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Evaluating Risk Identification Methods in Construction Projects: A Case Study from Western Province of Sri Lanka

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Abstract: ***This study evaluates how effectively risks are identified in construction projects within Sri Lanka's rapidly urbanizing Western Province. Given the complexity of the construction sector and its importance to economic growth, the research explores current practices, the accuracy of risk detection methods, and the adaptability of existing tools. Through qualitative analysis involving interviews and thematic assessment, the study reveals gaps in technological adoption and highlights practical challenges. Findings lead to actionable recommendations aimed at improving risk management strategies, ultimately contributing to more efficient and resilient construction practices in the region.***

Keywords: Construction management, Risk identification, Sri Lanka, Project risks, Risk management

1. Introduction

The construction industry is inherently complex, with multifaceted challenges and uncertainties that necessitate robust risk identification practices. Risk identification is a fundamental step in risk management, serving as the basis for mitigating potential disruptions, ensuring project success, and enhancing overall efficiency. Effective risk identification not only minimizes project delays and cost overruns but also contributes to sustainable construction practices. Globally, construction projects face diverse risks from financial constraints, safety hazards, environmental conditions, and stakeholder mismanagement. These risks require systematic approaches to identify and address them effectively.

Numerous studies have explored risk identification approaches in construction projects worldwide. Carter and Smith (2006) [1] emphasized the importance of safety hazard identification in reducing workplace accidents on construction sites. Sharma and Gupta (2019) [2] highlighted the need for systematic methods to address dynamic challenges in modern construction projects. Advanced techniques such as the Delphi method have been employed to enhance risk identification accuracy in large-scale projects Furthermore, Banerjee et al. (2021) [13] introduced machine learning models for risk prediction in mega construction projects, demonstrating the potential of technology-driven solutions.

In Sri Lanka, the construction industry plays a pivotal role in economic development but faces unique challenges due to its socio-economic and environmental context. Studies have identified critical risks such as financial instability (Rajakaruna et al., 2008) [3], regulatory barriers (Ganganath et al., 2023) [4], environmental hazards, and project-specific challenges. These issues highlight the need for systematic risk management strategies tailored to the country's specific conditions. For example, Perera et al. (2014) [5] explored risk management practices in road construction projects using the Delphi method to prioritize risks effectively. Similarly, Bandaranaike et al. (2024) [6] examined barriers and enablers to risk management in SMEs within the Sri Lankan construction sector. Financial risks associated with high-rise apartment building construction and water supply projects (Perera et al., 2020) and (Senanayake et al., 2025) [7], [8] further highlight the need for tailored risk management strategies.

Despite these studies, there remains a gap in understanding how risk identification approaches are utilized specifically in the Western Province of Sri Lanka, a region marked by rapid urbanization and high construction activity. This study aims to address this gap by exploring current practices, challenges, and opportunities for improvement in risk identification within this region. By examining local conditions and leveraging insights from existing research, this study seeks to provide actionable recommendations for stakeholders to enhance risk management strategies. The findings will contribute to both academic literature and practical applications in managing risks effectively in Sri Lankan construction projects. This study is significant as it addresses the gap in localized risk identification practices amidst rapid urban growth in Sri Lanka's Western Province.

2. Objectives

2.1 Main Objective

To assess the effectiveness of risk identification approaches in construction project management in the western province.

2.2 Sub Objectives

- To assess how reliable risk identification tools are in construction projects in the Western Province.
- To examine whether existing risk identification methods

reliably detect potential risks in construction projects
- To verify the adaptability of risk identification techniques applied in construction projects.

3. Literature Review

Although the construction sector plays a significant role in the growth of the economy, its dynamic nature and the involvement of many different stakeholders make it intrinsically complicated and vulnerable to many risks. This review highlights the methods, resources, and difficulties associated with risk identification and management in construction projects by combining insights from Sri Lankan and international viewpoints.

