply company. 4. Municipality has no budget to buy concrete.</p> <p><b>Suggested solution:</b> Necessary financing should be adjusted to project budgets.</p>	Procurement Man.	Financial Man.
32	<p>Issue: Project review underway</p> <p>1. University approval is needed for the Implementation Project 2. Municipal engineers did not approve the static project 3. Advisor interpreted the regulation differently</p> <p><b>Suggested solution:</b> Regulations related to the project should be examined more meticulously.</p>	Schedule Man.	Communications Man.
33	<p>Issue: Changes in the concrete program</p> <p>1. Concrete cannot be poured on schedule. 2. Concrete company did not deliver concrete on time. 3. Laboratory concrete day was not available. 4. Municipality could not identify a supplier before concrete procurement. 5. Municipality fails to budget for jobs.</p> <p><b>Suggested solution:</b> Work should not start before the project is financed.</p>	Procurement Man.	Financial Man.
34	<p>Issue: Excavation did not start on schedule.</p> <p>1. Gas distribution company delayed transportation of natural gas line 2. Application for removal of natural gas line 3. There was a natural gas line in the excavation area. 4. Infrastructure was not considered during project construction.</p> <p><b>Suggested solution:</b> Possible risks should be taken into account when planning the project.</p>	Schedule Man.	Risk Man.
35	<p>Issue: Columns had to be cut and straightened.</p> <p>1. Gaps were detected in the inner parts of the column that should not be there. 2. The vibrator was not used properly during concrete pouring. 3. Concrete did not arrive according to the requested recipe. 4. Supplier sent the wrong concrete instead of the requested concrete.</p> <p><b>Suggested solution:</b> The supplier should be changed.</p>	Schedule Man.	Procurement Man.
36	<p>Issue: Imam Hatip High School production halted</p> <p>1. Steel fabrication has not started after rough construction. 2. Steel company can't keep up with production. 3. Municipality did not deliver the necessary material to the manufacturer on time. 4. Municipality faced supply problems. 5. Failed to find the budget to pay the supplier on time</p> <p><b>Suggested solution:</b> Financial situations should be planned before starting the project.</p>	Schedule Man.	Financial Man.
37	<p>Issue: Increase in legal costs</p> <p>1. Work program took longer than planned.</p>	Cost Man.	Procurement Man.

	<ol style="list-style-type: none"> <li>2. The production time of works has been extended.</li> <li>3. Project revised</li> <li>4. No necessary materials found</li> <li>5. Suppliers not identified on time.</li> </ol> <p><b>Suggested solution:</b> Suppliers should be identified when they should be, otherwise costs may change.</p>		
38	<p>Issue: Concrete casting labor cost increased.</p> <ol style="list-style-type: none"> <li>1. Journeyman paid extra wages for pouring field concrete.</li> <li>2. Leveling concrete was not decided during the contract.</li> </ol> <p><b>Suggested solution:</b> More attention should be paid to contract details.</p>	Cost Man.	Scope Man.
39	<p>Issue: The foremen need to be paid extra wages.</p> <ol style="list-style-type: none"> <li>1. The concrete pouring takes place after hours.</li> <li>2. New pump must be supplied as the pump does not reach the entire building.</li> <li>3. The site manager did not calculate the distance between the place where the pump would be installed and the end of the structure.</li> </ol> <p><b>Suggested solution:</b> The project manager should be selected among qualified candidates.</p>	Cost Man.	Resources Man.
40	<p>Issue: Iron workers do not work at the construction site.</p> <ol style="list-style-type: none"> <li>1. No electricity to run their machines.</li> <li>2. There is no electrical panel for the industrial electricity required for the operation of the machines.</li> <li>3. This was discussed with the electrician but he forgot about it and moved on to other work.</li> </ol> <p><b>Suggested solution:</b> Work should be monitored by the authorities.</p>	Schedule Man.	Communications Man.
41	<p>Issue: Iron workers not working at the construction site.</p> <ol style="list-style-type: none"> <li>1. They want progress payments.</li> <li>2. Raft foundation construction is finished.</li> <li>3. Because workers won't discuss the terms of the agreement</li> <li>4. In the jobs so far, they had different ways of dealing, and they thought they would be paid in the same way.</li> </ol> <p><b>Suggested solution:</b> In projects, conditions should be clearly defined and stakeholders should be informed.</p>	Schedule Man.	Communications Man.
42	<p>Issue: Project start delayed.</p> <ol style="list-style-type: none"> <li>1. The companies to work with were decided late.</li> <li>2. Market research took a long time.</li> <li>3. The person responsible for the market research had an accident, and the research was delayed.</li> </ol> <p><b>Suggested solution:</b> There should be alternatives in the project.</p>	Schedule Man.	Risk Man.
