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Regular Article

Critical risk factors influencing the management of disruptions in construction projects: Insights from recent challenges in Sri Lanka

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ABSTRACT

The construction industry has a significantly contribute to the economy of Sri Lanka. However, in recent years, its overall share of the national output has declined, primarily due to the impacts of the COVID-19 pandemic, political instability, and ongoing economic challenges. Many construction firms halted projects and laid off employees, highlighting the critical need for effective risk management during crises to predict and mitigate risks. This study explores emerging risk factors in Sri Lanka's construction sector post-crisis. Using a three-phase linear decision-making model, the research combines a literature review, a survey of 290 construction professionals, and structural equation modelling (SEM) to identify major risk factors across four phases of risk management. Key risks out of 23 include general factors like health and safety issues, material costs, regulations, political interference, corruption, and labor shortages, while phase-specific risks involve delays, budget overruns, payment delays, and cancellations. The study revises the risk registers to improve risk management strategies. While the findings are context-specific to Sri Lanka, they may offer indicative insights for other developing countries facing similar crisis-driven disruptions. The practical implications extend to multinational and local companies, supported by data from 22 countries, offering a comprehensive framework for addressing construction industry challenges in volatile environments. The novelty of this study lies in its use of theoretical triangulation to align Classical Risk Management theory with real-world operational risk factors, revealing critical overlaps, behavioral influences, and contextual gaps in traditional frameworks.

1. Introduction

The construction industry is a high-risk sector with its lengthy project durations, intricate processes, suboptimal working conditions, adaptable organizational frameworks, and substantial financial investments (Kawmudi et al., 2020). It is about managing many factors that impact the project's success. Numerous projects often entail inconvenient occurrences, resulting in time inefficiencies and high expenditures. Recognizing and effectively managing risks is not just a necessity; it is a survival strategy. The presence of risks can lead to its failure.

The construction industry in Sri Lanka experienced rapid growth after the end of the 30-year civil war in 2009 (Jayalath & Gunawardhana, 2017). By 2022, it contributed 9.4 % to the national GDP (Central Bank of Sri Lanka, 2022) and remained the fourth largest economic sector, valued at approximately $12.8 billion in 2023. However, its growth was severely impacted by the COVID-19 pandemic, political instability, and an economic downturn. The pandemic disrupted supply chains and halted construction activities, while political unrest and high inflation deepened the crisis. As a result, the industry's value-added dropped by 20.9 % in 2022, following a 4.4 % increase in 2021 (Central Bank of Sri Lanka, 2022). The sector's GDP contribution declined from 8–10 %–6.2 % in 2020 (DailyFT, 2022). Additionally, the sharp depreciation of the Sri Lankan rupee against the US dollar worsened the situation, increasing project costs and reducing investor confidence (Asian Development Bank, 2023), further challenging the industry's recovery.

The construction sector in Sri Lanka has faced severe setbacks due to import restrictions and foreign exchange controls, causing a 90 % suspension of projects and bankruptcies among local contractors (GlobalData, 2023). Major projects like Port City were delayed, while investor confidence declined. These challenges highlight the urgent need for robust risk management practices. Evidence shows that early implementation of effective management procedures can significantly reduce delays and financial losses. Such measures not only ensure the survival of local firms but also build resilience, offering a transformative pathway for the construction industry to thrive in an uncertain economic environment.

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The Sri Lankan construction industry is grappling with unprecedented challenges from a deep economic crisis and ongoing political instability (Weerakoon, Ganganath, & Fedotova, 2023) and the crisis during the COVID-19 pandemic (Abeysinghe & Jayathilaka, 2022). These disruptions have significantly affected project implementation, causing widespread delays and cost escalations, with over 90 % of construction activities reportedly halted and more than 500,000 jobs lost during the peak of the crisis (Weerakoon, Ganganath, & Fedotova, 2023). The industry has also faced severe inflation, currency devaluation, and supply chain disruptions, leading to a projected real-term contraction of 14.9 % in 2023 (GlobalData, 2023). While risk management in construction has been extensively studied, existing models often developed in more stable or developed economies are increasingly misaligned with the rapidly evolving and volatile Sri Lankan context. Traditional risk registers typically isolate individual risks, lacking the dynamic, systemic view necessary to address the current complexity and interdependence of challenges (Weerakoon, Ganganath, & Fedotova, 2023).

Moreover, the compounded impacts of economic and political upheavals, particularly on long-term, capital-intensive projects, have been largely overlooked in the literature. Emerging risks such as labor shortages, cost volatility, and restricted access to imported materials are now central to project viability, underscoring the inadequacy of conventional frameworks (Abeysinghe & Jayathilaka, 2022). Consequently, there is a critical need to revisit and revise risk management practices, integrating adaptive and resilient strategies that can respond to socio-economic instability and sector-wide uncertainty.

This study seeks to bridge these gaps by offering a context-specific and forward-looking approach to risk management in Sri Lanka's post-crisis construction industry. The key objectives are.

- ➢ To identify and analyze emerging risk factors that have surfaced in the aftermath of Sri Lanka's financial and political crises, with a focus on their influence across the four key phases of risk management: identification, analysis, evaluation, and monitoring/control.
- ➢ To develop an updated risk register that reflects the current realities of the construction sector, integrating both traditional and newly emergent risks.
- ➢ To provide actionable recommendations for industry stakeholders to enhance preparedness, resilience, and responsiveness to the dynamic and interdependent risk conditions in Sri Lanka's construction environment.

2. Literature review and theoretical perspective

2.1. Theoretical perspective

The Classical Risk Management (CRM) theory was utilized as the theoretical framework for this study and examined accordingly. The CRM defines risk management as a systematic process that involves identifying and managing the underlying causes of risk and uncertainty and is grounded in several key principles that guide the systematic management of risks. The first principle, risk identification, involves detecting potential threats through methods such as brainstorming, checklists, and historical data (Project Management Institute, 2017). The second, risk analysis, prioritizes these risks using qualitative and quantitative assessments (Hillson & Murray-Webster, 2007). The third principle, risk evaluation, determines appropriate responses, such as avoiding, transferring, mitigating, or accepting risks, based on their impact and likelihood (Hopkin, 2018). Finally, risk monitoring and control ensure continuous oversight of risks and response effectiveness, adapting to changes and addressing newly emerging threats (Chapman & Ward, 2011). These four interconnected phases form the foundation for a systematic approach to managing risk in construction and provide a comprehensive lens through which emerging risks in Sri Lanka's current context can be analyzed.

2.2. Literature review

Toward this vein, the present study investigates newly emerging risk determinant factors that influence which are directly related to the four crucial phases of risk management during the crisis in Sri Lanka. Accordingly, 30 risk factors were identified from 22 different countries (Fig. 1), with 30 repetitions (Fig. 2).

2.3. Risk identification (RI)

2.3.1. General risk factors during crises

The COVID-19 pandemic has profoundly impacted the construction industry worldwide. Sierra (2022) identified seven significant challenges arising from the pandemic: on-site health and safety concerns, increased economic costs, potential legal exposures, workforce availability issues, supply chain and subcontractor instability, and the uncertainty stemming from the evolving nature of the crisis. Failure to identify these risks early can lead to major obstacles in regulatory compliance and emergency preparedness.

