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| RESEARCH ARTICLE

An Assessment of Schedule Risk Management Strategies in Afghanistan Construction Projects

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| ABSTRACT
This study assesses schedule risk management strategies in construction projects in Afghanistan and examines their relationship with project schedule performance. A quantitative, exploratory, and correlational research design was adopted, and data were collected through a structured questionnaire from 58 construction professionals with relevant project experience. The questionnaire assessed 15 schedule risk factors, 10 schedule risk management strategies, and four schedule performance indicators using five-point Likert scales. The data were analyzed using descriptive statistics, the Relative Importance Index (RII), Cronbach's alpha, Pearson correlation, and multiple regression analysis. The findings indicate that poor resource management (RII = 0.814), improper planning and scheduling (RII = 0.810), and shortage of skilled workers/low productivity (RII = 0.800) were the highest-ranked schedule risks. The overall use of schedule risk management strategies was moderate (mean = 3.57), whereas their perceived effectiveness was relatively high (mean = 4.28). Realistic and detailed scheduling was the most frequently used and most effective strategy. In contrast, Risk Register use was relatively low (mean = 2.98), despite its high perceived effectiveness (mean = 4.17). Overall strategy use was positively and significantly associated with schedule performance ($r = 0.339$, $p = 0.009$). Proactive strategy use also showed a significant positive relationship with schedule performance ($r = 0.348$, $p = 0.007$), while reactive/recovery strategies did not show a statistically significant relationship ($r = 0.154$, $p = 0.249$). Multiple regression analysis showed that proactive strategy use was a significant predictor of schedule performance ($B = 0.330$, $p = 0.015$), with the model explaining 12.4% of the variance in schedule performance. The study concludes that greater emphasis on proactive and structured schedule risk management can contribute to improved schedule performance in Afghanistan construction projects. Strengthening realistic scheduling, continuous monitoring, resource and procurement planning, early risk assessment, and formal Risk Registers is recommended. Reactive measures such as fast-tracking or adding resources should primarily serve as recovery mechanisms rather than substitutes for proactive risk management.

| KEYWORDS

Construction Projects; Schedule Risk; Risk Management; Schedule Performance; Proactive Strategies; Schedule Delays; Afghanistan; Risk Register.

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1. Introduction

Construction projects are complex undertakings that involve numerous interrelated activities, resources, stakeholders, contractual arrangements, and external conditions. Among the main indicators of project success, completing the project within the planned schedule is particularly important because schedule delays can increase project costs, disrupt resource utilization, affect contractual relationships, and reduce the overall performance of construction projects. The complexity and uncertainty associated with construction activities make schedule performance vulnerable to various risks throughout the project lifecycle [1], [7].

Schedule risk refers to the possibility that uncertainties and adverse events may prevent project activities from being completed according to the planned schedule. These risks may arise from unrealistic project durations, inadequate planning and scheduling, resource constraints, procurement and material delivery problems, design changes, delayed decisions and approvals, poor coordination, financial problems, and external conditions. Hulett [1] emphasizes that schedule risk is influenced not only by uncertainty in activity durations but also by weaknesses in the development of the schedule, unrealistic estimates and constraints, project complexity, and inadequate consideration of available float and contingency. Therefore, effective schedule management requires more than preparing a baseline schedule; it requires continuous identification, assessment, monitoring, and management of risks that may affect project completion.

Risk management provides a systematic approach for dealing with such uncertainties. In construction projects, the risk management process generally involves identifying potential risks, assessing their likelihood and impact, developing appropriate response strategies, and monitoring risks throughout project implementation [3], [9]. However, identifying risks alone does not necessarily prevent schedule delays. The effectiveness of risk management also depends on how project teams translate identified risks into appropriate management actions and how consistently those actions are implemented during project execution.

Previous studies have demonstrated that schedule delays are influenced by a wide range of factors, and their importance varies according to project characteristics and country context. A review of construction delays in developing countries identified numerous delay causes related to contractors, clients, consultants, resources, financial conditions, project management, and external factors [7]. Similarly, Cheng and Darsa [2], in their study of construction projects in Ethiopia, demonstrated that systematic identification and assessment of schedule-related risk factors can support the development of appropriate management strategies and contribute to reducing schedule delays. These findings indicate that schedule risk management should be considered not only as a risk identification activity but also as a process of selecting and implementing effective strategies to protect project schedules.

The issue is particularly important in developing-country construction environments, where projects may face additional institutional, financial, managerial, procurement, and resource-related challenges. Research on developing countries indicates that weaknesses in risk management practices can limit the ability of project organizations to anticipate and respond effectively to risks [8]. In such environments, project teams may rely heavily on previous experience and reactive problem-solving rather than systematic and proactive risk management processes.

The Afghanistan construction sector faces similar challenges, while also being influenced by country-specific conditions. Previous research on Afghan construction projects has identified several factors associated with project delays, including poor project management, material and equipment delays, financial and payment problems, labor-related issues, security conditions, and social or political disruptions [3], [10], [11]. Mohib [3], for example, identified security, poor management, material supply delays, and social disruption among important factors affecting construction project performance in Afghanistan. More recent research has also highlighted issues such as delayed payments, design changes, contractor cash-flow problems, delayed approvals, inaccurate surveys, and security-related conditions as important sources of construction delays in Afghanistan [11]. These findings demonstrate that schedule delays in Afghanistan result from a combination of managerial, financial, technical, resource, and external risks.

Although considerable attention has been given to identifying construction risks and causes of delays in Afghanistan, less attention has been directed toward the comparative use and perceived effectiveness of specific schedule risk management strategies. This distinction is important because the presence of a risk does not automatically indicate how effectively a project organization manages that risk. For example, a project team may recognize resource shortages or procurement delays as important risks but may not consistently use formal risk registers, schedule contingency, proactive risk assessment, or systematic schedule monitoring to manage them.

Recent evidence supports this concern. Amin, Wardak, and Faqiri [4] found that risk management practices in Afghan construction projects remain relatively underdeveloped and are not consistently embedded throughout project development. Their findings also indicate that project organizations often rely on experience rather than structured risk management frameworks. Regarding schedule risk responses, the study reported the use of strategies such as fast-tracking and adding manpower, while the use of systematic and proactive approaches remained limited [4]. This suggests a potential difference between recognizing risks, using risk management strategies, and perceiving those strategies as effective.

An important distinction in this regard is between proactive and reactive/recovery schedule risk management strategies. Proactive strategies seek to identify and address potential schedule problems before they materialize. These may include realistic and detailed scheduling, regular schedule monitoring and updating, proactive schedule risk assessment, risk registers, time buffers, resource planning, early procurement planning, early design review and change control, and timely decision-making and coordination. In contrast, reactive or recovery strategies are generally applied after a schedule problem has occurred or when a project is already experiencing delay. Examples include fast-tracking activities and adding resources to recover lost time. While reactive measures can be important for recovering delays, their effectiveness may depend on the extent to which risks have already affected the project.

Therefore, examining only the causes of construction delays does not provide a complete understanding of schedule risk management. There is a need to examine which strategies are actually used, how effective practitioners perceive these strategies to be, and whether greater use of schedule risk management practices is associated with better schedule performance. This

approach moves the analysis from simple risk identification toward an assessment of management practice and its relationship with project outcomes.

Accordingly, this study investigates schedule risk management strategies in Afghanistan construction projects. The study first identifies and ranks major schedule-related risks, then examines the extent to which different schedule risk management strategies are used and how effective they are perceived to be. Finally, the study assesses the relationship between the use of these strategies and project schedule performance, with particular attention to the difference between proactive and reactive/recovery strategies.

1) Research Aim

The main aim of this study is:

To assess schedule risk management strategies in Afghanistan construction projects and examine their relationship with project schedule performance.

2) Research Objectives

The study pursues the following objectives:

1. To identify and rank the major risks affecting construction project schedules in Afghanistan.
2. To assess the extent to which schedule risk management strategies are used in Afghanistan construction projects.
3. To evaluate the perceived effectiveness of different schedule risk management strategies.
4. To examine the relationship between schedule risk management practices and project schedule performance.
5. To compare the relationship of proactive and reactive/recovery strategies with schedule performance.

3) Research Questions

The study addresses the following questions:

1. What are the major risks affecting construction project schedules in Afghanistan?
2. Which schedule risk management strategies are most frequently used in Afghanistan construction projects?
3. Which schedule risk management strategies are perceived as most effective?
4. Is there a significant relationship between the use of schedule risk management strategies and project schedule performance?
5. Do proactive schedule risk management strategies have a stronger relationship with schedule performance than reactive/recovery strategies?

4) Research Hypotheses

Based on the research objectives and conceptual framework, the following hypotheses are proposed:

H1: Schedule risk management practices have a significant positive relationship with project schedule performance in Afghanistan construction projects.

H2: Proactive schedule risk management strategies have a significant positive relationship with project schedule performance.

H3: Proactive schedule risk management strategies have a stronger relationship with project schedule performance than reactive/recovery strategies.

5) Significance of the Study

This study contributes to the existing literature by shifting attention from the identification of construction delay factors toward the management of schedule risks and the effectiveness of the strategies used to address them. While previous studies in Afghanistan have identified important causes of construction delays and examined general risk management practices, this study provides empirical evidence on the use and perceived effectiveness of specific schedule risk management strategies and their relationship with schedule performance.

From a practical perspective, the findings may help project managers, contractors, consultants, planning engineers, and other construction professionals identify strategies that deserve greater attention during project planning and execution. The results may also support construction organizations in moving from predominantly reactive responses toward more systematic and proactive schedule risk management practices.

6) Scope and Contribution

The study focuses specifically on schedule-related risks and schedule risk management strategies in construction projects in Afghanistan. It considers both the frequency of strategy use and practitioners' perceptions of strategy effectiveness, followed by an assessment of their relationship with schedule performance. The study therefore provides a practical framework for understanding the progression from schedule risk identification → risk management strategy → schedule performance.

Overall, the study seeks to provide evidence that can support more structured schedule risk management practices in Afghanistan's construction sector and contribute to improved control of project schedules.

2. Literature Review

2.1 Construction Project Delays and Schedule Risk

Timely completion is one of the basic measures of construction project success. A project may meet its technical requirements and remain within an acceptable cost range, but significant delay can still reduce its overall value to the client, contractor, and other

stakeholders. Construction projects are exposed to uncertainty throughout their life cycle, and this uncertainty can affect planned activity durations, resource availability, procurement, design, decision-making, and ultimately the project completion date.