43	<p>Issue: Project start time delayed.</p> <ol style="list-style-type: none"> <li>1. Electrical project was not completed.</li> <li>2. Mechanical projects were not completed.</li> <li>3. Architectural projects are constantly being revised.</li> <li>4. Property owners keep changing their minds.</li> </ol> <p><b>Suggested solution:</b> Demands between stakeholders should be clarified.</p>	Schedule Man.	Stakeholders Man.
44	<p>Issue: Project needs to be revised.</p> <ol style="list-style-type: none"> <li>1. Reinforced concrete wall added to the project</li> <li>2. It was requested to protect the cables in the infrastructure of the building.</li> <li>3. The project did not specify such a detail.</li> </ol> <p><b>Suggested solution:</b> All work to be done must be specified in detail in the project.</p>	Schedule Man.	Communications Man.
45	<p>Issue: Extra money paid for concrete</p> <ol style="list-style-type: none"> <li>1. Concrete quantity was below the required concrete.</li> <li>2. Not every point met 15 cm because the ground was backfilled.</li> <li>3. No checks were made with leveling.</li> </ol> <p><b>Suggested solution:</b> Qualified personnel should be employed.</p>	Cost Man.	Resources Man.
46	<p>Issue: Work is behind schedule.</p> <ol style="list-style-type: none"> <li>1. Craftsmen failed to finish the mold on time.</li> <li>2. Blacksmiths delayed the work.</li> <li>3. Due to weather conditions</li> <li>4. Weather was not taken into account during the program.</li> </ol> <p><b>Suggested solution:</b> Weather conditions should be taken into consideration when making the work program.</p>	Schedule Man.	Risk Man.
47	<p>Issue: Leveling concrete could not be poured.</p> <ol style="list-style-type: none"> <li>1. The steel mesh could not be discarded.</li> <li>2. Field leveling could not be done.</li> <li>3. Masters failed to arrive on the field on time.</li> <li>4. Excavation company didn't show up.</li> <li>5. Confusion in the company program</li> </ol> <p><b>Suggested solution:</b> Suppliers should be selected from qualified companies and monitored.</p>	Schedule Man.	Procurement Man.
48	<p>Issue: Formwork opened during concrete pouring</p> <ol style="list-style-type: none"> <li>1. The support plank broke.</li> <li>2. The support plank is rotten.</li> <li>3. The materials got caught in the rain.</li> <li>4. Craftsmen forgot to stack the material.</li> <li>5. Quick exit from the workplace</li> </ol> <p><b>Suggested solution:</b> The tightness of the work program should be reduced.</p>	Quality Man.	Schedule Man.
49	<p>Issue: Level differences in the deck after leveling concrete</p> <ol style="list-style-type: none"> <li>1. Screed errors during concrete pouring</li> <li>2. Defects in the jeans bars</li> <li>3. Jeans bars are not well secured.</li> <li>4. The staff on duty wanted to do it fast.</li> <li>5. To catch up on work</li> </ol> <p><b>Suggested solution:</b> Quality control should be done at the end of each job before moving on to the next one.</p>	Quality Man.	Schedule Man.

50	<p>Issue: Concrete pour postponed</p> <ol style="list-style-type: none"> <li>Roads deteriorated</li> <li>It rained before casting.</li> <li>The weather was not taken into account.</li> </ol> <p><b>Suggested solution:</b> Weather conditions should be taken into account when planning outdoor work.</p>	Schedule Man.	Risk Man.
51	<p>Issue: Delays in the work program</p> <ol style="list-style-type: none"> <li>Concrete could not be poured on time.</li> <li>Mold was not finished on time.</li> <li>Iron could not be manufactured on time.</li> <li>Reduction in the number of staff</li> <li>Site facilities were not appreciated.</li> </ol> <p><b>Suggested solution:</b> Working conditions should be improved.</p>	Schedule Man.	Procurement Man.
52	<p>Issue: Exceeded the planned labor cost</p> <ol style="list-style-type: none"> <li>Dismantling of the productions made</li> <li>The project was revised.</li> <li>Employers demanded a revision</li> <li>He said it was not what he wanted.</li> <li>It was not expected to be so after the production.</li> </ol> <p><b>Suggested solution:</b> Stakeholders should be informed about the end product before the project starts.</p>	Cost Man.	Communications Man.
53	<p>Issue: Extra money paid for construction equipment.</p> <ol style="list-style-type: none"> <li>Scraping required after rain</li> <li>Vehicles were sinking.</li> <li>The road was not finalized.</li> <li>Since the employer has not yet decided on the plans and elevations</li> </ol> <p><b>Suggested solution:</b> Interaction between stakeholders should be increased.</p>	Cost Man.	Stakeholders Man.
54	<p>Issue: More concrete was spent than planned.</p> <ol style="list-style-type: none"> <li>Formwork opened and concrete flowed out</li> <li>Mold exploded</li> <li>Support was not enough.</li> <li>It was manufactured fast to get to the program.</li> </ol> <p><b>Suggested solution:</b> Proper planning should be done, and the construction time of each work should be considered, and no time constraints should be imposed for quality.</p>	Cost Man.	Schedule Man.