Crisis-related risks often manifest as economic losses, reduced productivity, and project delays or stoppages (Araya et al., 2021). For instance, in Chile, health and safety concerns critically reduced workforce availability and disrupted site operations during the pandemic (Stiles et al., 2021). Similarly, Al-Mhdawi et al. (2024) identified major delay factors in Iraq—such as poor safety practices, increased material costs, and labor shortages—highlighting the essential need for proactive risk identification.

Global lockdowns and travel restrictions further exacerbated workplace interruptions, with many construction workers returning to rural areas, leading to acute labor shortages and delayed project timelines (Araya et al., 2021; Niroshana et al., 2023). In the United States, Jeon et al, (2022) emphasized the importance of prioritizing worker health and safety to maintain morale and reduce delays.

In Sri Lanka, pandemic health protocols like physical distancing, mask mandates, and sanitization requirements introduced significant operational complexity and increased costs (Niroshana et al., 2023; Vithana et al., 2020). Rapidly changing government regulations required frequent adjustments in project design, scheduling, and execution. Vithana et al. (2020) also pointed to supply chain disruptions, regulatory hurdles, and staff absenteeism as core causes of delay. Additional stressors included material shortages, delayed payments, rising office rental costs, and risks of bankruptcy or premature project termination (Chadee et al., 2021).

Other major risk factors included contractor financial instability, loan repayment issues, and increased material prices—particularly affecting small-scale contractors (Kawmudi et al., 2020; Namarathna & Gunarathna, 2022). According to Weerakoon, Ganganath, and Fedotova (2023), many of these adverse outcomes were directly linked to poor early-stage risk identification, resulting in budget overruns, delayed completions, and regulatory non-compliance. Additional risks included substandard quality controls and design flaws, which diminished project value and caused stakeholder dissatisfaction and costly rework (Shaawat et al., 2023).

2.3.2. Phase-specific risk factors in risk identification

Successful risk identification requires not only detecting broad threats but also understanding their relevance within the project's lifecycle and context. In Sri Lanka, a study by Santoso and Gallage (2020) found that contractors assigned significantly more weight than clients to over 40 % of key risk criteria, emphasizing their pivotal role in early risk detection and mitigation. Seven of the ten major risk factors identified were contractor-related—highlighting the importance of technical skills, managerial competence, and local contextual knowledge.

The ability to distinguish and prioritize risks at the identification phase—such as adapting to policy changes or anticipating political interference—strengthens a project's resilience. Additionally,

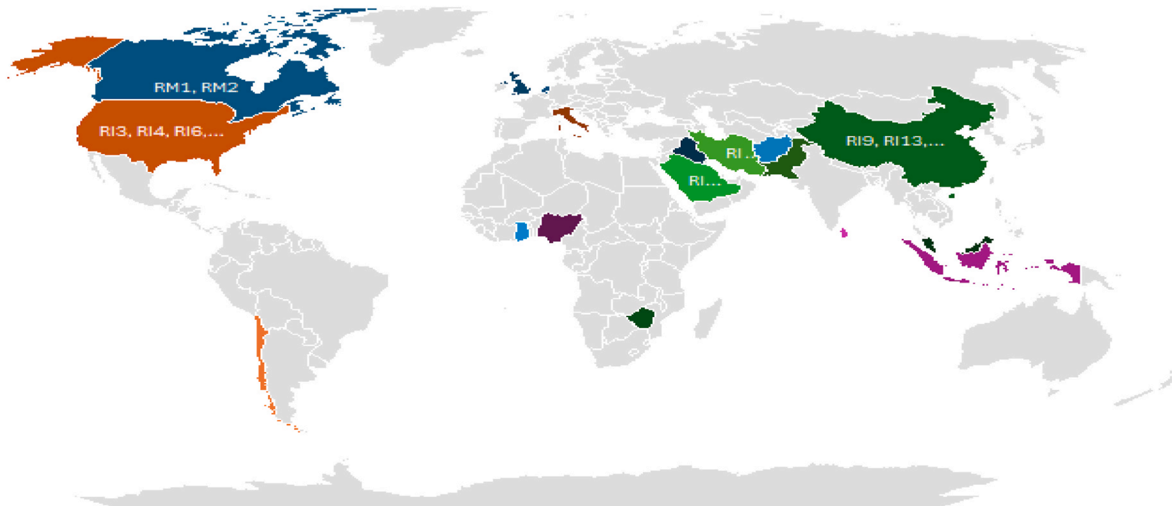

Fig. 1. 30 risk factors by country
• source: Author.

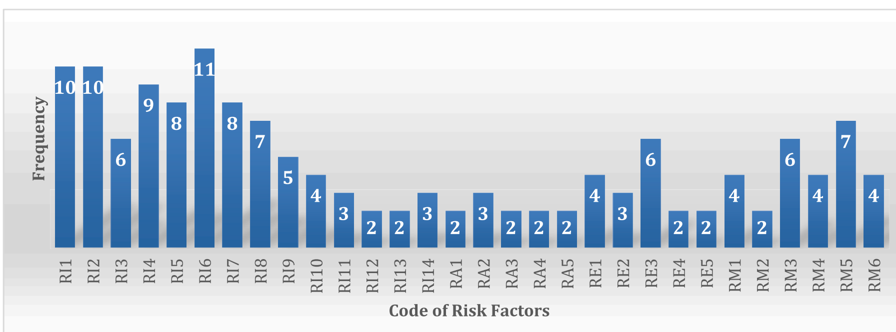

Fig. 2. Frequency of occurrence for 30 risk factors
• source: Author.

incorporating diverse stakeholder perspectives into the identification process helps ensure that both internal (e.g., management capacity) and external (e.g., regulatory shifts) risks are effectively captured. Moreover, the study underscores the consequences of non-compliance with legal and regulatory frameworks, further stressing the importance of comprehensive and targeted risk identification strategies tailored to crisis contexts.

2.4. Risk analysis (RA)

2.4.1. General risk factors during crises

A systemic bias in many emergency management organizations often leads to the underestimation of risks, largely due to inadequate or outdated risk analysis practices (Mamuji & Etkin, 2019). This tendency to overlook or misjudge risks can severely affect construction projects, disrupting timelines, increasing costs, compromising stakeholder satisfaction, and potentially resulting in project failure. The urgency of robust risk analysis becomes even more pronounced during crisis events such as pandemics, political unrest, or economic downturns.

The COVID-19 pandemic, in particular, exposed critical gaps in the preparedness of the construction sector, revealing vulnerabilities in supply chains, project financing, labor availability, and regulatory adaptability (Iqbal et al., 2021; Karamoozian, & Wu, 2022). Traditional risk management models were often ill-equipped to handle the scale and complexity of these disruptions, emphasizing the necessity for more dynamic and responsive analytical frameworks (Nekrasova & Kaloshina, 2016).