Schedule delay is not a problem limited to one country or one type of construction project. A review of construction delay studies from developing countries found that delay is a common constraint to achieving project objectives and identified a wide range of causes across different regions and project environments [7]. More recent reviews have also shown that construction-delay research has largely concentrated on identifying delay causes, while differences in terminology, project characteristics, and research methods make direct comparison between studies difficult [8].

From a schedule management perspective, delay can be understood as the result of uncertainty affecting the planned sequence and duration of project activities. Hulett [1] argues that even a carefully developed Critical Path Method (CPM) schedule cannot eliminate schedule risk because activity durations are estimates of uncertain future events. Consequently, a schedule may appear technically achievable while still having a substantial probability of exceeding its planned completion date. Schedule risk assessment is therefore needed to understand the likelihood and potential magnitude of schedule overruns [1].

The importance of schedule risk becomes greater as project complexity increases. Projects involving multiple contractors, suppliers, design teams, government agencies, and other stakeholders may contain numerous dependencies and points where delays can accumulate. Hulett [1] identifies several sources of schedule risk, including unrealistic schedules, uncertainty in work duration, project complexity, optimistic duration estimates, aggressive constraint dates, fast-track implementation, and insufficient float or management reserve.

Therefore, schedule risk should not be viewed simply as the possibility that a project will finish late. It is better understood as the uncertainty surrounding the planned project duration and the factors that may cause the actual schedule to differ from the baseline.

2.2 Schedule Risk Assessment

Schedule risk assessment provides a structured way of examining the uncertainty associated with project duration. Traditional CPM scheduling generally uses a single duration estimate for each activity. Hulett [1] points out that such estimates cannot adequately represent the uncertainty of future events because actual activity durations may be either shorter or longer than planned.

Quantitative schedule risk assessment addresses this limitation by representing activity durations through ranges or probability distributions rather than relying solely on single-point estimates. This makes it possible to estimate the probability of completing a project by a particular date and to determine an appropriate schedule contingency [1].

Among quantitative approaches, Monte Carlo simulation is one of the commonly used methods. In a Monte Carlo schedule risk analysis, uncertain activity durations are repeatedly sampled and the project schedule is recalculated. The resulting distribution provides information about possible completion dates and identifies activities or paths that contribute substantially to schedule risk [1].

However, sophisticated quantitative methods are not the only way to manage schedule risk. In many construction environments, particularly where reliable historical data and advanced software are limited, qualitative identification, expert judgment, risk ranking, schedule monitoring, and structured response planning remain important. This is particularly relevant to developing-country contexts, where risk management practices may be constrained by limited data, technical capacity, and institutional support [9].

The literature therefore suggests that schedule risk management should not depend on a single analytical technique. Rather, it should combine realistic scheduling, risk identification, assessment, monitoring, response planning, and, where feasible, quantitative analysis.

2.3 Construction Risk Management

Construction risk management has developed from relatively informal approaches toward more structured processes for identifying, assessing, responding to, and monitoring project risks. A review of risk management in developing countries identifies risk identification, risk analysis and evaluation, and risk response as central elements of a systematic risk management process [9].

In construction projects, risks can emerge during feasibility, design, procurement, construction, and handover. They may be technical, financial, contractual, managerial, environmental, political, social, or security-related. The consequence of these risks may appear in one or more project objectives, particularly time, cost, quality, and safety.

The recent study by Amin, Wardak, and Faqiri [4] emphasizes that construction risk management should cover the entire project life cycle rather than being treated as an isolated activity. Their review identifies risks related to cost escalation, time delays, technical errors, safety, quality, environmental conditions, and legal disputes. Their study also highlights the importance of risk identification, risk assessment, risk allocation and response, and risk monitoring and control.

A structured risk management process is particularly important because identifying a risk does not automatically reduce its effect. Risk information must be converted into an appropriate response and then monitored to determine whether the response remains effective. In this sense, risk management is a continuous management process rather than a one-time exercise.

Hulett [1] similarly describes schedule risk assessment as a continuing responsibility of the project manager. He cautions against conducting risk assessment at the beginning of a project and then leaving it unused. Instead, changing levels of schedule risk should be monitored during routine project updates.

2.4 Schedule Risk Management Strategies

Schedule risk management strategies can broadly be viewed as actions intended either to prevent schedule problems before they occur or to reduce their consequences after a delay has developed. This distinction is important for the present study.

2.4.1 Proactive Schedule Risk Management

Proactive strategies attempt to identify and reduce schedule risks before they become actual delays. Examples include developing realistic schedules, conducting schedule risk assessments, maintaining risk registers, allocating adequate resources, planning procurement early, reviewing designs, controlling changes, and maintaining regular communication and schedule monitoring.

Realistic scheduling is particularly important. Hulett [1] explains that unrealistic or overly optimistic schedules can create a high probability of overrun from the beginning. He also notes that constraint dates imposed without considering available resources and realistic activity durations may hide rather than eliminate schedule risk.

Another important proactive measure is the use of schedule contingency or buffer. Hulett [1] demonstrates that contingency should be related to the level of schedule risk rather than simply added at the end of a schedule. Risk-based contingency can provide management with a more realistic level of confidence in the planned completion date.

Resource planning is also closely connected with schedule risk. A schedule cannot be considered feasible if its time-phased resource requirements are inconsistent with available resources [1]. This supports the inclusion of resource planning and allocation as an important schedule risk management strategy.

Early procurement and material planning are similarly relevant because construction activities frequently depend on the timely availability of materials, equipment, and specialist services. Poor resource and material management can create delays that subsequently affect dependent activities and the overall completion date.

2.4.2 Reactive and Recovery Strategies

Reactive strategies are generally applied after a schedule problem has already occurred. Common examples include fast-tracking, adding manpower or equipment, increasing working hours, and reallocating resources to delayed activities.

These approaches can be useful when the project has limited flexibility and the contractual completion date cannot easily be changed. Hulett [1] recognizes that adding resources can sometimes reduce the duration of risky activities.

Fast-tracking, however, involves additional risk. Hulett [1] explains that fast-tracking may shorten project duration by allowing activities to proceed in parallel, but releasing design or construction work before preceding work is sufficiently developed can increase rework, cost, and delay risk. Therefore, fast-tracking should not automatically be considered a low-risk solution to schedule problems.

This distinction between proactive and reactive approaches is particularly relevant to the Afghan construction context. The 2026 study by Amin et al. [4] found that fast-tracking was the most frequently reported response to schedule risks, followed by adding manpower, while buffering was less common. The authors interpreted this pattern as evidence of a predominantly reactive approach in which acceleration measures are applied after delays have occurred.

This finding provides an important basis for examining whether proactive and reactive strategies have different relationships with schedule performance.

2.5 Empirical Studies on Construction Schedule Risk

Several empirical studies have attempted to identify and rank the risks that influence construction schedules. Cheng and Darsa [2] developed a Construction Schedule Risk Assessment Model using data from 94 delayed construction projects and a questionnaire survey of 75 experts. The study identified 22 schedule risk factors and compared rankings using an Artificial Neural Network/Garson Algorithm approach and the Relative Importance Index (RII).

The study identified different priorities depending on the analytical method. Using the Garson Algorithm, change orders, corruption/bribery, and payment delays were among the highest-ranked factors, while the RII analysis identified poor resource management, corruption/bribery, and material delivery delays among the leading factors [2]. The researchers concluded that improving the factors with substantial influence on schedule performance could significantly reduce schedule delays.

The importance of this study for the present research is twofold. First, it demonstrates that schedule risk factors can be ranked systematically rather than treated as an undifferentiated list. Second, it shows that management actions should focus on the risks with the greatest potential influence on project schedules. However, the Ethiopian context is different from Afghanistan, and the use of an ANN-based model requires a relatively substantial data foundation. The present study therefore adopts a simpler questionnaire-based approach that is more appropriate for its available Afghan sample while retaining the principle of prioritizing schedule risks.

2.6 Risk Management in Afghanistan Construction Projects

Afghanistan presents a particularly challenging environment for construction risk management. Construction projects operate under conditions that may include financial uncertainty, procurement difficulties, management weaknesses, limited technical capacity, security concerns, design changes, material shortages, and institutional constraints.

Mohib [3], in a study of risk management in Afghan construction projects, examined risk factors, causes of delays, types of risks, risk management processes, and mitigation measures. The study identified security issues, poor management, delays in material supply, and social disruptions among the major causes of schedule problems. It also highlighted financial risks such as currency fluctuations, price increases, procurement problems, and payment delays.

The same study emphasizes the need for qualified personnel and a dedicated risk management function within construction organizations. It argues that risk management should be considered from the planning stage through project completion rather than only when problems occur [3].

Security is another important factor in Afghanistan. Earlier Afghan research reported security as one of the major reasons for construction delay, with Mohib [3] reporting a 45.5% response for security as a major delay motive in his study. More recent research has also specifically investigated the relationship between security conditions and construction delays in Afghanistan, identifying local armed actors, interference by tribal leaders, and other insecurity-related conditions as important threats to project progress [10].

At the same time, recent Afghan research suggests that delays cannot be explained by security alone. A 2025 mixed-method study by Ahmadzai and Ye reported that Afghan construction projects experience substantial delays and identified interconnected causes involving government, consultants, contractors, and security conditions. The study highlighted issues such as late payments, design changes, contractor cash-flow problems, late design approvals, inaccurate surveys, and security threats [11].

Similarly, an integrated study of time delays and cost overruns in Afghan construction projects identified security issues, variation orders and extra work, corruption and bribery, inadequate feasibility studies, and adverse weather among the most critical factors [12].

These studies indicate that schedule risks in Afghanistan are multidimensional. They emerge from the interaction of managerial, financial, technical, contractual, environmental, and socio-political conditions. This supports the need for a schedule risk management framework that goes beyond a simple list of delay causes.

2.7 Current State of Risk Management Practice in Afghanistan

Although awareness of construction risk management has increased in Afghanistan, evidence suggests that formal implementation remains limited. Amin et al. [4] found that risk management practices in Afghan construction projects remain underdeveloped and are not consistently embedded throughout the project life cycle. Projects often depend on personal experience and informal approaches instead of recognized frameworks such as ISO 31000 and PMBOK.