3.1 Introduction to Construction Industries

The construction industry is characterized by dynamic work environments, high-risk operations, and complex stakeholder relationships (Renault & Agumba, 2016) [9]. These factors necessitate robust risk management strategies to ensure project success, enhance safety, and maintain financial stability. Risk management in construction typically involves a systematic process of identifying, analyzing, and mitigating potential threats to project objectives (Renault & Agumba, 2016) [9].

Recent studies have highlighted the critical role of risk management in improving project outcomes. A systematic literature review by Oladimeji et al. (2023) [10] analyzed the impact of risk management practices on construction project performance in Nigeria. The study identified key risk factors such as inflation, inadequate financial resources, and government policy inconsistencies that significantly affect project success.

3.2 Risk Identification in Construction

The construction industry is inherently complex and risk-prone, necessitating robust risk identification and management strategies to ensure project success. Effective risk management not only mitigates potential disruptions but also enhances overall efficiency and sustainability. Carter and Smith (2006) and Sharma and Gupta (2019) [1], [2] emphasized global and Sri Lankan perspectives on risk identification and management in construction projects, highlighting key approaches, tools, and challenges.

3.3 Global Perspectives on Risk Identification

Globally, numerous studies have explored risk identification approaches in construction projects. Siraj and Fayek (2019) [11] conducted a comprehensive literature review to identify common risks in construction, categorizing them into financial risks, safety hazards, and stakeholder management issues. Advanced methodologies for risk identification have also been explored. For instance, Kıral, Kural, and Çomu (2014) [12] employed the Delphi method to systematically identify risks in construction projects. Banerjee et., al 2021 [13] introduced a machine learning-based risk prediction paradigm for mega construction projects, demonstrating the potential of technology-driven solutions for accurate risk assessment.

Safety hazard identification remains a critical focus area in global research. Carter and Smith (2006) [1] highlighted the importance of proactive safety measures to minimize workplace accidents on construction sites. Sharma and Gupta (2019) [2] reviewed various tools and techniques for risk identification in construction projects, advocating for a systematic approach to address dynamic challenges. Hanna, Thomas, and Swanson (2013) [14] emphasized cooperative approaches to risk identification and allocation to foster collaboration among project stakeholders.

3.4 Risk Identification in Sri Lanka

In Sri Lanka, the construction industry faces unique challenges due to socio-economic conditions, regulatory frameworks, and environmental factors. examined risk management practices in road construction projects and identified financial instability and regulatory barriers as critical risks. Similarly, Perera et al. (2014) [5] used the Delphi method to enhance the effectiveness of risk management practices in Sri Lankan Road projects.

Environmental risks are particularly significant in Sri Lanka's construction sector. Abhayantha et al. (2023) [15] investigated environmental risks in highway construction projects and emphasized the need for sustainable practices. Sandaruwan et al. (2024) [16] explored risk assessment in joint ventures within Sri Lanka's construction industry, identifying collaboration challenges as a key concern.

Financial risks also play a prominent role in Sri Lankan construction projects. (Perera et al., 2020) [7] analyzed financial risks associated with high-rise apartment building projects, while (Senanayake et al., 2025) [8] focused on optimizing financial risk management strategies in water supply projects. examined barriers to effective risk management in small- and medium-scale enterprises (SMEs), highlighting resource constraints as a significant challenge.

4. Methods

In this research, the researcher employs qualitative methods to collect and analyze the data. The purpose of the researcher using this methodology is to produce a large amount of textual data (Pope et al., 2000) [17] and this method can also aid with problem-solving and hypothesis generation for future quantitative research (Lahmann and Keiser, 2018) [18] Although these research designs are usually more flexible, creative, and elaborate based on what is discovered during the research process. It will give a detailed understanding of a specific context.

Data was gathered from primary and secondary data sources. The Researcher has collected primary data through interviews and observations. Specifically, researchers have used semi-structured interviews which are commonly transcribed to record in-depth personal opinions. The secondary data has been collected through a literature review, reports and existing documents.

The main objective of this research is to assess how reliable risk identification tools are in construction projects in the

Western Province. For this purpose, three construction organizations were selected. In these three organizations, a total of ten respondents were chosen through the convenience sampling method to ensure accessibility and relevance to the research objectives.