In the Sri Lankan context, the construction industry's resilience was severely tested by concurrent economic challenges, illustrating the pressing need for an evolved risk analysis approach that incorporates uncertainty, rapid change, and localized crisis factors (Perera et al., 2023).

2.4.2. Phase-specific success factors in risk analysis

Effective risk analysis during crises requires an in-depth understanding of how interdependent risk factors influence one another across the project lifecycle. In Sri Lanka, Senaratne and Udawatta (2013) found that many construction crises stemmed from a failure to analyze interrelated risks, which often cascade and intensify if not properly assessed early on.

Santoso and Gallage (2020) emphasized that poor risk analysis not only leads to underestimating technical and managerial weaknesses but also overlooks contextual issues such as local political instability and policy unpredictability. These oversights can impair resource allocation, delay response strategies, and ultimately disrupt project outcomes.

A phase-specific approach to risk analysis ensures that critical variables such as contractor skill gaps, misjudged policy implications, or funding volatility are identified, prioritized, and evaluated systematically. This targeted analysis enables construction firms to respond more effectively to dynamic risk environments, particularly in low-resilience markets like Sri Lanka.

2.5. Risk evaluation (RE)

2.5.1. General risk factors during crises

Risk evaluation plays a pivotal role in managing construction projects under crisis conditions. A study on an Iranian construction project revealed that failing to identify and assess a broad spectrum of risks—including financial, environmental, and operational risks—can result in unanticipated problems that disrupt project execution (Dabirian et al., 2020). Such oversights often lead to project delays as teams must urgently respond to emerging threats, frequently without adequate contingency plans.

Moreover, the failure to manage external risks such as political instability or economic volatility can severely erode stakeholder confidence. Razzaq et al. (2018) argue that improved risk evaluation practices—particularly those incorporating external political and regulatory risks—can enhance stakeholder trust and provide a greater sense of control during uncertain times.

Beyond immediate delays or cost overruns, unmitigated risks can damage an organization's internal and external reputation, undermining its ability to secure future projects or retain stakeholder support (Olawale et al., 2020). Thus, general risk factors during crises are not only operational in nature but also reputational and strategic.

2.5.2. Phase-specific success factors in risk evaluation

Risk evaluation involves systematically assessing and prioritizing risks based on their likelihood and potential impact. This phase is critical during crises, where poor risk evaluation can compromise not just cost and time objectives but also overall project quality. According to Santoso and Gallage (2020), ineffective evaluation leads to reduced customer satisfaction, costly rework, and in some cases, total project failure.

In the Sri Lankan context, Weerakoon, Wimalasena, and Fedotova (2023) found that the failure to conduct thorough evaluations contributed to the abandonment of several local construction projects during the financial crisis. The inadequate anticipation of economic impacts, such as inflation and currency fluctuations, led major firms to relocate operations abroad, weakening the country's construction capacity and long-term infrastructure development.

Effective evaluation during the crisis phase should therefore include a broader set of indicators, beyond cost and time such as contractor reliability, supply chain vulnerability, political risk exposure, and financial resilience. A structured and phase-specific risk evaluation framework allows construction stakeholders to make informed decisions and implement corrective actions before risks escalate.

2.6. Risk monitor & control (RM)

2.6.1. General risk factors during crises

Risk monitoring and control are vital during periods of crisis, particularly in the construction sector, which is highly susceptible to external disruptions. In Sri Lanka, the compounded effects of the COVID-19 pandemic and a severe financial crisis exposed major vulnerabilities within the construction industry. Perera and Palihakkara (2023) observed that many firms lacked sufficient risk maturity, resulting in ineffective responses to the rapidly evolving threats. Deficiencies in monitoring mechanisms and the absence of contingency planning led to project delays, cost overruns, and contractual disputes.

This scenario was exacerbated by the country's economic instability. High dependency on imported materials and labor, coupled with inflation and foreign exchange volatility, intensified the financial strain on ongoing and upcoming construction projects (Weerakoon, Wimalasena, & Fedotova, 2023). These broad economic factors represent systemic risks that affected not only individual project outcomes but the viability of the entire sector.

Globally, inadequate risk monitoring and control have shown similar consequences. In the Iranian construction industry, Al-Mhdawi et al. (2024) emphasized how unmanaged risks escalated into major disruptions and high financial losses. In Toronto, Geva and Siemiatycki (2023) reported that poor visibility into emerging risks hindered timely responses. In the U.S., Alsharef et al. (2021); Iqbal et al., 2015)and Vaughan and Vaughan (2013) highlighted those failures to address latent risks such as design flaws or material shortages, can jeopardize project quality, inflate costs, and damage reputations.

2.6.2. Phase-specific success factors in risk monitoring and control

Effective monitoring and control mechanisms are indispensable for minimizing the impact of crises on construction projects. During the risk monitoring and control phase, success depends on the ability to track risk indicators in real-time, assess the effectiveness of mitigation strategies, and promptly implement corrective actions. In Sri Lanka, Perera, Samarakkody, and Nandasena (2020) developed guidelines for managing risks in high-rise apartment projects, underscoring the link between poor risk control and operational failures such as tenant dissatisfaction, revenue losses, and increased management costs.

Proactive monitoring helps maintain alignment with performance benchmarks and contractual obligations. Santoso and Gallage (2020) emphasized that inadequate control not only affects project execution but also deteriorates stakeholder relationships. Dissatisfied stakeholders may withhold financial support, initiate litigation, or withdraw altogether, amplifying the consequences of already stressed projects.

Moreover, success in this phase requires a well-structured feedback mechanism where lessons from emerging issues are rapidly integrated into ongoing risk strategies. Adaptive control systems, real-time dashboards, and performance audits are increasingly vital tools in high-risk environments.

In summary, risk monitoring and control must go beyond routine supervision. They should integrate early warning systems, dynamic response plans, and stakeholder communication protocols tailored to evolving risk conditions, especially during crises.

In the literature, scholars concur that construction projects entail a wide range of risks, as illustrated in S1 Table 1. However, the methodologies and variables considered in each study varied, suggesting that identifying these characteristics relies on multiple variables.

3. Methods

3.1. Research design

This study adopts an Exploratory Sequential Mixed Methods approach to ensure a comprehensive, valid, and reliable investigation of

Table 1
Demographics.

Demographic Factor	Categories	Frequency	Percentage
Age	18–30	34	12 %
	30–45	214	74 %
	45–55	32	11 %
	More than 55	10	3 %
Gender	Male	170	59 %
	Female	120	41 %
Designation	Architect	34	12 %
	Project Manager	214	74 %
	Contract Administrator	42	14 %
	Engineer	0	0 %
	Quantity Surveyor	0	0 %
Experience	0–1 Years	76	26 %
	1–3 Years	184	63 %
	3–5 Years	18	6 %
	5–10 Years	8	3 %
	More than 10 Years	4	1 %
Type of Organization	Architectural Firm	24	8 %
	Consultancy Firm	68	23 %
	Contractor Firm	198	69 %

Source: Author

emerging risk factors in the Sri Lankan construction industry, particularly in the context of mixed-use development projects (Fig. 3) (Sony et al., 2024). The design is structured into three key phases—Initial Evaluation, Mid Evaluation, and Final Evaluation—each contributing to a systematic progression from qualitative exploration to quantitative validation.