The study further found that risk identification and assessment were practiced to some extent, but systematic documentation and advanced analytical approaches were limited. Monitoring and control practices also showed moderate implementation rather than full institutionalization.

The findings concerning schedule risk response are particularly relevant to the present study. Amin et al. [4] reported that 35.4% of respondents identified fast-tracking as a schedule risk response and 33.8% reported adding manpower, compared with 26.2% for buffering. Only 4.6% reported having no clear strategy.

The study also reported a relatively high overall perceived effectiveness of risk response and mitigation strategies, with a mean score of 4.17 out of 5. At the same time, the authors concluded that risk management in Afghan construction remains largely reactive, with communication, reporting, lessons learned, and other monitoring practices not yet fully integrated.

This combination of findings is important. It suggests that construction professionals may recognize the value of risk management strategies while organizations still struggle to apply them systematically. The present study therefore goes one step further by examining not only the use and perceived effectiveness of schedule risk management strategies, but also their relationship with schedule performance.

2.8 From Risk Identification to Strategy Effectiveness

A significant part of the existing construction literature has focused on identifying and ranking risk factors. This work is useful because organizations cannot manage risks effectively without first understanding them. However, identifying a risk does not necessarily explain which management action is most appropriate or whether that action improves project performance.

Cheng and Darsa [2] addressed this issue by developing management strategies for highly ranked schedule risks and examining the potential effect of improvements in those factors. Their study showed that reducing the influence of important risk factors could lead to meaningful reductions in schedule delays.

More broadly, a systematic review of research on the relationship between construction risk and project performance found that much of the literature has concentrated on developing tools and approaches for assessing the influence of risks on project outcomes [13].

This suggests a shift in research interest from simply asking "What causes construction delay?" toward asking "How can identified risks be managed effectively to improve project performance?"

The distinction is important for the present research. The objective is not to produce another comprehensive list of delay causes in Afghanistan. Instead, the study focuses on schedule risk management strategies and asks whether the use of these strategies is associated with better schedule performance.

2.9 Research Gap

The reviewed literature shows that construction schedule delays and risk factors have received considerable attention internationally and in Afghanistan. Previous studies have identified a wide range of factors, including poor management, resource shortages, material delivery problems, payment delays, design changes, security conditions, and contractual issues [2–4,10–12].

However, several gaps remain.

First, much of the Afghanistan-specific literature has focused on identifying causes of delay and general construction risks rather than systematically comparing the effectiveness of different schedule risk management strategies. Mohib [3], for example, examined risk factors, delay causes, risk categories, and mitigation practices, while more recent studies have continued to examine the causes of time delays and security-related delays [3,10–12].

Second, the recent assessment by Amin et al. [4] provides useful evidence on the current state of risk management practice in Afghanistan, including schedule risk responses. However, its focus is on the broader maturity and current application of risk management rather than on statistically examining the relationship between specific schedule risk management strategies and schedule performance.

Third, international studies such as Cheng and Darsa [2] have developed sophisticated models for assessing schedule risk and have demonstrated the importance of prioritizing influential risk factors. However, such approaches have generally been applied in contexts outside Afghanistan and may require larger datasets and more extensive historical project information than is readily available in the Afghan construction sector.

Fourth, the literature provides limited empirical evidence comparing proactive schedule risk management practices with reactive recovery practices in terms of their relationship with schedule performance. This distinction is particularly relevant in Afghanistan because existing evidence suggests that fast-tracking and manpower addition are frequently used after schedule problems emerge, while systematic preventive approaches remain less institutionalized [4].

Accordingly, the present study addresses the following gap:

Existing studies in Afghanistan have provided substantial evidence on construction delay factors and general risk management practices, but there remains limited empirical evidence on the comparative use and perceived effectiveness of schedule risk management strategies and their relationship with schedule performance, particularly the distinction between proactive and reactive strategies.

This gap provides the basis for the present study.

2.10 Conceptual Basis of the Present Study

Based on the reviewed literature, the present study considers schedule risk management as a process through which construction organizations identify schedule-related risks, apply management strategies, and monitor their effects on project schedule performance.

The conceptual relationship can be represented as:

Schedule Risk Factors → Schedule Risk Management Strategies → Schedule Performance

Schedule risk factors represent conditions that may threaten planned completion, including planning problems, resource constraints, procurement delays, payment problems, design issues, decision delays, coordination problems, contractor performance, equipment availability, and security conditions.

Schedule risk management strategies are divided into two broad dimensions:

1. **Proactive strategies**, including realistic scheduling, regular schedule monitoring, proactive risk assessment, risk registers, time buffers, resource planning, procurement planning, design review and change control, and timely coordination and approvals.
2. **Reactive/recovery strategies**, particularly fast-tracking and additional resources used to recover an existing delay.

Schedule performance represents the extent to which projects achieve planned completion dates, maintain control against the baseline schedule, control or recover delays, and achieve satisfactory overall schedule performance.

This conceptualization is consistent with Hulett's [1] view that schedule management requires continuous risk assessment and management rather than reliance on a deterministic schedule alone. It is also consistent with the Afghanistan literature emphasizing the need to move from reactive and informal practices toward more systematic and proactive risk management [3,4].

2.11 Summary of Literature Review

The literature demonstrates that schedule delay is a persistent challenge in construction projects and is closely connected to uncertainty in activity durations, project complexity, resources, procurement, design, management, and external conditions [1,2]. Schedule risk assessment provides a means of understanding this uncertainty and identifying areas that require management attention.

Previous research also shows that effective construction risk management involves more than identifying risks. Risks need to be assessed, prioritized, assigned, responded to, and monitored throughout the project life cycle [1,4,9].

In Afghanistan, previous studies have identified a broad range of schedule-related risks, including poor management, poor planning, material and equipment delays, financial problems, design changes, security issues, and other institutional and environmental factors [3,10–12]. Recent evidence further indicates that risk management awareness is increasing, but systematic and proactive implementation remains limited [4].

The literature therefore supports the need for research that moves beyond the identification of delay causes and examines the practical use and effectiveness of schedule risk management strategies. In particular, the limited empirical comparison between proactive and reactive strategies provides a relevant research opportunity in the Afghan construction context. The present study addresses this issue by assessing schedule risks, measuring the use and perceived effectiveness of schedule risk management strategies, and examining their relationship with project schedule performance.

3. Data and Methodology

3.1 Research Design

This study adopted a quantitative, exploratory, and correlational research design to assess schedule risk management strategies and their relationship with schedule performance in construction projects in Afghanistan.

The exploratory component of the study focused on identifying and ranking the major risks that affect project schedules and examining the extent to which different schedule risk management strategies are used in construction practice. The correlational component was used to examine whether the use of schedule risk management strategies is associated with better project schedule performance.

The research framework was developed based on the construction risk management and schedule risk literature. Hulett [1] emphasizes that schedule risk assessment should be used to identify sources of schedule overrun, evaluate the effects of risk management actions, and continuously monitor changing risks. Similarly, Cheng and Darsa [2] developed a construction schedule risk assessment and management approach using risk-factor identification, RII ranking, and management strategies for schedule-delay reduction. Their study demonstrates the value of systematically linking schedule risks with management responses.

The Afghanistan context was incorporated through previous local studies. Mohib [3] examined risk management in Afghan construction projects and identified issues such as poor management, material supply delays, financial problems, security conditions, and social disruption as important project risks. More recently, Amin et al. [4] found that although awareness of risk management has increased in Afghanistan, the consistent application of proactive and structured risk management practices remains limited.

Accordingly, the present study goes beyond identifying delay factors and examines three related dimensions:

Schedule Risk Factors → Schedule Risk Management Strategies → Schedule Performance

3.2 Study Population and Sample

The target population consisted of professionals with experience in construction projects, including project managers, site engineers, planning/scheduling engineers, contractors, consultants, clients, and other construction-related professionals.

A non-probability sampling approach was used to obtain responses from professionals with relevant construction experience. To ensure that respondents had sufficient practical exposure to construction projects, participation was limited to individuals reporting at least three years of construction experience.

A total of 58 completed questionnaires were obtained and included in the final analysis. All 58 responses contained valid observations for the analytical questionnaire items, resulting in N = 58 for the statistical analysis.

The final sample included respondents from different professional positions and organizational backgrounds, providing perspectives from several groups involved in construction project planning and implementation.

3.3 Questionnaire Development

A structured questionnaire was developed based on the literature on construction delays, construction risk management, and schedule risk assessment. The questionnaire was also informed by previous studies conducted in Afghanistan and other developing-country construction environments.

Mohib [3] examined risk factors, risk management techniques, mitigation approaches, and their effects on cost, quality, and schedule in Afghan construction projects. Amin et al. [4] similarly examined risk identification, risk assessment, risk response, and risk monitoring and control in Afghan construction projects. The structure of the present questionnaire was therefore designed to capture not only the existence of schedule risks but also the use and perceived effectiveness of management strategies.

The questionnaire consisted of five main parts:

Section A: Respondent Characteristics

This section collected information regarding:

- Professional position;
- Years of construction experience;
- Type of organization;
- Main type of construction project experienced.

Section B: Schedule Risk Factors

Fifteen potential factors affecting construction project schedules were assessed using a five-point Likert scale ranging from 1 = Very Low to 5 = Very High.

The factors were:

1. Improper planning and scheduling;
2. Unrealistic project duration;
3. Payment delays;
4. Poor resource management;
5. Poor project/site management;
6. Shortage of skilled workers and low productivity;
7. Delay in procurement and delivery of construction materials;

8. Shortage or unavailability of construction materials;
9. Design problems and errors;
10. Delayed decisions and approvals;
11. Contract and scope changes;
12. Poor coordination and communication among project parties;
13. Poor contractor and subcontractor performance;
14. Inadequate availability of equipment and machinery;
15. Security and social/political instability.

Section C: Use of Schedule Risk Management Strategies

Respondents assessed how frequently each strategy was used in projects with which they had experience.

A five-point frequency scale was applied:

1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always.

Ten strategies were assessed, including proactive planning, monitoring, risk assessment, risk registers, time contingency, resource planning, procurement planning, design/change control, timely decision-making, and delay recovery.

Section D: Perceived Effectiveness of Strategies

The same ten strategies were evaluated according to their perceived effectiveness in reducing schedule delays.