The data will be analyzed using thematic analysis. It is a prominent strategy for analyzing qualitative data about unidentified events (Creswell & Poth, 2016) [19]. It is a method of categorizing and analyzing data based on themes and relative frequency. It is also a tool for organizing and analyzing data in order to get clear findings and outcomes (Vaismoradi et al., 2013). [20]. Accordingly, thematic content analysis was performed under four major themes.

Theme 1: Perceived Reliability of Risk Identification Tools: To assess how reliable risk identification tools are in construction projects in the Western Province. Theme 2: Effectiveness of Methods in Identifying Real Risks: To examine whether existing risk identification methods reliably detect potential risks in construction projects. Theme 3: Adaptability of Risk Identification Techniques: To verify the adaptability of risk identification techniques applied in construction projects. Theme 4: Practical Challenges in Applying Risk Identification Approaches.

The size of the target population is not fixed but will generally consist of the whole population of the relevant professionals within the construction industry of the Western Province, such as project managers, risk managers, engineers, architects, contractors, site managers, and consultants, who directly contribute to risk identification, assessment, and management in construction projects.

Individuals with at least five years of construction industry experience working on Western Province projects who are actively involved in risk detection processes will be included in the sampling. The researcher selected 03 contractors and used coding for the selected 10 respondents' roles in the organization, such as contractor 1 (C1), contractor 2 (C2), and contractor 3 (C3).

Table 1: List of Samples

Contractors name	*Code number*	*Respondent role in the organization*
Contractor 1	C1	R1: Project manager
		R2: Assistant Project Manager
		R3: Technical Officer
		R4: Site Engineer
Contractor 2	C2	R5: Project Manager
		R6: Assistant Project Manager
		R7: Technical Officer
Contractor 3	C3	R8: Project Manager
		R9: Assistant Project Manager
		R10: Site Engineer

5. Results & Discussion

The purpose of this research is to assess the effectiveness of risk identification approaches in construction project management. To get the intended results semi structured interviews were conducted with 10 respondents from selected 03 contractors in the western province, Sri Lanka. The sample size of ten respondents was chosen as adequate because it provided for profound understanding while being feasible for a qualitative study focusing on a specific regional context. This section represents the results from the analysis based on the data collected

5.1 Theme 1: Perceived Reliability of Risk Identification Tools

The respondents are using numerous tools and techniques which are used to identify the project risks in construction project management. Such as Brainstorming, Checklist, SWOT Analysis, Risk Breakdown Structure, Historical Data Analysis, Expert Interviews, Risk Register, Documentation Review, Cause-and-Effect Analysis and Site Inspections/ Observations.

From 13 respondents, Brainstorming, Checklist, and SWOT Analysis are the most frequently used risk identification tools and techniques among the project team members. Further Respondents suggested Advanced Risk Management Software, Training Programs, Risk Workshops, Monte Carlo Simulations, Building Information Modeling (BIM), Risk Breakdown Structure (RBS), Drone Technology, Third-Party Risk Assessments, Mobile Risk Reporting App and Collaborative Dashboard such tools effectiveness of risk Identification.

Although Construction projects in the Western Province predominantly rely on traditional tools and techniques for risk identification. Common practices include checklists, brainstorming sessions, and expert judgment. These methods are easy to implement and cost-effective, making them popular among small and medium-sized contractors. However, advanced techniques such as root cause analysis, SWOT analysis, and risk breakdown structures (RBS) are rarely utilized, primarily due to a lack of awareness and training. The limited adoption of digital tools further highlights a gap in technological integration, restricting the ability of firms to monitor risks in real- time or address complex, evolving project scenarios.

According to Ksenia (2024) [21] in their research have mentioned Identifying and handling risks is critical to project success, and techniques such as SWOT analysis, brainstorming sessions, expert interviews, and checklists assist in proactively addressing potential issues, ultimately keeping the project on track and enhancing your reputation as a competent project manager.

Risk identification in construction projects is a key process that requires several kinds of tools and procedures. The most recent literature emphasizes stakeholder involvement, tool selection, and documentation/communication as critical to effective risk management.