In the Initial Evaluation Phase, the research problem is clearly defined, and specific objectives and research questions are formulated. A thorough literature review is conducted to assess existing frameworks and identify preliminary risk factors, establishing a theoretical foundation for the study.

The Mid Evaluation Phase involves the development of a structured questionnaire based on insights from the literature review and expert input. Appropriate sampling techniques are applied to select respondents from relevant stakeholder groups. Primary data is then collected through field surveys, enabling the identification of context-specific and empirically grounded risk factors influencing project performance.

In the Final Evaluation Phase, the collected data is analyzed using Structural Equation Modeling (SEM) to examine the relationships between identified risk factors and their impact on project outcomes. This analysis is aligned with the four stages of risk management—risk identification, risk analysis, risk evaluation, and risk monitoring and control—ensuring that the findings contribute to a robust, actionable framework for risk mitigation and strategic decision-making in post-crisis construction environments.

3.2. Data collection and sampling

Data collection commenced with a comprehensive content analysis (Fig. 1), involving an extensive review of scholarly literature to identify risk factors across the four key stages of risk management: risk identification, risk analysis, risk evaluation, and risk monitoring and control. Due to limited construction-specific risk literature in the Sri Lankan context, this review was broadened to include risk-related studies from allied sectors, ensuring a more holistic and contextually grounded foundation.

Based on insights from the content analysis, primary data were collected through a structured questionnaire administered to professionals across Sri Lanka's construction industry. The target group included architects, project managers, engineers, and quantity surveyors from both public and private organizations. The Colombo District was selected as the focal area for data collection due to its status as the commercial and administrative capital, accounting for approximately 75 % of ongoing or recently completed mixed-use developments Council on Tall Buildings and Urban Habitat, 2022). Its high concentration of large-scale infrastructure projects and foreign investments further reinforces its representativeness.

Using Morgan's formula , with a 95 % confidence level and 5 % margin of error, the required sample size was determined to be 385 respondents (Krejcie and Morgan, 1970). A convenience sampling method was employed in May 2023 for practical feasibility. Out of 400 questionnaires distributed, 302 were returned, yielding a 75.5 % response rate. After a thorough screening process to remove incomplete or inconsistent responses, 290 valid questionnaires were retained for analysis, resulting in a 72.5 % acceptance rate, which meets standards for empirical studies (Baruch & Holtom, 2008).

3.3. Survey instrument and measures

The survey instrument utilized in this study consisted of two discrete sections: A and B. The first section gathered demographic information about the participants. The second section focused on participants' perceptions regarding the probability of risk of construction projects. All elements in section B were evaluated using a five-point Likert scale, ranging from very likely to very unlikely for probability.

3.4. Data analysis and SEM justification

To analyze the demographic and background data of respondents, descriptive statistics such as frequencies and percentages were applied. To assess the internal consistency and reliability of the constructs, Cronbach's alpha was computed for all relevant items. Values of 0.60 or higher were considered acceptable, consistent with the threshold established by Hair et al. (2010).

The study employed Confirmatory Factor Analysis (CFA) to verify the structure and consistency of the measurement model. This included assessments of Convergent Validity and Composite Reliability through Average Variance Extracted (AVE) and Composite Reliability (CR) values. According to Hair et al. (2010), AVE values above 0.50 and CR values above 0.70 indicate satisfactory construct validity and reliability. These measures ensured that the constructs reliably captured the intended latent variables and reduced the likelihood of measurement error.

Following validation of the measurement model, the study applied Structural Equation Modeling (SEM) to test the hypothesized relationships between latent variables representing the four stages of risk management. SEM is a multivariate statistical technique that allows for simultaneous analysis of multiple relationships and is particularly suited to models involving latent constructs that cannot be directly observed

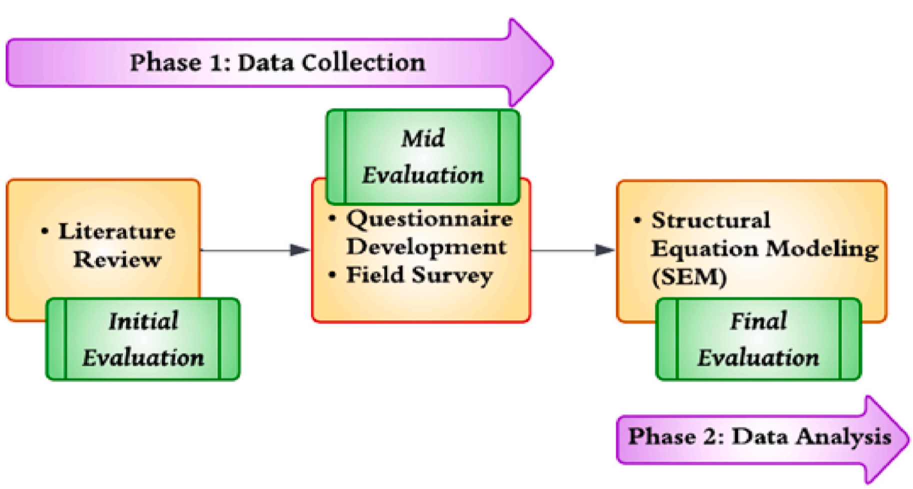

Fig. 3. Exploratory sequential mixed Method
Source: Author.

(Mueller & Hancock, 2018). SEM was used to identify the most significant factors influencing risk management practices and to evaluate the structural relationships among the variables.

All statistical analyses were conducted using IBM SPSS for descriptive statistics and reliability testing, and AMOS (Version 26) for Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). Before estimating the model, several key statistical assumptions and psychometric properties were evaluated to ensure the robustness of the analysis. These included assessing factor loadings, with values above 0.60 considered acceptable to confirm item relevance to their respective constructs, and calculating Cronbach's alpha to measure internal consistency, where values of 0.60 or higher were deemed acceptable (Hair et al., 2010). The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was used to determine the suitability of the data for factor analysis, with values above 0.60 indicating adequacy. Additionally, Average Variance Extracted (AVE) was calculated to assess convergent validity, with values of 0.50 or higher suggesting satisfactory levels of variance captured by each construct. Composite Reliability (CR) was also computed to evaluate the overall reliability of latent variables, with acceptable thresholds set at 0.70 or above. These diagnostic tests confirmed the reliability and validity of the measurement model prior to conducting the final structural analysis using SEM.

3.5. Data triangulation

To enhance the credibility and internal validity of the research, the study employed theory triangulation—the use of multiple theoretical perspectives to interpret the data (Denzin, 2012). This approach acknowledges that differing theories may address distinct but complementary aspects of the research problem. In this study, triangulation was used to verify and reinforce the conceptual understanding of CRM. By combining insights from the literature review, expert input, and statistical validation, triangulation minimized the risk of bias and misinterpretation, thereby improving the overall accuracy and reliability of the findings.