The scale ranged from:

1 = Very Ineffective to 5 = Very Effective.

Using the same strategies for Sections C and D allows comparison between strategy use and perceived strategy effectiveness.

Section E: Schedule Performance

Four statements were used to assess project schedule performance:

1. The project achieved its planned completion date.
2. The project schedule was regularly compared and controlled against the baseline.
3. Project delays were effectively controlled and recovered.
4. Overall, project schedule performance was satisfactory.

These items were measured on a five-point agreement scale from 1 = Strongly Disagree to 5 = Strongly Agree.

An open-ended question was also included to obtain respondents' views regarding the most important action for reducing construction delays in Afghanistan.

3.4 Research Variables and Measurement

The main independent variable of the study was Schedule Risk Management Practices (SRMP), while Schedule Performance was treated as the dependent variable.

Schedule Risk Management Practices were examined through two dimensions:

Proactive Schedule Risk Management Strategies

The first nine strategies represent activities that are primarily intended to identify, prevent, or control schedule risks before they develop into significant delays:

- Realistic and detailed scheduling;
- Regular schedule monitoring and updating;
- Proactive schedule risk assessment;
- Risk Register development and updating;
- Time contingency/buffer allocation;
- Resource planning and allocation;
- Procurement and material-delivery planning;
- Early design review and change control;
- Timely decisions, approvals, and coordination.

Reactive/Recovery Strategy

The tenth strategy addressed:

Fast-tracking or adding resources to recover delays.

This strategy was treated separately from the proactive strategies because it is mainly associated with recovering time after schedule pressure or delay has emerged.

A methodological limitation is that the tenth item combines two technically different approaches—fast-tracking and adding resources—in one questionnaire item. Therefore, the results for this item are interpreted as a combined recovery strategy rather than as separate estimates for the two approaches.

3.5 Data Collection

Data were collected through a structured questionnaire distributed to construction professionals with relevant project experience. The final dataset contained 58 completed responses. The questionnaire was designed to obtain respondents' professional perceptions and practical experience regarding schedule risks, management strategies, and schedule performance.

The use of practitioner perceptions is consistent with previous construction risk studies. For example, Cheng and Darsa [2] used expert questionnaires alongside project data to identify and rank schedule risk factors, while Mohib [3] collected information from construction practitioners concerning risk factors and risk management techniques in Afghanistan.

3.6 Data Analysis

The collected data were analyzed quantitatively using descriptive and inferential statistical techniques.

Descriptive Statistics

Descriptive statistics were used to summarize:

- Respondent characteristics;
- Mean scores;
- Standard deviations;
- Relative Importance Index (RII);
- Rankings of schedule risk factors;
- Frequency of strategy use;
- Perceived effectiveness of strategies;
- Schedule performance.

For the schedule risk factors, the Relative Importance Index (RII) was calculated as:

$$RII = \frac{\sum W}{A \times N}$$

where:

- W = weight assigned by each respondent;
- A = maximum possible weight, which is 5;
- N = total number of respondents.

Thus, the RII ranges from 0 to 1, with higher values indicating greater perceived importance.

The use of RII is consistent with Cheng and Darsa [2], who applied RII to rank construction schedule risk factors and compare the resulting priorities with their ANN/Garson-based analysis.

Reliability Analysis

Cronbach's alpha was used to assess the internal consistency of the multi-item scales:

- Schedule Risk Factors;
- Strategy Use;
- Strategy Effectiveness;
- Schedule Performance.

Correlation Analysis

Pearson correlation analysis was used to examine the relationship between:

- Overall schedule risk management strategy use and schedule performance;
- Proactive strategy use and schedule performance;
- Reactive/recovery strategy use and schedule performance.

Regression Analysis

Multiple linear regression was conducted to examine the relative contribution of proactive and reactive/recovery strategy use to schedule performance.

The regression model was specified as:

$$SP = \beta_0 + \beta_1(PS) + \beta_2(RS) + \epsilon$$

where:

- SP = Schedule Performance;
- PS = Proactive Strategy Use;
- RS = Reactive/Recovery Strategy Use;
- β_0= constant;
- β_1,β_2 = regression coefficients;
- ϵ = error term.

3.7 Reliability and Measurement Quality

The reliability analysis of the 58 responses produced the following results:

Scale	Cronbach's Alpha	Interpretation
Schedule Risk Factors	0.889	Good
Strategy Use	0.902	Excellent
Strategy Effectiveness	0.873	Good
Schedule Performance	0.791	Acceptable

All four scales demonstrated acceptable internal consistency. The Strategy Use scale showed the highest reliability, with Cronbach's alpha of 0.902.

The relatively high reliability values indicate that the items within each analytical construct provide reasonably consistent measurements. However, the schedule risk-factor scale represents a broad range of different risk types; therefore, its alpha should be interpreted as evidence of internal consistency rather than as evidence that all risk factors represent a single homogeneous underlying construct.

3.8 Ethical Considerations

Participation in the questionnaire was voluntary. Respondents were asked to provide information based on their professional experience, and the analysis was conducted using the collected responses for academic research purposes.

The analysis focuses on aggregate results rather than identifying individual respondents.

3.9 Sample Size and Study Limitations

The final sample consisted of 58 respondents. Although the sample provides useful empirical evidence from construction professionals, the findings should be interpreted within the context of the sample and research design.

First, the study used non-probability sampling; therefore, the findings should not be interpreted as statistically representative of the entire Afghan construction industry.

Second, the sample size of 58 limits the statistical power and generalizability of more complex analyses.

Third, the study relies on respondents' perceptions and professional experiences rather than a large project-level database containing actual planned and achieved completion dates.

Fourth, the cross-sectional nature of the survey allows the study to identify relationships and associations, but it does not establish causal relationships.

Finally, the recovery-strategy item combines fast-tracking and adding resources in a single measure. Future research should assess these strategies separately.

4. Results

4.1 Introduction

This chapter presents the results obtained from the analysis of 58 completed questionnaires. The analysis examines the characteristics of the respondents, the major schedule risk factors, the use of schedule risk management strategies, perceived strategy effectiveness, project schedule performance, reliability of the measurement scales, and the relationships between strategy use and schedule performance.

The results are presented using descriptive statistics, Relative Importance Index (RII), Cronbach's alpha, Pearson correlation, and regression analysis.

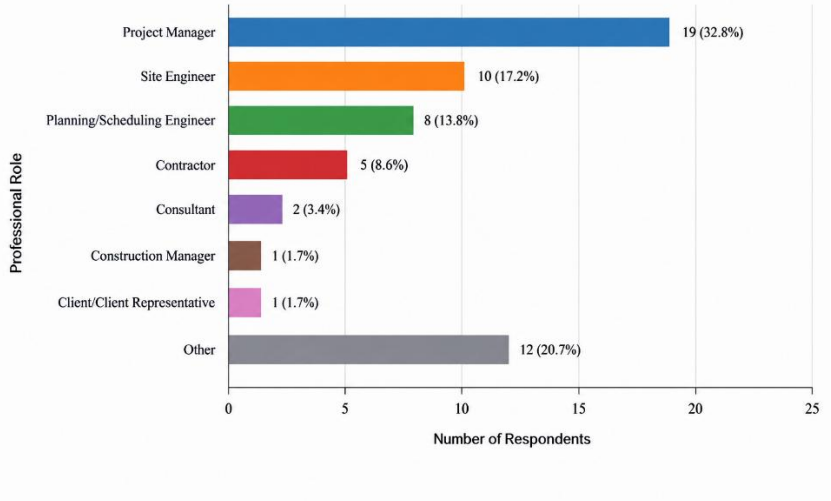
4.2 Respondent Profile

A total of 58 respondents participated in the study. All respondents reported at least three years of construction experience.

Table 4.1. Professional Position of Respondents

Professional Position	Frequency	Percentage
Project Manager	19	32.8%
Site Engineer	10	17.2%
Planning/Scheduling Engineer	8	13.8%
Contractor	5	8.6%
Consultant	2	3.4%
Construction Manager	1	1.7%
Client/Client Representative	1	1.7%
Other	12	20.7%
Total	**58**	**100%**

Figure 1. Distribution of Respondents by Professional Role



Project Managers represented the largest professional group, accounting for 32.8% of the sample. Site Engineers and Planning/Scheduling Engineers represented 17.2% and 13.8%, respectively. The sample therefore included substantial representation from professionals directly involved in project management, site execution, and schedule planning.

Table 4.2. Construction Experience

Experience	Frequency	Percentage
3–5 years	23	39.7%
6–10 years	18	31.0%
11–15 years	7	12.1%
More than 15 years	10	17.2%
Total	**58**	**100%**

The largest group had 3–5 years of experience (39.7%), followed by respondents with 6–10 years of experience (31.0%). Importantly, 60.3% of respondents had more than five years of construction experience, indicating that a substantial proportion of participants had relatively extensive professional exposure.

Table 4.3. Type of Organization

Organization Type	Frequency	Percentage
Government organization	30	51.7%
Contractor/Construction Company	17	29.3%
NGO/Organization	6	10.3%
Client	2	3.4%
Other	3	5.2%
Total	**58**	**100%**

Government organizations constituted the largest organizational category, representing 51.7% of respondents, followed by contractors/construction companies at 29.3%.

Table 4.4. Main Project Type

Project Type	Frequency	Percentage
Building	29	50.0%
Road/Highway	17	29.3%
Water and Irrigation	4	6.9%
Infrastructure	3	5.2%
Bridge	1	1.7%
Other	4	6.9%
Total	**58**	**100%**

Building projects represented exactly half of the respondents' primary project experience, while road/highway projects represented 29.3%. The sample therefore included experience from both building and infrastructure-related construction projects.