5.1.1 Stakeholder Involvement

Respondents mainly consider clients, contractors, safety officers, design consultants, regulatory agencies, subcontractors, suppliers, quality control teams, environmental consultants, and surveyors involved in risk identification. Among the 30 responses, 10 respondents stated that environmental consultants and surveyors are

involved throughout the project's lifecycle, with all phases. Also, safety officers and quality control teams are involved in the middle phases, due to the increased necessity for safety precautions and quality inspections throughout construction. Regulatory agencies play a limited role, particularly during the initial and approval stages.

According to Iandolo et al., 2024 [22], it's proved that Stakeholder engagement is important for identifying risks comprehensively. It implies various insights are considered, leading to better risk mitigation and mitigation techniques.

5.1.2 Tool Selection

The selection of tools for risk detection greatly impacts the performance of the process. Based on the respondents' responses, factors such as project complexity, stakeholder involvement, budget limits, and the project timeline are important when choosing risk identification tools. This aligns with Dikmen et al., (2022) [23] statement, which highlights the need to match risk identification tools with specific project features like complexity, stakeholder roles, budget, and timeframes for effective risk management in construction projects.

5.1.3 Communication

Clear documentation and communication help simplify risk identification and management. Tools such as email, risk registers, project management software, site meetings, and risk workshops are commonly used by various roles in construction projects. Serpell (2014) [24] highlights that using specific communication methods is essential for ensuring clear and accurate communication.

5.2 Theme 2: Perceived Reliability of Risk Identification Tools

According to respondent responses, the effectiveness of risk identification tools in construction projects will be explored, including how they work during project stages, the extent to which they consider external risk, and how regularly risk identification is performed.

5.2.1 Effectiveness Across Project Stages

Table 2: Respondent – Based Construction Frequency

Construction stages	Project Manager	Assistant Project Manager	Technical Officer	Site Engineers
Initial Planning and Design Stage	1	1	0	0
Pre-Construction Stage	1	0	1	0
Construction Stage	1	1	0	1
Commissioning and Handover Stage	0	1	1	1

Table 02 provides insights into how different project roles (Project Manager, Assistant Project Manager, Technical Officer, and Site Engineer) show their involvement across the various stages of a construction project. Highly involved indicated by (1) and show no involvement (0). While Assistant Project Managers, Technical Officers, and Site Engineers get more engaged as the project moves into construction and handover, project managers play a critical role in planning and early execution.

5.2.2 Consideration of External Risks

Table 3: External Risk Consideration

Project Life Cycle	Economic Risk Consideration	Environmental Risk Consideration
Initiation	Partially considered (e.g., inflation, currency)	Considered during feasibility studies
Planning	Limited to budget allocation	Focus on compliance with regulations
Design	Rarely identified unless flagged by management	Considered material selection
Procurement	Addressed through contract terms (e.g., supplier defaults)	Not well integrated into tools
Execution	Not mentioned	Managed reactively (e.g., floods, weather)
Quality Assurance	Not mentioned	Focused only on site-specific risks (e.g., soil)
Monitoring	Somewhat included via cost control mechanisms	Broader external risks not systematically identified
Post-Review	Gaps found in economic risk handling	Minimal focus on climate/environmental impacts

According to the respondents, external risks such as economic and environmental factors are solely considered across various project phases. Economic risks like inflation and currency changes are sometimes addressed during initiation, monitoring, and procurement stages, mainly through cost control and contract terms. However, their identification is often limited or reactive, especially during the design and planning stages. Environmental risks are mostly addressed during feasibility studies, planning, material selection, and on-site during execution or construction. However, these are generally specific responses, factors such as project complexity, stakeholder involvement, budget limits, and the project timeline are important when choosing risk identification tools. This aligns with Dikmen et al., (2022) [23] statement, which highlights the need to match risk identification tools with specific project features like complexity, stakeholder roles, budget, and timeframes for effective risk management in construction projects to the site and handled rapidly, with limited integration into formal risk tools. Post-project reviews and closure phases reveal gaps in considering external factors, indicating a need for better systematic approaches in future projects. According to the Gluch & Baumann statement (2004) [25] emphasized integrating environmental aspects into construction processes.