3.6. Ethical consideration

This study, which has not disclosed the names and organizational identities of the respondents, has been reviewed and approved by the Research Committee of the SLIIT Business School (SLIIT/ERC/SBS/2023/05). Strict adherence to the ethical standards outlined in Code 5.11 of the SLIIT Ethics Review Committee's Charter is maintained. The Committee was notified if research involving human participants and their data poses ethical risks, requires sensitivity, or involves a procedure that may impact engagement with human subjects. Before the study's commencement, explicit verbal consent was obtained from each participant. Researchers maintain *detailed notes for verbal consent*, including the date, time, researchers' names, respondents' identified numbers, eyewitness designations, and a summary of the discussion before the data collection.

Furthermore, it is crucial to note that informed consent was obtained from participants, ensuring complete transparency in the research process. An overview of the study's characteristics, approach, and objective was provided to the participants, empowering them to make an informed decision about their participation. Participants were explicitly instructed to express their thoughts freely when responding to the questionnaire. Importantly, no financial incentives were provided, and participants were in no way coerced to participate in the study, reaffirming the voluntary nature of their involvement.

4. Results

4.1. Respondents profile

According to Table 1, 74 % of participants were aged between 30 and 45 years, with an average age of 34.3 years and a standard deviation of 12.4 years, indicating a workforce primarily in their early to mid-30s (Department of Census and Statistics, 2024). The survey also shows that 59 % of respondents are male, reflecting the gender distribution in the industry. Additionally, 68 % of respondents are affiliated with contractors. Project managers make up the largest group of respondents at 74 %, followed by contract administrators (14 %) and architects (12 %). Most respondents (63 %) have 1–3 years of professional experience, highlighting a mix of seasoned professionals and newcomers. A recent study found that nearly half of Sri Lankan construction professionals have 1–5 years of experience, reflecting the prevalence of early-career individuals in the sector (Firose et al., 2025). Furthermore, many Sri Lankan contractors prioritize practical experience over formal qualifications, often requiring at least one year of experience for skilled labor roles (Jayawardena et al., 2008). The study thus reflects the perceptions of relatively young, moderately experienced professionals, with future studies including senior professionals to deepen these findings.

4.2. Measurement model assessment

The SEM process began with a confirmatory factor analysis (CFA), where factors were extracted using the Varimax rotation method and reduced based on the Eigenvalue criterion, selecting only those with Eigenvalues greater than one. Reliability was ensured by considering factor loadings exceeding 0.5 (Straub, 1989). Table 2 presents the CFA results, with values above 0.5 deemed suitable for analysis, confirming the overall model fit.

Bartlett's test of sphericity was used to assess the correlation among variables, with a significance level of 0.00 (less than 0.005), indicating a significant association among the variables. Kaiser-Meyer-Olkin (KMO) values, ranging from 0.723 to 0.910 (Kaiser, 1974), confirmed the suitability of the data for factor analysis. Cronbach's alpha coefficient, used to assess internal consistency and reliability, exceeded 0.7 for all variables, meeting the expected reliability threshold. Convergent validity was established with Average Variance Extracted (AVE) values above 0.5, indicating strong internal consistency. Composite Reliability (CR) values above 0.8 further confirm reliability and internal consistency. These results support the adequacy of the variables, allowing for confident SEM analysis (Rajapakshe et al., 2023).

When assessing the model fit, the null model was compared with the model created using constrained independence, assuming no correlation between the observed variables. Initially, due to low factor loading, the model faced challenges in fitting and meeting the fitting index criteria, leading to the deletion of RI7, RI9, RI12, RI13, RI14, RM4, and RM5. However, their theoretical relevance remains preserved, as their core concepts are adequately represented by other retained indicators. Specifically, RI7 (risk management practices and emergency preparedness) is conceptually covered by RI1, RI2, and RI3, which comprehensively address risk management practices. RI9 (delayed project timeline and cancellation) overlaps with RE1, while RI12 and RI13, which pertain to stakeholder satisfaction, are sufficiently reflected in RM6. Similarly, RM4 (poor project control) and RM5 (operational disruptions) are encompassed within RM3, which addresses poor project management. Therefore, the removal of these items did not compromise the theoretical framework, as their essence is retained through more statistically robust indicators. Then, through careful adjustments and iterations, the model's fitting index criteria values reached an acceptable level (RMSEA = 0.056; CFI = 0.927; IFI = 0.929; TLI = 0.914 and Chi-sq./df = 1.45) as shown in Table 3.

4.3. Structural model assessment

An analysis was conducted to identify the determinant factors of four phases of risk management: risk identification, risk analysis, risk evaluation and risk control during the two crises, namely the economic crisis and the COVID-19 pandemic, on the construction industry in Sri Lanka.

Table 2
Factor analysis, validity, and reliability test.

Variable	Factor Loading	Alpha	KMO	AVE	CR	Variable	Factor Loading	Alpha	KMO	AVE	CR
RI3	0.847	0.816	0.749	0.796	0.884	RE5	0.855	0.827	0.723	0.757	0.874
RI4	0.833	0.814				RE4	0.849	0.826			
RI1	0.806	0.825				RM1	0.768	0.828			
RI5	0.770	0.813				RM3	0.757	0.829			
RI6	0.767	0.816				RM2	0.558	0.828			
RI2	0.753	0.816									
RE1	0.808	0.827	0.724	0.700	0.854	RA1	0.757	0.826	0.910	0.776	0.918
RE2	0.790	0.822				RI11	0.788	0.832			
RA5	0.727	0.822				RA3	0.860	0.821			
RA4	0.685	0.820				RI8	0.674	0.833			
RE3	0.631	0.826				RI10	0.709	0.829			
RM6	0.557	0.829				RA2	0.871	0.821			

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.
Source: Author

Table 3
Model fitting analysis.

Index Name	Index	Model	Level of Acceptance	Reference	Fit Condition
Absolute fit	RMSEA	0.057	<0.08	Hair et al. (2010)	Acceptable
Comparative fit	CFI	0.922	≥0.90	Hair et al. (2010)	Acceptable
Parsimonious fit	Chi-sq./df	1.474	<5.0	Hair et al. (2010)	Acceptable
Incremental Fit	IFI	0.924	≥0.90	Hair et al. (2010)	Acceptable
Tucker-Lewis Index	TLI	0.909	≥0.90	Hair et al. (2010)	Acceptable

Source: Author

The path coefficients (Fig. 4, Table 4) show that budget overruns, delays in payments and inability to repay loans (β = 0.721), fluctuating cost of materials (β = 0.844), health and safety issues & welfare facilities (β = 0.812), legal and government regulations (β = 0.813), instability of the supply chain and subcontractors hiring (β = 0.748), are the main determinant factors of risk identification. In contrast, workplace interruptions (labour shortage) (β = 0.502) have a moderate value but are still a significant determinant factor, indicating their importance in the risk identification process.