4.3 Schedule Risk Factors

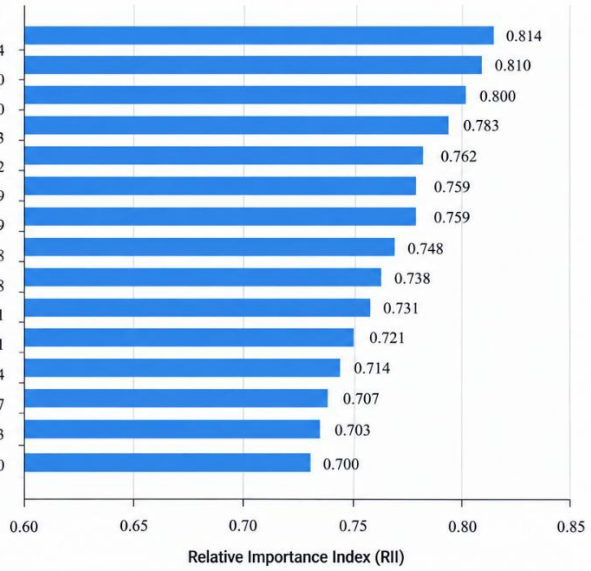
Fifteen schedule risk factors were evaluated using a five-point scale. The overall mean score across the 15 risk factors was:
Overall Mean = 3.76 / 5

This indicates that respondents generally considered the identified factors to have a moderate-to-high influence on construction project schedule delays.

The ranking was calculated using the Relative Importance Index (RII).

Figure 2. Ranking of 15 Schedule Risk Factors

Rank	Schedule Risk Factor	Mean	RII
1	Poor resource management	4.069	0.814
2	Improper planning and scheduling	4.052	0.810
3	Shortage of skilled workers/low productivity	4.000	0.800
4	Poor project/site management	3.905	0.783
5	Unrealistic project duration	3.810	0.762
6	Payment delays	3.793	0.759
7	Procurement/material delivery delay	3.793	0.759
8	Design problems	3.741	0.748
9	Contract/scope changes	3.690	0.738
10	Financial constraints	3.655	0.731
11	Equipment/material shortage	3.603	0.721
12	Poor coordination and communication	3.569	0.714
13	Weather and natural conditions	3.534	0.707
14	Legal and regulatory issues	3.517	0.703
15	Security/social-political instability	3.500	0.700



Note: Mean values are based on a 5-point Likert scale. RII = Relative Importance Index.

4.3.1 Highest-Ranked Risks

The highest-ranked risk was poor resource management, with a mean of 4.07 and RII of 0.814. This was followed closely by improper planning and scheduling, with a mean of 4.05 and RII of 0.810.

The third-ranked factor was shortage of skilled workers and low productivity, with a mean of 4.00 (RII = 0.800), followed by poor project/site management, with a mean of 3.91 (RII = 0.783).

These results indicate that the most strongly perceived schedule risks in the current sample are predominantly managerial, planning, and resource-related risks rather than purely external risks.

This finding is particularly relevant when compared with previous Afghan research. Mohib [3] identified poor management, material supply delays, security, and social disruption among important causes of projects falling behind schedule. The present study similarly identifies management and resource-related issues as highly important, although the relative ranking of individual factors differs.

The results also correspond with Cheng and Darsa's [2] findings that poor resource management and material delivery delay were among the highest-ranked schedule risk factors using the RII approach.

4.3.2 Security as a Schedule Risk

An important finding is that security/social-political instability ranked 15th, with a mean of 3.50 and RII of 0.700.

This result should not be interpreted as indicating that security is unimportant in Afghanistan generally. Rather, it indicates that within this particular sample and relative to the other 14 factors assessed, respondents assigned a comparatively lower ranking to security-related schedule risk.

This difference is noteworthy because previous Afghan studies have reported security as an important contributor to construction delays. Mohib [3], for example, identified security issues among the main causes of projects falling behind schedule. Recent Afghanistan research has also specifically examined security-related causes of construction delays.

The difference may reflect variations in project context, respondent composition, project type, geographic conditions, and the relative importance of managerial risks within the projects represented by the current respondents. Therefore, this finding should be interpreted as a sample-specific result rather than a national conclusion.

4.4 Use of Schedule Risk Management Strategies

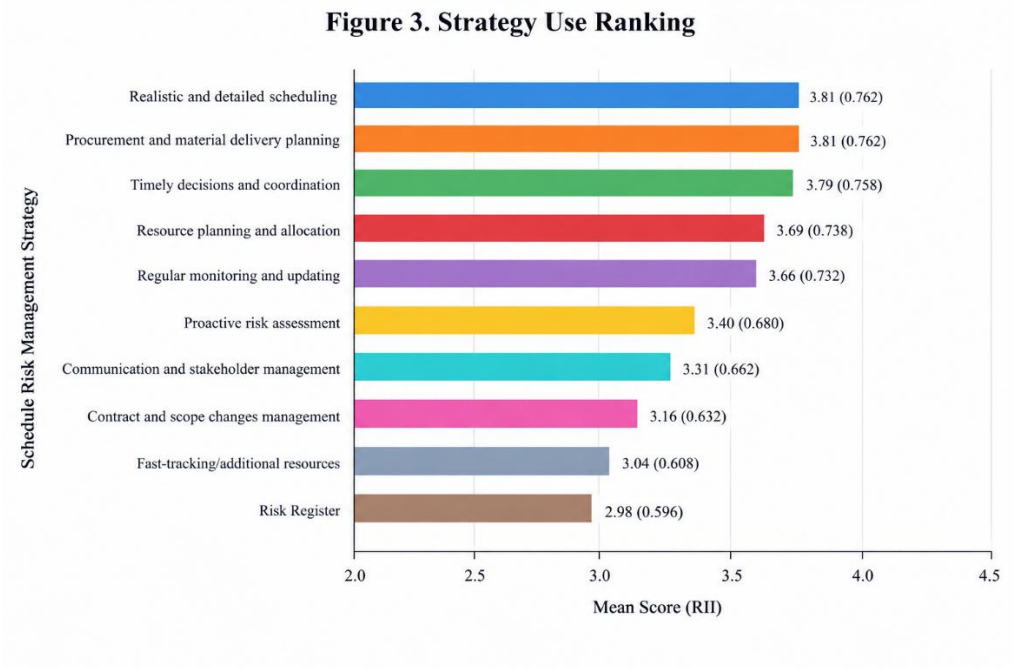
Respondents evaluated ten schedule risk management strategies according to how frequently they were used in projects with which they had experience.

The overall mean for strategy use was:

Overall Strategy Use Mean = 3.57 / 5

This indicates that schedule risk management strategies were generally used between sometimes and often, but their application was not consistently high across all strategies.

Figure 3. Strategy Use Ranking



The most frequently used strategies were realistic and detailed scheduling and procurement/material delivery planning and monitoring, both with a mean of 3.81.

The lowest-used strategy was Risk Register creation and updating, with a mean of only 2.98.

This result is particularly important because Amin et al. [4] reported that structured and proactive risk management practices in Afghanistan remain limited and that projects often rely on experience-based approaches rather than standardized risk management practices.

The low use of Risk Registers in the current sample provides empirical support for this broader observation.

4.5 Perceived Effectiveness of Schedule Risk Management Strategies

Respondents also evaluated how effective each strategy was perceived to be in reducing schedule delays.

The overall mean effectiveness score was:

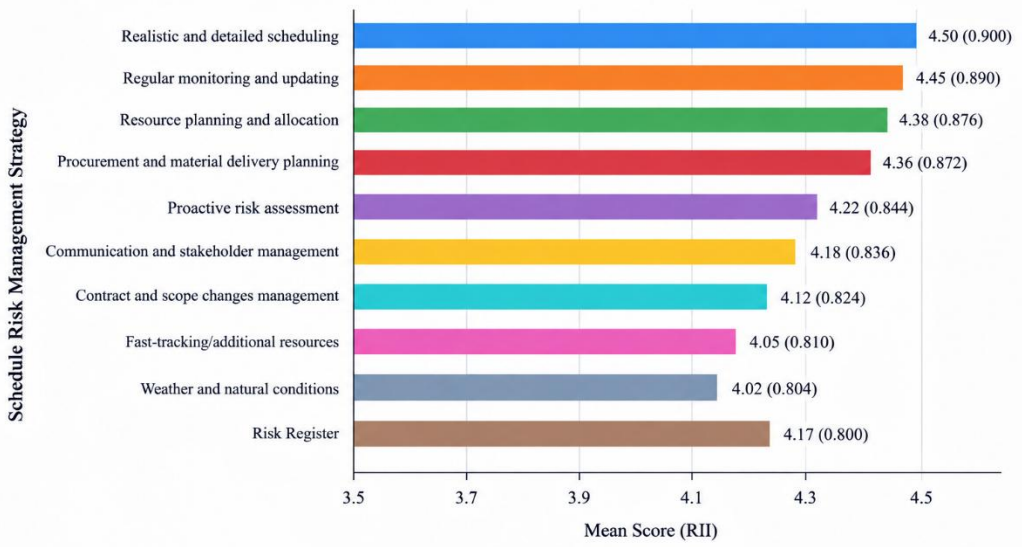
Overall Strategy Effectiveness Mean = 4.28 / 5

This is considerably higher than the overall strategy-use mean of 3.57.

Table 4.5. Perceived Effectiveness of Strategies

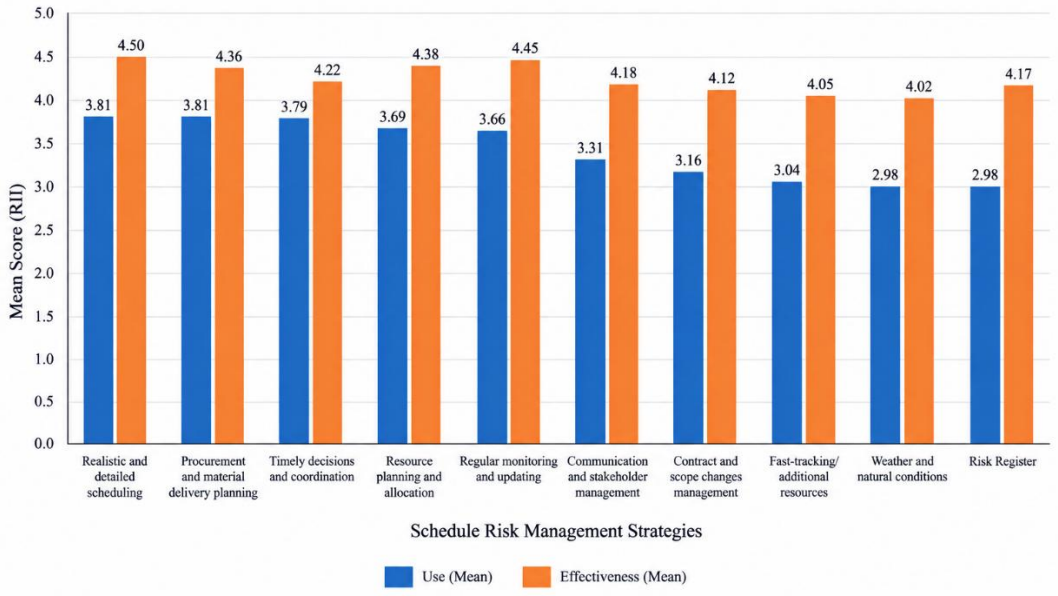
Rank	Strategy	Mean	RII
1	Realistic and detailed schedule	4.50	0.900
2	Regular schedule monitoring/updating	4.45	0.890
3	Effective resource planning/allocation	4.38	0.876
4	Procurement/material delivery planning	4.36	0.872
5	Timely decisions, approvals and coordination	4.35	0.869
6	Proactive schedule risk assessment	4.22	0.845
7	Early design review/change control	4.21	0.841
8	Risk Register creation/updating	4.17	0.834
9	Time contingency/buffer	4.12	0.824
10	Fast-tracking/additional resources	4.05	0.810

Figure 4. Strategy Effectiveness Ranking



Note: Mean values are based on a 5-point Likert scale. RII = Relative Importance Index.