5.2.3 Frequency of Risk Identification

Risk detection happens at different frequencies during several project phases, Initiation and Planning: In the beginning, risk is effectively identified (R1, R2, R4, R5). Workshops, brainstorming sessions, and the practical use of tools such as risk registers are among the activities, particularly when modifications occur.

R1: To identify high-level risks and direct subsequent assessments, risk identification takes place once during the initiation phase.

R2: Using workshops, brainstorming, and analysis techniques, risks are identified frequently and in detail during the planning phase.

R4: During project modifications, risk identification is carried out on a regular basis during the planning stage, and tools such as risk registers are updated frequently.
R5: Risk identification is reexamined during the procurement initiation phase, with frequent evaluations of supplier and contractor risks.

The execution phase involves reactive and continuous risk identification (R3, R6, R9, R10), with frequent (weekly, biweekly, or monthly) site meetings to manage new risks.
R3: As difficulties emerge during the execution phase, risks are proactively and consistently identified through weekly or biweekly reviews.
R6: Throughout execution, risks are continuously identified, and the risk register is updated, and new risks are managed through monthly or bi-monthly reviews.
R9: As concerns like environmental hazards and safety emerge during site meetings, risks are reactively identified during the execution phase.
R10: Throughout construction, risk identification is ongoing, with an emphasis on unforeseen environmental hazards that are discussed at site meetings.

Design and Quality Phases: Often connected to inspections and updates, risk identification occurs often during the quality assurance phase (R8) and rarely during the design phase (R7).
R7: Risk identification happens sporadically during the design phase, particularly when design updates force reevaluation.
R8: To manage quality-related risks, risk is frequently identified during quality assurance through testing and inspections.

Implementing efficient risk identification technologies in organizations faces challenges such as training gaps, financial constraints, cultural resistance, and fragmented regulatory frameworks. These challenges are even harder for small and medium businesses (SMEs) and in countries like Sri Lanka, where local conditions make it more difficult to put these tools into practice. Hussain, (2017) [26] findings highlight that challenges in risk identification are complex and come from different areas. Addressing them effectively requires practical solutions that focus on improving training, ensuring proper use of resources, encouraging positive changes in organizational culture, and aligning rules and regulations clearly and consistently.

5.3 Theme 3: Adaptability of Risk Identification Techniques

5.3.1 Challenges in Implementation

The findings highlight several practical challenges that organizations face in implementing risk identification practices and tools. The challenges are classified under four headings:

Resource Constraints include:
R1 noted "limited availability of staff" and use of "old software tools," which made it challenging to keep risk registers updated on a regular basis.
R2 indicated that "tight time schedules and budget constraints" made it difficult to convene stakeholders for risk workshops.
R10 further stated that there generally is "not enough time to discuss all risks in meetings."

Technical Limitations:
R5 mentioned "slow internet and software compatibility" as barriers to efficient risk monitoring.
R6 also mentioned that "insufficient training" and "tight budgets" impacted risk register use.
R9 observed that instant messaging tools "are not fit for monitoring complex risks," which caused a lack of order in updates.

Organizational Challenges:
R3 emphasized that "email threads become cumbersome to track through," and slippage occurs because of "late responses from key stakeholders."
R4 noted that "risk departments prioritize differently," leading to software implementation slippages.
R7 reported that "lack of proper coordination" during workshops left risk conversations incomplete.

Contextual and Environmental Challenges:
R6 highlighted the "dynamic nature of construction sites" as a problem.
R8 described how "unpredictable weather and site conditions" undermined the reliability of risk discussions.
R10 also recognized "unexpected disruptions on-site" that limit the effectiveness of site meetings.

This review of Prioteasa, (2017) [27] comprehensively covers the impediments facing organizations in adopting risk management, with special focus on resource constraints (limited resources, time, and finance), technical limitations (outdated hardware, compatibility issues), organizational dimensions (coordination issues, stakeholder engagement), and environmental aspects (dynamically changing environments, unpredictable situations). The study finds that these challenges are often worse in sectors with fewer resources and constant changes. It also suggests that risk management solutions should be tailored to the specific situation and easy for users to apply.