The findings revealed that three key risk-determinant factors of risk analysis were incomplete risk coverage (β = 0.606), underestimation of risk impact and political interference (β = 0.814), and misallocation of resources (β = 0.806). Additionally, other three risk factors such as reduction in efficiency, quality, and productivity rates (β = 0.202), financial and administrative corruption and political interference (β = 0.251), and exchange rate fluctuation (β = 0.201) also show a weaker

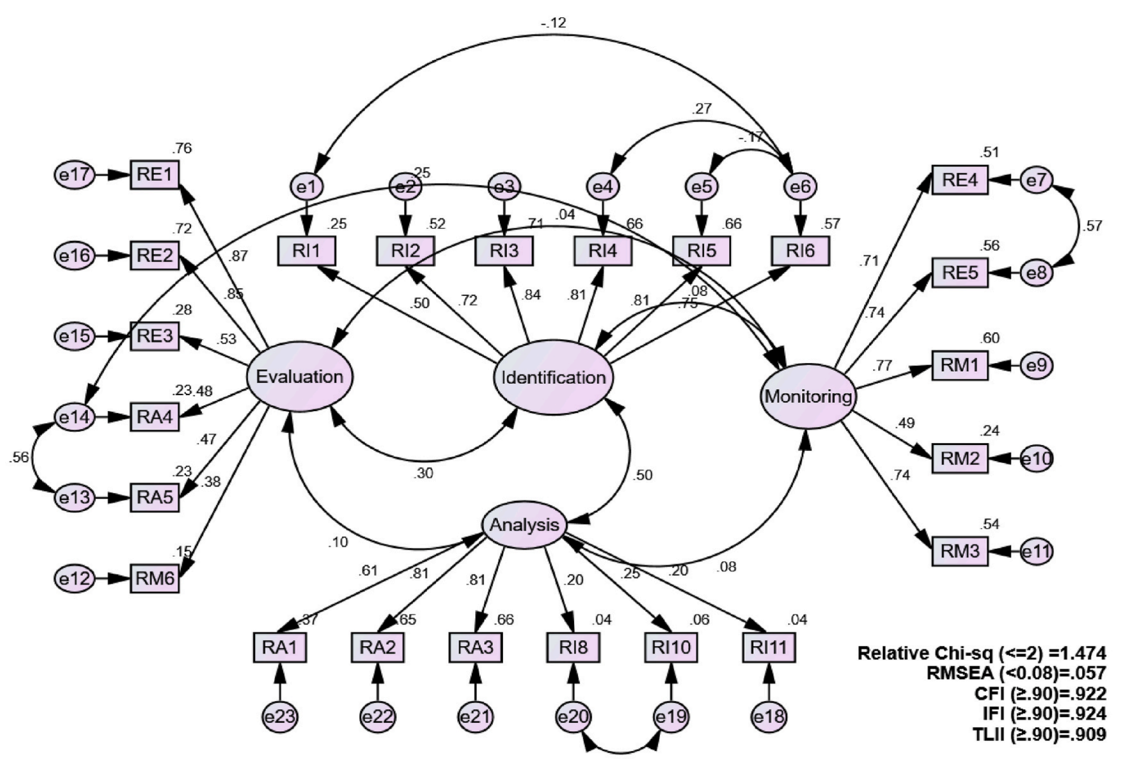

Fig. 4. Structural model Assessment
Source: Author.

Table 4
Path coefficient.

Path			β	P	Path			β	P
RI1	<—	RI	0.502	0.000	RA1	<—	RA	0.606	0.000
RI2	<—	RI	0.721	0.000	RA2	<—	RA	0.814	0.000
RI3	<—	RI	0.844	0.000	RA3	<—	RA	0.806	0.000
RI4	<—	RI	0.812	0.000	RI8	<—	RA	0.202	0.030
RI5	<—	RI	0.811	0.000	RI10	<—	RA	0.251	0.008
RI6	<—	RI	0.748	0.000	RI11	<—	RA	0.201	0.031
RE1	<—	RE	0.869	0.000	RM1	<—	RM	0.799	0.000
RE2	<—	RE	0.848	0.000	RM2	<—	RM	0.477	0.000
RE3	<—	RE	0.526	0.000	RM3	<—	RM	0.714	0.000
RA4	<—	RE	0.479	0.000	RE4	<—	RM	0.788	0.000
RA5	<—	RE	0.475	0.000	RE5	<—	RM	0.745	0.000
RM6	<—	RE	0.384	0.000					

Source: Author

but significant determinant factors of risk analysis (Fig. 4, Table 4).

The study identified three risk determinant factors under the risk evaluation: project delays are brought on by quality sacrifices, risk mitigation, and a failure to recognize political hazards ($p = 0.000$ and $\beta = 0.869, 0.848, 0.526$, respectively). Three additional risk variables were identified, namely overconfidence bias ($\beta = 0.479$), failure to detect interdependencies ($\beta = 0.475$), and stakeholder dissatisfaction ($\beta = 0.384$), which also moderate but are significant determinant factors of the risk evaluation phase. This suggests that the need for comprehensive risk assessment in project planning and execution is important in the construction industry during the crisis period (Fig. 4, Table 4).

The results in Fig. 4 and Table 4 indicate that the four factors play a significant role in determining the project monitoring and control phase in project management. Loss of visibility ($\beta = 0.477$), escalation of risks ($\beta = 0.799$), contract suspension due to poor management ($\beta = 0.714$), reputation damage ($\beta = 0.788$), and lost opportunities ($\beta = 0.745$) are significant determinant factors of risk monitoring and control phase of risk management. These findings, derived from a comprehensive analysis, serve to update the risk register (Table 5).

Table 5
Updated risk register.

Risk Identification *General Risk Factors*	**Risk Analysis** *General Risk Factors*
Workplace Interruptions (Labor shortage)	Incomplete Risk Coverage
Fluctuating cost of materials	Underestimation of Risk Impact and Political Interference
Health and safety issues & welfare facilities	Misallocation of Resources
Phase-Specific Risk Factors	***Phase-Specific Risk Factors***
Legal and government regulations	Financial and administrative corruption and political interference
Budget overruns, delays in payments, and inability to repay loans	Reduction in Efficiency, Quality, and Productivity Rates
Instability of the supply chain and subcontractors' hiring	Exchange rate fluctuation
Risk Evaluation *General Risk Factors*	**Risk Monitoring and Control** *General Risk Factors*
Stakeholder Dissatisfaction Failure to Identify Interdependencies	Escalation of Risks Loss of Visibility Contract suspension due to poor management Reputation damage
Phase-Specific Risk Factors	***Phase-Specific Risk Factors***
Overconfidence Bias Failure to identify political risks Project delays and mitigating risk Quality compromises	Lost opportunities

Source: Author

4.4. *Theoretical triangulation*

4.4.1. *Comparison of theoretical criteria with empirical findings*

This study applies theoretical triangulation to compare CRM criteria, RI, RA, RE, and Risk RM with operational variables. The results show strong alignment between theoretical and empirical components, supporting the relevance of CRM in managing risks in mixed-use development projects, as illustrated in Fig. 5.