Figure 5. Strategy Use vs Effectiveness



The most effective strategy was perceived to be realistic and detailed scheduling, with a mean of 4.50. Regular schedule monitoring and updating ranked second at 4.45, while effective resource planning ranked third at 4.38.

An important result is the difference between Risk Register use and Risk Register effectiveness:

- Use: Mean = 2.98
- Effectiveness: Mean = 4.17

The difference is approximately 1.19 points.

This suggests that respondents generally believe Risk Registers can be effective in reducing schedule delays, while their actual use in experienced projects is considerably lower.

This finding is consistent with the broader concern identified by Amin et al. [4] regarding limited application of proactive and structured risk management practices in Afghanistan.

4.6 Schedule Performance

Four items were used to assess project schedule performance.

The overall schedule performance mean was:

Overall Schedule Performance Mean = 3.73 / 5

Table 4.6. Schedule Performance

Rank	Schedule Performance Indicator	Mean	RII
1	Project achieved planned completion date	3.93	0.786
2	Schedule regularly compared/controlled against baseline	3.76	0.752
3	Delays effectively controlled/recovered	3.69	0.738
4	Overall schedule performance satisfactory	3.55	0.710
	Overall	3.73	0.746

The highest-rated performance indicator was the ability of projects to achieve their planned completion dates, with a mean of 3.93.

The lowest-rated item was overall satisfaction with schedule performance, with a mean of 3.55.

Overall, the results indicate a moderate level of schedule performance, with clear room for improvement in schedule control and delay management.

4.7 Reliability Analysis

Cronbach's alpha was calculated for the four principal analytical scales.

Table 4.7. Reliability Analysis

Construct	Number of Items	Cronbach's Alpha
Schedule Risk Factors	15	0.889
Strategy Use	10	0.902
Strategy Effectiveness	10	0.873
Schedule Performance	4	0.791

All four scales achieved acceptable reliability. The Strategy Use scale showed the highest internal consistency ($\alpha = 0.902$), while Schedule Performance also demonstrated acceptable reliability ($\alpha = 0.791$).

Therefore, the measurement scales provide a suitable level of internal consistency for the subsequent correlation and regression analyses.

4.8 Relationship Between Strategy Use and Schedule Performance

Pearson correlation analysis was conducted to examine the relationship between overall schedule risk management strategy use and schedule performance.

The results were:

$r = 0.339$, $p = 0.009$, $N = 58$

This represents a positive and statistically significant relationship between the use of schedule risk management strategies and schedule performance.

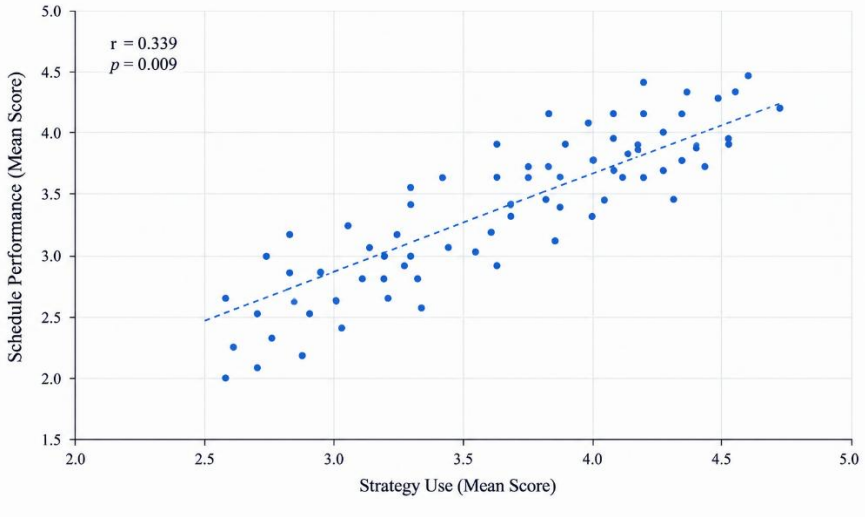
In other words, respondents reporting greater use of schedule risk management strategies also tended to report better schedule performance.

Therefore:

H1 is supported.

However, the correlation coefficient is moderate-to-low in magnitude, indicating that schedule management strategy use is associated with schedule performance but does not explain all variation in schedule performance.

Figure 6. Strategy Use vs Schedule Performance



The scatter plot illustrates the positive direction of the relationship between schedule risk management strategy use and schedule performance. Although the relationship is statistically significant, the correlation coefficient indicates a moderate-to-low association, suggesting that strategy use is only one of several factors associated with schedule performance.
In other words, respondents reporting greater use of schedule risk management strategies also tended to report better schedule performance.
Therefore:
H1 is supported.

4.9 Proactive Strategies and Schedule Performance

The first nine strategy items were combined to represent Proactive Schedule Risk Management Strategy Use.
Pearson correlation produced:
$r = 0.348$, $p = 0.007$, $N = 58$
The relationship is positive and statistically significant.
Thus, greater use of proactive strategies was associated with better reported schedule performance.
Therefore:
H2 is supported.
This finding is particularly important in the Afghanistan context because Amin et al. [4] reported that consistent application of proactive and structured risk management remains limited in Afghan construction practice.
The current findings suggest that increasing the implementation of such proactive practices may be associated with better schedule outcomes, although the cross-sectional design does not allow a causal conclusion.

4.10 Reactive/Recovery Strategy and Schedule Performance

The tenth strategy—fast-tracking or adding resources to recover delays—was analyzed separately as the reactive/recovery measure.
The correlation result was:
$r = 0.154$, $p = 0.249$
The relationship was positive but not statistically significant at the 0.05 level.
Therefore:
There is insufficient statistical evidence to support H3 as a definitive hypothesis.
This result should be interpreted carefully. It does not mean that fast-tracking or adding resources is ineffective in all circumstances. Rather, the current data do not show a statistically significant relationship between the reported use of this combined recovery strategy and schedule performance.

4.11 Multiple Regression Analysis

A multiple linear regression model was conducted using:

- Proactive strategy use;
- Reactive/recovery strategy use

as predictors of schedule performance.

Table 4.8. Multiple Regression Results

Predictor	B	p-value
Constant	2.706	<0.001
Proactive strategy use	0.330	0.015
Reactive/recovery strategy	−0.045	0.647

Model statistics:

- $R^2 = 0.124$
- Adjusted $R^2 = 0.092$
- $F = 3.903$
- $p = 0.026$
- $N = 58$

The overall regression model was statistically significant ($p = 0.026$).
The model explains approximately 12.4% of the variance in schedule performance, while the adjusted R^2 indicates that approximately 9.2% remains explained after adjustment for the number of predictors.
The proactive strategy variable had a statistically significant positive coefficient:
$B = 0.330$, $p = 0.015$
This indicates that higher proactive strategy use was associated with higher schedule performance scores when the recovery strategy variable was included in the model.
The reactive/recovery variable was not statistically significant:
$B = -0.045$, $p = 0.647$

Therefore, the regression results provide further evidence that proactive strategy use has a stronger statistical relationship with schedule performance than the combined reactive/recovery measure.

However, because of the sample size, cross-sectional design, and combined measurement of fast-tracking and additional resources, this result should be considered exploratory rather than definitive evidence of superiority.

4.12 Summary of Hypothesis Testing

Table 4.9. Hypothesis Testing

Hypothesis	Statistical Result	Decision
H1: Schedule risk management practices have a significant positive relationship with schedule performance.	r = 0.339, p = 0.009	Supported
H2: Proactive strategies have a significant positive relationship with schedule performance.	r = 0.348, p = 0.007	Supported
H3: Proactive strategies have a stronger relationship with schedule performance than reactive/recovery strategies.	Proactive: r = 0.348, p = 0.007; Recovery: r = 0.154, p = 0.249	Exploratory support / not definitive

The regression analysis strengthens the interpretation for H2 because proactive strategy use remained statistically significant when the recovery strategy was included in the model (B = 0.330, p = 0.015).

4.13 Analysis of Open-Ended Responses

The final questionnaire item asked respondents to identify the most important action for reducing delays in Afghan construction projects.

The responses generally emphasized several recurring areas:

- Better planning and scheduling;
- Stronger project management and monitoring;
- Adequate and skilled human resources;
- Timely financial/payment management;
- Timely procurement and availability of materials;
- Improved coordination and communication;
- Better design/document control;
- Proactive risk identification and response.

These qualitative responses broadly support the quantitative findings, particularly the high ranking of resource management, planning/scheduling, skilled labor, and project management as major schedule risks.

Several responses also emphasized the need for an integrated approach rather than relying on a single intervention. This is consistent with Mohib's [3] recommendation for stronger risk-management involvement and appropriate technical expertise in construction projects in Afghanistan.

4.14 Overall Findings

The analysis of 58 responses produced five major findings.

First, managerial and resource-related factors were the most important perceived schedule risks. Poor resource management (RII = 0.814) and improper planning and scheduling (RII = 0.810) ranked first and second.

Second, schedule risk management strategies were used at a moderate level overall (Mean = 3.57), with realistic scheduling and procurement planning being among the most frequently used strategies.