5.3.2 Limitations of Current Practices

Respondent comments indicate that accuracy is the most well-known constraint in multiple project positions when identifying risks. Technical Officers, Project Managers, and Site Engineers all cited accuracy as a crucial matter, supporting its widespread relevance to risk management.

Several respondents raised this issue:
R1 explained how "the accuracy of risk identification is often compromised due to incomplete data during the early stages of the project," and the consequence of that is overlooked risks.
R5 reported that spreadsheet use is "time-consuming and error-prone, minimizing the effectiveness and accuracy of risk identification."
R8 reported that "inadequate training leads to subjective or variable risk identification," decreasing accuracy.
R9 noted that "quickly changing site conditions" impact on-site risk practice accuracy.
R10 reported that "time constraints within site meetings reduce the accuracy of risk identification results."

Time is another significant constraint, especially for Site Engineers and Assistant Project Managers, as the responses show.
R2 reported that risk identification is "time-consuming in terms of time due to coordination lags between stakeholders."
R5 and R6 indicated that manual methods and traditional tools make the process "time-consuming, slowing down decision-making and progress."
R10 also mentioned that "site meeting time constraints" prevent full discussion of potential risks.

Cost is emphasized more by Technical Officers and Assistant Project Managers, reflecting their more immediate interaction with financial planning and resource allocation.
R3 stated that "keeping up with high-end software drains project budgets."
R4 clarified that "the exercise of holding regular risk workshops consumes resources and specialist facilitation," at a greater cost.
R7 clarified that advanced tools are "a substantial limitation for smaller projects with tight budgets."

The findings show that accuracy is a cross-role issue, while time and cost pressures are more role-specific. Project Managers emphasize data completeness and tool accuracy, while Assistant Project Managers and Technical Officers emphasize time coordination and financial costs. Site Engineers emphasize pragmatic constraints due to site conditions. The findings suggest the need for better tools, training, and context-dependent strategies to maximize the effectiveness of risk identification practice. Zou et al., 2007 [28] study shows that to improve risk identification process in construction, organizations must invest in better tools, targeted training, and contextual methods that consider the specific challenges for different positions in the project team.

Enhancing risk identification of construction projects in the Western Province can be attained through training in modern tools like digital tracing and simulations. Collaborative workshops for all stakeholders could enhance brainstorming and risk mapping. Government or industry support like subsidies and benchmark frameworks could uphold standard practices. Such steps would raise risk identification as well as project success in general.

6. Conclusion

Overall, this research assessed the effectiveness of risk identification techniques in construction project management in the Western Province with a focus on gaining insight into current practices and areas of enhancement. Through the qualitative data collected from three selected construction companies, it was evident that improved risk management practice can lead to improved planning, reduced delays, and reduced cost overruns.

The findings revealed that although traditional techniques such as checklists, brainstorming, and expert judgment are widely used, they are mostly not effective in addressing the region's particular construction issues. Evaluation of effectiveness of tools in use can inform better tool selection, while determination of gaps present is able to boost proactive risk management culture through suitable training and more complete tools. Besides, early risk analysis allows cost-effectiveness in the long term, better decision-making, and improved inter-stakeholder coordination.

Advanced technologies like Building Information Modeling (BIM) and real-time data monitoring are not being investigated to their potential due to limitations like low awareness, inadequate training, and ineffective stakeholder coordination. The study emphasized more utilization of state-of-the-art technologies, improved stakeholder coordination, and more relevant risk identification methods considering the peculiar socio-economic, regulatory, and environmental context of the Western Province.

Suggestions that are designed by this study are also expected to address challenges at the local level and assist in shaping policy and industry best practices. adaption and training of professionals will ultimately bring about enhanced competency in risk management, providing long-term benefits to the construction industry in Western Province through enhanced resilience, ensuring investments, and enabling sustainable infrastructure development.

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