However, when comparing detailed determinant factors coming under the CRM with the empirical results from this study, it is evident that the majority of the identified risk factors align with the key phases outlined in CRM theory. In the RI phase, variables like RI*7 (Risk Management Practices and Emergency Preparedness)* typically belong under RM in classical theory, indicating an overlap between phases in practice. Similarly, *RI8 (Reduction in Efficiency, Quality, and Productivity)* reflects risk consequences, suggesting that operational impacts are often identified as risk factors themselves.

In the RA phase, *RA4 (Overconfidence Bias)* and *RA5 (Failure to Identify Interdependencies)* highlight human and systemic issues not fully addressed in classical theory. These findings stress the importance of incorporating behavioural dimensions into risk analysis. *RA3 (Misallocation of Resources)* further supports the need for integrated methods that consider both human error and technical inefficiencies. During RE, the failure to identify *RE3 (Political Risks)* underscores a breakdown in the RI phase, showing how incomplete identification weakens subsequent evaluations. In the RM phase, issues like *RM2 (Loss of Visibility)* and *RM3 (Contract Suspension)* expose limitations in traditional monitoring frameworks and suggest the need for more agile, real-time control systems.

5. Discussion

The path analysis results indicate that the construction industry faced numerous substantial challenges throughout the crisis period, such as supply chain disruptions, labor shortages, and financial instability. The results, as demonstrated in Fig. 4 and Table 4, crucial risk factors affected to determination of four phases of risk management: risk identification, risk analysis, risk evaluation, risk management and control.

5.1. *Risk Identification*

The study identified six key determinants for early-stage risk identification within Sri Lanka's construction industry during periods of crisis (Table 5). These determinants were classified into two categories: general risk factors and phase-specific risk factors. The findings underscore the critical role of proactive risk detection in enhancing forecasting accuracy and minimizing project vulnerabilities, particularly in the face of prolonged disruptions (Al-Mhdawi et al., 2024; Perera et al., 2020).

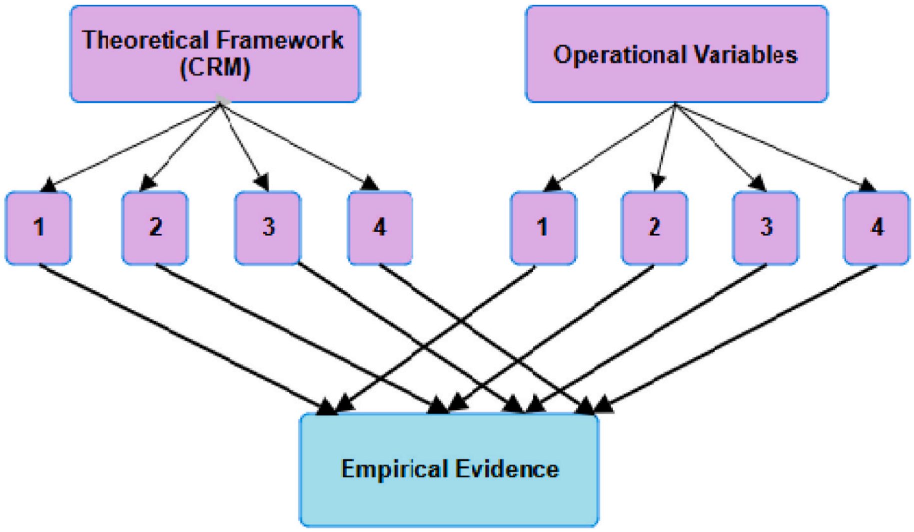

Fig. 5. Theoretical triangulation.
Where CRM criteria: 1. Risk identification, 2. Risk analysis, 3. Risk evaluation, 4. Risk monitoring.
Operational variables: 1. Risk identification, 2. Risk analysis, 3. Risk evaluation, 4. Risk monitoring.
Source: Author.

Among the general risk factors, workplace interruptions, especially labor shortages, emerged as a significant issue. The COVID-19 pandemic-induced lockdowns and mobility restrictions severely disrupted the availability of skilled labor. This shortage was further intensified by the industry's dependence on manual labor and limited domestic workforce capacity, leading to delays and increased project uncertainty (Al-Mhdawi et al., 2024; Namarathna & Gunarathna, 2022). Fluctuating material costs were another dominant risk, driven by currency depreciation, inflation, and global supply chain disruptions (Chadee et al., 2021). These price volatilities made budgeting unpredictable and strained contractors' financial stability (Araya et al., 2021; Perera et al., 2020). In addition, the imposition of new health, safety, and welfare regulations during the pandemic added compliance burdens, forcing firms to invest in infrastructure upgrades and protective measures, which further strained already limited financial resources (Al-Mhdawi et al., 2024).

Phase-specific risks were particularly pronounced during the planning and execution phases of projects. Regulatory uncertainties and rapidly changing government directives—including import bans and emergency public health mandates—created confusion and compliance challenges, which stalled progress and impaired decision-making (Araya et al., 2021; Namarathna & Gunarathna, 2022). Financial risks, including budget overruns, delays in payments, and contractors' inability to repay loans, were heightened due to the economic crisis and poor cash flow management. These issues were exacerbated by inflationary pressures and limited access to credit, leaving many firms vulnerable to insolvency (Perera et al., 2020). Supply chain instability and difficulties in subcontractor hiring further contributed to project inefficiencies. Material imports restrictions and domestic transport limitations caused significant delays in procurement and construction timelines, reflecting the fragility of the sector's logistics and subcontracting networks (Al-Mhdawi et al., 2024; Araya et al., 2021).

These findings align with prior studies, such as those by Perera et al. (2020), which emphasized the limited financial reserves in Sri Lankan construction firms and their susceptibility to macroeconomic shocks. Al-Mhdawi et al. (2024) similarly highlighted the absence of preparedness mechanisms during the pandemic, particularly in developing economies. Thus, the results reinforce the need for robust, context-specific risk identification mechanisms that can detect and address both general and phase-specific threats at the earliest stages of project planning. Failure to do so can lead to operational setbacks, financial losses, and reputational damage, particularly in environments characterized by instability and prolonged crises.

5.2. Risk Analysis

The study identified six key determinants under the risk analysis phase that critically influenced construction project performance in Sri Lanka during times of crisis, as shown in Table 5. These determinants were classified into general and phase-specific risk factors, highlighting how the absence of structured and systematic risk analysis exacerbated vulnerabilities across the sector. As noted by Santoso and Gallage (2020), the Sri Lankan construction industry traditionally lacks a proactive risk management culture, often relying on reactive strategies that fail to adequately anticipate or mitigate emerging threats.

Among the general risk factors, incomplete risk coverage was one of the most prominent issues. Many firms failed to consider the full range of risks, especially external economic shocks, political instability, and global supply disruptions, which left them unprepared for the cascading effects of events such as the COVID-19 lockdowns, labor shortages, and material scarcities (Alsharef et al., 2021). Closely related to this was the underestimation of risk impact, where construction firms either ignored or minimized the potential consequences of foreseeable threats, delaying timely mitigation actions. Political interference further compromised the accuracy of risk assessments by allowing politically motivated decisions to override evidence-based prioritization (Mamuji & Etkin, 2019; Santoso & Gallage, 2020). Another significant general factor was the misallocation of resources, a widespread problem during the crisis. Poor distribution of financial, material, and human resources led to project delays, cost overruns, and inefficient execution (Santoso & Gallage, 2020).