Third, respondents perceived the strategies as highly effective overall (Mean = 4.28). Realistic scheduling (Mean = 4.50) and regular schedule monitoring/updating (Mean = 4.45) were considered the most effective.

Fourth, a substantial implementation gap was observed for the Risk Register. Although its perceived effectiveness was high (Mean = 4.17), its reported use was comparatively low (Mean = 2.98).

Fifth, schedule risk management strategy use had a statistically significant positive relationship with schedule performance (r = 0.339, p = 0.009). Proactive strategy use also showed a significant positive relationship (r = 0.348, p = 0.007), whereas the combined reactive/recovery strategy did not show a significant relationship (r = 0.154, p = 0.249). The regression model further showed that proactive strategy use was a significant predictor of schedule performance (B = 0.330, p = 0.015).

5. DISCUSSION

5.1 Introduction

This chapter discusses the findings of the study in relation to the research objectives, hypotheses, and previous studies on construction schedule risk management. The discussion focuses on four main areas: the major schedule risk factors identified by respondents, the use and perceived effectiveness of schedule risk management strategies, the relationship between these strategies and schedule performance, and the relative contribution of proactive and reactive/recovery strategies.

The study was conducted using 58 valid questionnaire responses from construction professionals with relevant experience. The findings provide empirical evidence regarding how schedule risks are perceived and managed in the context of Afghanistan construction projects. Because the study uses a cross-sectional questionnaire design, the results are interpreted as relationships and associations rather than evidence of direct causality.

5.2 Major Schedule Risk Factors

The findings indicate that schedule risks in the surveyed construction projects are strongly associated with management, planning, and resource-related problems. The overall mean of the 15 assessed risk factors was 3.76 out of 5, indicating a moderate-to-high perceived level of schedule risk.

The three highest-ranked factors were poor resource management (Mean = 4.07; RII = 0.814), improper planning and scheduling (Mean = 4.05; RII = 0.810), and shortage of skilled workers/low productivity (Mean = 4.00; RII = 0.800). Poor project/site management was ranked fourth (Mean = 3.91; RII = 0.783).

The high ranking of these factors suggests that many of the major schedule problems perceived by respondents are related to factors that are potentially manageable within the project organization. In particular, inadequate resource allocation, weak planning, insufficient skilled labor, and site-management weaknesses can directly affect activity sequencing, productivity, resource availability, and the ability to maintain the planned schedule.

This finding is consistent with the broader construction risk literature. Cheng and Darsa [2], using RII as one of their analytical methods, identified poor resource management among the highest-ranked schedule risk factors in their study of construction projects in Ethiopia. Their study also developed management strategies for highly influential schedule risk factors and found that improvements in important risk factors could contribute to reducing schedule delays [2].

The findings are also consistent with previous research in Afghanistan. Mohib [3] identified poor management, material supply problems, financial issues, and other project-related risks as important contributors to construction project difficulties in Afghanistan. The similarity in the importance of management-related factors suggests that improving project planning, resource management, and managerial capacity should remain an important component of schedule improvement in Afghan construction projects.

The fifth-ranked risk, unrealistic project duration (Mean = 3.81; RII = 0.762), is also important because it is closely related to the quality of project planning. An unrealistic duration can create schedule pressure from the beginning of a project and reduce the ability of project teams to absorb normal variations in activity duration, procurement, resources, and approvals. This finding supports Hulett's [1] argument that schedule risk can originate from unrealistic estimates, underdeveloped schedules, unrealistic constraints, and insufficient consideration of schedule uncertainty.

5.3 Financial, Procurement, and Contractor-Related Risks

Payment delays and procurement/material delivery delays were also among the relatively important risks. Payment delays had a mean of 3.79, while procurement/material delivery delay had a mean of 3.79.

These findings indicate that schedule performance cannot be considered independently of financial and supply-chain conditions. Delayed payments may affect contractors' ability to maintain labor, purchase materials, mobilize equipment, and continue project activities. Similarly, delayed material procurement or delivery can interrupt activity sequences and create idle time for labor and equipment.

The importance of these factors is also reflected in international schedule-risk research. Cheng and Darsa [2] identified delay in payment and delay in material delivery among the important schedule-related risk factors and developed management strategies for these areas.

The results therefore suggest that schedule risk management in Afghanistan should not be limited to the preparation of project schedules. Effective schedule control requires coordination between planning, financial management, procurement, resource allocation, and project execution.

5.4 Security and Social-Political Risks

One of the more interesting findings of this study is the relatively low ranking of security/social-political instability, which ranked 15th with a mean of 3.50 and RII = 0.700.

This finding differs from some previous Afghanistan studies that have identified security as an important contributor to construction delays. Mohib [3], for example, reported security among the important causes affecting construction project schedules. Other recent research has also specifically investigated security-related factors as causes of construction delays in Afghanistan.

The difference should not be interpreted to mean that security is generally unimportant in Afghanistan. Rather, it suggests that within the projects and respondents represented in this study, managerial, planning, and resource-related risks were perceived as relatively more important than security-related risks.

Differences between studies may result from variations in project type, geographical conditions, organizational context, respondent characteristics, and the period in which the projects were implemented. Therefore, the present result should be regarded as a finding specific to the study sample rather than a general conclusion about all construction projects in Afghanistan.

5.5 Use of Schedule Risk Management Strategies

The overall mean for the use of schedule risk management strategies was 3.57 out of 5. This indicates that the strategies were generally used at a moderate level, but their implementation was not uniform across all practices.

The most frequently used strategies were realistic and detailed scheduling and procurement/material delivery planning and monitoring, both with a mean of 3.81. Timely decisions, approvals and coordination and regular schedule monitoring were also relatively frequently used.

This pattern indicates that construction organizations tend to apply conventional project-control practices such as scheduling, monitoring, procurement planning, and coordination. However, more formal risk-management practices appear to be less consistently implemented.

The most notable example is the Risk Register, which had the lowest use score, with a mean of only 2.98. This suggests that although project professionals may recognize schedule risks, systematic documentation and continuous tracking of identified risks are not being implemented to the same extent as more traditional schedule-control activities.

This finding is particularly relevant to the research of Amin et al. [4], who reported that structured and proactive risk management practices remain limited in Afghanistan construction projects and that organizations often depend on experience rather than systematic risk management approaches.

The present study provides further evidence of this implementation gap at the level of schedule risk management.

5.6 Perceived Effectiveness of Schedule Risk Management Strategies

Although the reported use of strategies was moderate, their perceived effectiveness was relatively high. The overall effectiveness mean was 4.28 out of 5.

The most effective strategy was realistic and detailed scheduling (Mean = 4.50), followed by regular schedule monitoring and updating (Mean = 4.45), resource planning and allocation (Mean = 4.38), and procurement/material delivery planning (Mean = 4.36).

These findings are important because they show that practitioners generally recognize the value of proactive schedule management practices even when these practices are not always implemented at a high frequency.

The result for the Risk Register is particularly informative. Respondents rated its effectiveness at 4.17, but its use was only 2.98. This produces an implementation gap of approximately 1.19 points.

This difference suggests that the problem may not necessarily be a lack of awareness of the value of formal risk management. Instead, the problem may involve implementation, institutionalization, skills, procedures, or organizational commitment.

This interpretation is consistent with Amin et al. [4], who found that the implementation of structured risk management practices in Afghan construction projects remains limited.

Consequently, construction organizations may benefit not simply from training professionals to identify risks, but from integrating risk registers, schedule risk reviews, responsibility assignments, and monitoring procedures into routine project-control systems.

5.7 Schedule Performance

The overall schedule performance mean was 3.73 out of 5, indicating a moderate level of perceived schedule performance.

The highest-rated performance indicator was achieving the planned completion date (Mean = 3.93). Schedule comparison and control against the baseline received a mean of 3.76, while delay control/recovery received 3.69. Overall satisfaction with schedule performance had the lowest mean of 3.55.

These findings suggest that although respondents generally reported reasonable schedule performance, there remains considerable room for improvement, particularly in systematic schedule control and the overall ability to maintain project schedules.

The relatively high effectiveness scores for schedule management strategies compared with the moderate schedule performance score also suggest that the existence of effective practices alone may not guarantee strong schedule performance. Their consistent and systematic implementation is likely to be important.

5.8 Relationship Between Schedule Risk Management and Schedule Performance

The correlation analysis provides an important finding for the main research question.

The use of schedule risk management strategies had a statistically significant positive relationship with schedule performance:

$r = 0.339$, $p = 0.009$

This means that respondents who reported greater use of schedule risk management strategies also tended to report better schedule performance.

Therefore, H1 is supported.

The correlation is positive but moderate in magnitude. This indicates that schedule risk management practices are associated with schedule performance, but they are not the only factors influencing project schedule outcomes.

This is reasonable because construction schedule performance can also be affected by financial conditions, contractual arrangements, client decisions, design quality, external conditions, contractor capability, market conditions, and other factors not fully captured by the present model.

The result supports the general argument in previous construction risk studies that effective management of important schedule risks can contribute to improved schedule outcomes. Cheng and Darsa [2], for example, found that improvements in important schedule risk factors could significantly reduce schedule delays in their study context.

However, because the present study is cross-sectional, the finding should be expressed as a significant positive association, rather than claiming that strategy use directly causes better schedule performance.

5.9 Proactive Strategies and Schedule Performance

The relationship between proactive strategy use and schedule performance was also statistically significant:

$r = 0.348$, $p = 0.007$

This result provides support for H2.

The finding suggests that project teams reporting greater use of proactive strategies—such as realistic scheduling, regular monitoring, proactive risk assessment, risk registers, time buffers, resource planning, procurement planning, design review, and timely coordination—also tend to report better schedule performance.

The finding is particularly important in light of the current risk-management environment in Afghanistan. Amin et al. [4] found that proactive and structured risk management practices remain limited in Afghan construction projects.

The present findings suggest that strengthening proactive practices may be an important area for improving schedule management. However, again, the result demonstrates an association rather than causation.

5.10 Reactive/Recovery Strategies and Schedule Performance

The combined reactive/recovery strategy—fast-tracking or adding resources to recover delays—showed a positive but statistically non-significant relationship with schedule performance:

$r = 0.154$, $p = 0.249$

Therefore, there is insufficient statistical evidence to establish a significant relationship between this recovery measure and schedule performance in the present sample.