55	<p>Issue: Construction site set up late.</p> <ol style="list-style-type: none"> <li>Late settlement of personnel in the container living area</li> <li>Failure to install electricity and water lines</li> <li>The master didn't come.</li> <li>They had to go to another job.</li> <li>Not having a program</li> </ol> <p><b>Suggested solution:</b> Planning should be made regarding suppliers.</p>	Schedule Man.	Procurement Man.
56	<p>Issue: Steel roof fabrication delayed</p> <ol style="list-style-type: none"> <li>Pre-production quotations were delayed.</li> <li>Concrete pour postponed</li> <li>Iron team could not complete the reinforcement work</li> <li>Weather conditions</li> <li>Unexpected developments in the weather</li> </ol> <p><b>Suggested solution:</b> Possible risks should always be considered when planning.</p>	Schedule Man.	Risk Man.
57	<p>Issue: Facade fabrication delayed</p> <ol style="list-style-type: none"> <li>The facade company could not enter the site at the planned time.</li> <li>The facade company was identified late.</li> <li>Final design could not be decided.</li> <li>Employer did not like the designs.</li> <li>Undecided</li> </ol> <p><b>Suggested solution:</b> Stakeholders should be informed at regular intervals while the work is in progress.</p>	Schedule Man.	Stakeholders Man.
58	<p>Issue: Concrete pours took longer than planned.</p> <ol style="list-style-type: none"> <li>Crews pouring slowly</li> <li>The vibrator works slowly</li> <li>The power of the power line was not enough</li> <li>Site panel not connected correctly</li> </ol> <p><b>Suggested solution:</b> Qualified personnel should be assigned for the works.</p>	Schedule Man.	Quality Man.
59	<p>Issue: Behind schedule</p> <ol style="list-style-type: none"> <li>Some activities stopped.</li> <li>Material could not be received on time.</li> <li>Crane couldn't reach</li> <li>Mobile crane had to be installed in different places.</li> <li>The crane can't cover the whole area.</li> </ol> <p><b>Suggested solution:</b> Equipment selection should be appropriate for the project.</p>	Schedule Man.	Schedule Man.
60	<p>Issue: Exceeded the planned budget</p> <ol style="list-style-type: none"> <li>Long-term mobile crane rental</li> <li>Continuous crane required for fabrications</li> <li>The manufacturing site is too large.</li> </ol> <p><b>Suggested solution:</b> Resource selection should be made more precisely in the work program.</p>	Cost Man.	Schedule Man.
61	<p>Issue: Static project could not be completed on time</p> <ol style="list-style-type: none"> <li>The architectural project took a long time to prepare</li> <li>Revision requested by the institution</li> <li>Requested locations added</li> <li>Additional units added</li> <li>The organization has rescheduled.</li> </ol>	Schedule Man.	Stakeholders Man.

	<b>Suggested solution:</b> Stakeholders' requests should be clarified.		
62	<p>Issue: Project blueprint costs were higher than planned.</p> <ol style="list-style-type: none"> <li>1. Post-output revision requested</li> <li>2. Sent to printout without reaching a final conclusion</li> <li>3. To finish the project early</li> <li>4. To ensure that the end time is not delayed</li> <li>5. To avoid penalties after the legal deadline</li> </ol> <p><b>Suggested solution:</b> Project approvals should be obtained on time and sent to the output.</p>	Cost Man.	Schedule Man.
63	<p>Issue: Tender dossier process could not be completed on time.</p> <ol style="list-style-type: none"> <li>1. Delays in preparing approximate costs</li> <li>2. Projects are not completed on time.</li> <li>3. Control times take a long time.</li> <li>4. Working hours and schedules are disrupted.</li> </ol> <p><b>Suggested solution:</b> Interaction between stakeholders should be increased.</p>	Schedule Man.	Stakeholders Man.
64	<p>Issue: Work at the construction site was not finished on time.</p> <ol style="list-style-type: none"> <li>1. Low concrete strength</li> <li>2. The concrete company could not send the concrete in the required quality.</li> <li>3. Concrete water/cement ratio incorrectly calculated.</li> <li>4. Company laboratory error</li> </ol> <p><b>Suggested solution:</b> Supplier selections should be made more carefully.</p>	Schedule Man.	Procurement Man.
65	<p>Issue: Long duration of the license process</p> <ol style="list-style-type: none"> <li>1. Back to square one after the municipal process is completed</li> <li>2. Municipality asked for the documents and applications to be submitted again</li> <li>3. Control put it in the wrong category</li> <li>4. The special situation of the region was not taken into account.</li> <li>5. Staff carelessness</li> </ol> <p><b>Suggested solution:</b> Stakeholders should be more qualified and attentive.</p>	Schedule Man.	Stakeholders Man.