This does not mean that fast-tracking or additional resources are ineffective. Such measures can be important when projects experience delays and require recovery actions. Rather, the current data suggest that the reported use of this combined recovery measure was not significantly associated with schedule performance.

One possible interpretation is that recovery strategies are generally implemented after schedule problems have already developed, whereas proactive strategies seek to prevent or reduce the effects of risks before they become serious delays.

A second consideration is the measurement itself. Fast-tracking and adding resources are technically different strategies, but they were combined into one questionnaire item. Therefore, the result cannot determine whether one of these approaches is more effective than the other.

5.11 Proactive Versus Reactive/Recovery Strategies

The comparison between proactive and reactive/recovery strategies is one of the central contributions of this study.

The correlation coefficients were:

Proactive strategies: $r = 0.348$, $p = 0.007$

Reactive/recovery strategy: $r = 0.154$, $p = 0.249$

In addition, the regression analysis showed that proactive strategy use remained a significant predictor of schedule performance:

$B = 0.330$, $p = 0.015$

while the recovery strategy was not significant:

$B = -0.045$, $p = 0.647$

The overall regression model was significant:

$R^2 = 0.124$; Adjusted $R^2 = 0.092$; $p = 0.026$

These findings provide exploratory support for the proposition that proactive strategies have a stronger relationship with schedule performance than the measured reactive/recovery strategy.

However, H3 should not be presented as conclusively proven. The sample size is relatively small, the design is cross-sectional, and the recovery variable combines two different strategies. Therefore, the evidence is better described as preliminary or exploratory support.

5.12 Comparison with Previous Research in Afghanistan

The findings of the present study both support and extend previous research on construction risk management in Afghanistan.

Mohib [3] highlighted poor management, material supply problems, security, and other risks as important issues in Afghan construction projects. The current study similarly identifies management, planning, labor, resource, and material-related risks among the most important schedule risks.

Amin et al. [4] found that risk management in Afghan construction projects remains underdeveloped and that proactive and structured approaches are not consistently implemented. The current study supports this observation, particularly through the low reported use of the Risk Register despite its high perceived effectiveness.

The present study extends these findings by explicitly examining the relationship between **strategy use and schedule performance**. This provides a different perspective from studies that primarily focus on identifying risk factors or describing general risk-management practices.

5.13 Practical Implications

The findings have several practical implications for construction organizations in Afghanistan.

First, greater attention should be given to realistic planning and scheduling. Since improper planning and scheduling ranked among the highest schedule risks and realistic detailed scheduling was rated the most effective strategy, organizations should improve the quality of baseline schedules before project execution.

Second, resource planning should be strengthened. Poor resource management was the highest-ranked risk, while resource planning was among the highest-rated strategies in terms of effectiveness.

Third, organizations should strengthen regular schedule monitoring and updating rather than treating the baseline schedule as a static document.

Fourth, the implementation of Risk Registers should be improved. The large difference between perceived effectiveness and actual use indicates an opportunity for improvement.

Fifth, procurement and material delivery should be integrated into schedule risk management rather than treated as a separate procurement function.

Finally, project organizations should emphasize proactive risk management alongside conventional schedule control. The significant relationship between proactive strategy use and schedule performance provides empirical support for this direction.

5.14 Discussion Summary

Overall, the findings indicate that schedule risks in the surveyed Afghan construction projects are dominated by managerial, planning, resource, labor, and procurement-related issues.

Although respondents generally perceived schedule risk management strategies as highly effective, their actual use was only moderate. The most significant implementation gap concerned Risk Registers, which were perceived as effective but were comparatively underused.

Most importantly, the study found a statistically significant positive relationship between schedule risk management strategy use and schedule performance. Proactive strategy use also showed a significant positive relationship with schedule performance, while the measured reactive/recovery strategy did not.

These findings support the importance of moving from primarily reactive responses toward more systematic and proactive schedule risk management in Afghanistan construction projects.

6. Conclusion

6.1 Conclusion

The main purpose of this study was to assess schedule risk management strategies in Afghanistan construction projects and examine their relationship with project schedule performance.

The study identified poor resource management, improper planning and scheduling, shortage of skilled workers/low productivity, poor project/site management, and unrealistic project duration as the five highest-ranked schedule risks.

These findings indicate that schedule delays in the surveyed projects are strongly associated with internal project-management and resource-related conditions. Therefore, improving schedule performance requires attention not only to external risks but also to the way projects are planned, staffed, resourced, monitored, and managed.

The study also found that schedule risk management strategies were used at a moderate level (Mean = 3.57), while their perceived effectiveness was considerably higher (Mean = 4.28). This difference indicates that construction professionals generally recognize the value of schedule risk management practices but do not always implement them consistently.

A particularly important finding was the low use of Risk Registers (Mean = 2.98) compared with their high perceived effectiveness (Mean = 4.17). This represents an implementation gap of approximately 1.19 points and suggests that formal risk documentation and monitoring require greater attention in construction organizations.

The study further found a statistically significant positive relationship between overall schedule risk management strategy use and schedule performance:

$r = 0.339$, $p = 0.009$

Therefore, H1 was supported.

Proactive schedule risk management strategies also had a statistically significant positive relationship with schedule performance:

$r = 0.348$, $p = 0.007$

Thus, H2 was supported.

In contrast, the combined reactive/recovery strategy of fast-tracking or adding resources did not show a statistically significant relationship with schedule performance:

$r = 0.154$, $p = 0.249$

The regression analysis further indicated that proactive strategy use was a significant predictor of schedule performance ($B = 0.330$, $p = 0.015$), while the reactive/recovery measure was not significant ($B = -0.045$, $p = 0.647$). The overall model explained approximately 12.4% of the variance in schedule performance.

Consequently, the study provides exploratory support for H3, but the hypothesis should not be regarded as conclusively established because of the sample size, cross-sectional design, and combined measurement of fast-tracking and additional resources.

Overall, the findings suggest that improving construction schedule performance in Afghanistan requires greater emphasis on proactive, structured, and continuous schedule risk management, rather than relying predominantly on recovery actions after delays have already occurred.

6.2 Recommendations

Based on the findings, the following recommendations are proposed.

6.2.1 Strengthen Project Planning and Scheduling

Because improper planning and scheduling was one of the highest-ranked risks, construction organizations should place greater emphasis on developing realistic and detailed baseline schedules.

Schedules should be developed using realistic activity durations, resource requirements, procurement constraints, project dependencies, and reasonable contingency rather than overly optimistic completion targets.

6.2.2 Improve Resource Management

Poor resource management was the highest-ranked schedule risk.

Project managers should therefore improve:

- Labor planning;
- Skilled workforce allocation;
- Equipment planning;
- Material planning;
- Resource productivity monitoring;
- Resource allocation according to the schedule.

Resource plans should be linked directly to the project baseline schedule and updated when project conditions change.

6.2.3 Institutionalize Risk Registers

The low use of Risk Registers despite their high perceived effectiveness is one of the clearest findings of this study.

Construction organizations should require project teams to establish a Schedule Risk Register during project planning and update it regularly throughout implementation.

The Risk Register should include at least:

- Risk description;
- Probability;
- Schedule impact;
- Risk owner;
- Response strategy;
- Planned action;
- Current status;
- Review date.

This would help transform risk management from an informal activity into a routine project-control process.

6.2.4 Strengthen Regular Schedule Monitoring

Regular monitoring and updating was ranked as one of the most effective strategies.

Project teams should periodically compare actual progress against the baseline schedule and identify:

- Activities behind schedule;
- Critical-path changes;
- Resource constraints;
- Procurement delays;
- Emerging risks;
- Required corrective actions.

Schedule monitoring should be continuous rather than performed only when a major delay has already occurred.

6.2.5 Integrate Procurement with Schedule Management

Because material procurement and delivery delay was among the important schedule risks, procurement activities should be incorporated into the project schedule.

Long-lead materials should be identified during early planning, and procurement milestones should be monitored alongside construction activities.

6.2.6 Improve Early Design Review and Change Control

Design problems and contract/scope changes were identified as relevant schedule risks.

Project organizations should conduct early design reviews and establish clear procedures for:

- Design verification;
- Drawing approval;
- Change requests;
- Change-order evaluation;
- Impact assessment on time;
- Communication of approved changes.

This can reduce the possibility of design-related disruptions during construction.

6.2.7 Improve Coordination and Decision-Making

Although poor coordination and communication ranked relatively lower among the 15 risks, timely decisions and coordination were among the most frequently used and highly effective strategies.

Regular coordination meetings and clearly defined responsibilities can help reduce delays caused by waiting for information, approvals, instructions, or decisions.

6.2.8 Develop Risk Management Capacity

Previous Afghan research has identified limited awareness and implementation of structured risk management as an important challenge. The present findings support the need for strengthening organizational capacity in this area.

Construction organizations should provide practical training in:

- Schedule risk identification;
- Risk assessment;
- Risk Register preparation;
- Schedule risk response;
- Schedule monitoring;
- Risk review and reporting.

Risk management responsibilities should also be clearly assigned rather than treated as an informal responsibility of the project manager alone.

6.2.9 Use Reactive Strategies as Recovery Measures, Not Primary Risk Management

Fast-tracking and adding resources can remain important tools for recovering delays. However, based on the present findings, organizations should not rely on recovery strategies as a substitute for proactive risk management.

Where recovery measures are required, they should be supported by an assessment of their effect on:

- Cost;
- Quality;
- Safety;
- Resource availability;
- Critical activities;
- Remaining project duration.

6.3 Recommendations for Future Research

Future studies could improve upon the present research in several ways.

First, future research should use a larger and more geographically diverse sample covering different regions and project environments in Afghanistan.

Second, future studies should collect project-level objective data, including planned duration, actual duration, percentage of delay, baseline changes, and actual risk events.

Third, future research should examine fast-tracking and adding resources as separate strategies, rather than combining them into one questionnaire item.

Fourth, longitudinal research could investigate how schedule risk management practices change throughout the project lifecycle and whether changes in management practices correspond with subsequent schedule outcomes.

Fifth, future studies could examine differences between:

- Building and infrastructure projects;
- Public and private projects;
- Government and contractor organizations;
- Small and large projects;
- Projects with and without formal project-control systems.

Finally, future research could develop a more comprehensive statistical model incorporating other factors such as project complexity, contract type, financial conditions, contractor capability, client decision-making, and external risks.

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