In terms of phase-specific risk factors, financial and administrative corruption emerged as a critical issue. Corruption at both institutional and project levels obstructed transparency, delayed procurement, and limited responsiveness to crisis conditions. This was further exacerbated by ongoing political interference, which reduced accountability and hampered decision-making processes (Fadhil & Burhan, 2021; Weerakoon, Ganganath, & Fedotova, 2023). Additionally, the crisis led to a reduction in efficiency, quality, and productivity, as firms struggled to maintain standards under constrained resources and weakened oversight. Finally, exchange rate fluctuations, especially the depreciation of the Sri Lankan rupee, caused severe financial instability, increasing the cost of imported materials and undermining firms' ability to repay loans or manage liquidity effectively (Perera et al., 2020; Weerakoon, Wimalasena, & Fedotova, 2023). These economic shocks were particularly damaging for firms that lacked financial buffers or risk hedging mechanisms.

As emphasized across multiple studies, the failure to integrate structured risk analysis into project planning has had far-reaching consequences (Perera et al., 2020; Santoso & Gallage, 2020). Without comprehensive, forward-looking risk assessment frameworks, many firms in Sri Lanka faced legal non-compliance, project delays, and financial insolvency. Addressing these shortcomings by embedding thorough risk analysis into every stage of the project lifecycle is essential for enhancing resilience, safeguarding investments, and promoting sustainable development in the construction industry.

5.3. *Risk Evaluation*

The findings of this study revealed six critical determinants that significantly affect risk evaluation practices within Sri Lanka's construction sector (Table 5). These were categorized as general and phase-specific risk factors and are supported by extensive prior research. Poor risk evaluation was found to contribute directly to project delays and ineffective mitigation strategies, weakening project feasibility and overall sector resilience (Perera et al., 2020).Among the general risk factors, stakeholder dissatisfaction was a prominent consequence of poor risk evaluation. Delays, quality issues, and communication breakdowns eroded trust among project stakeholders, including clients, regulators, and financiers, thereby damaging reputations and affecting future project opportunities (Perera et al., 2020). Another overlooked general risk factor was the failure to identify interdependencies within construction systems, particularly among supply chains, subcontractors, and financial institutions. This limited the ability of firms to understand cascading risks and proactively respond to disruptions. As Senaratne and Udawatta (2013) emphasize, recognizing the interconnected nature of construction operations is essential for effective risk mitigation and decision-making.

The phase-specific risk factors further demonstrate how weak evaluation practices compromised project outcomes. Overconfidence bias was frequently observed, where project managers and contractors underestimated potential risks or over-relied on past experiences, thereby ignoring early warning signs and failing to prepare contingency plans (Alsharef et al., 2021). Another significant issue was the failure to identify political risks, including sudden changes in government policies, contract regulations, and import restrictions. Firms without the capacity to anticipate and adapt to these changes faced operational disruptions and renegotiation challenges (Perera et al., 2020; Santoso & Gallage, 2020). Additionally, project delays and inadequate mitigation strategies were directly linked to poor risk evaluation frameworks, leaving firms vulnerable to crises and prolonging project timelines. These delays often led to cost escalations and strained client relationships. Lastly, quality compromises became inevitable as firms, in an attempt to meet revised schedules or budgets, sacrificed construction standards. This not only affected safety and durability but also long-term stakeholder trust (Alsharef et al., 2021; Santoso & Gallage, 2020).

Thus, the lack of comprehensive and forward-looking risk evaluation has significantly impacted the performance and sustainability of construction projects in Sri Lanka. Strengthening risk evaluation by addressing both general and phase-specific risk factors is essential for improving stakeholder satisfaction, minimizing disruptions, and enhancing overall project resilience.

5.4. *Risk monitoring and control*

Decreased risk monitoring and control directly improve project risk. These processes enhance organizational resilience, decision-making, and compliance, contributing to long-term performance and viability (Hopkin, 2018). Ongoing risk management is crucial for sustaining efficiency and project success. The study identified six key factors that hinder effective risk monitoring and control within Sri Lanka's construction sector during times of crisis (Table 5). These factors, categorized as general and phase-specific, emphasize the significance of continuous monitoring and adaptive management in reducing project uncertainty. As Hopkin (2018) and Hubbard (2020) highlight, robust risk monitoring and control not only strengthen organizational resilience and decision-making but also enhance compliance and long-term project viability. Despite this, many construction firms in Sri Lanka lacked adequate monitoring mechanisms, which exacerbated existing vulnerabilities.

Among the general risk factors, the escalation of risks was frequently observed due to the absence of timely reassessment and early warning systems. Without continuous tracking, initial risks intensified into more severe threats, leading to major disruptions. Similarly, a loss of visibility over project-level risks—especially in complex or multi-stakeholder projects—contributed to ineffective responses and poor coordination (Hubbard, 2020). Another critical issue was contract suspension due to poor management, where lapses in monitoring obligations and deliverables led to legal disputes or project halts (Al-Mhdawi et al., 2024). Moreover, reputation damage became a substantial long-term consequence. Firms that failed to manage risks transparently and efficiently lost stakeholder trust, which in turn limited future business opportunities (Olawale et al., 2020; Rajapakshe & Chandrasiri, 2023).

The phase-specific risk factor of lost opportunities emerged as a direct result of weak control systems and misaligned strategic decisions. Due to delayed risk recognition and poor communication, several firms missed key investment windows, resource allocations, or contractual partnerships (Obondi, 2022). The lack of proactive risk mitigation also restricted firms from capitalizing on adaptive opportunities during the crisis, such as shifting procurement sources or renegotiating contracts (Shayan et al., 2022).

Supporting literature reinforces these findings. The application of CRM (Construction Risk Management) theory underscores the importance of managing social, technological, and procedural risk elements in an integrated manner (Liu et al., 2020). Training and awareness programs have proven effective in enhancing risk visibility and safety outcomes, particularly when embedded within routine monitoring activities (Rashid & Behzadan, 2018). Other studies advocate for regular risk audits, updated contingency planning, and interdepartmental coordination to ensure timely interventions (El-Sayegh et al., 2021; George, 2020; Suharyanto & Simanjuntak, 2020). The evidence suggests that without a structured approach to risk monitoring and control, construction firms in Sri Lanka remain exposed to compounding risks that compromise project outcomes and sector-wide resilience.

S2 Table S2 shows the consolidated summary of the key risk factors identified during the Risk Identification, Risk Analysis, and Risk Evaluation phases, categorized into General and Phase-Specific Risk Factors, along with their supporting references.

6. Conclusion

This study aims to identify emerging risk factors affecting the Sri Lankan construction industry during the financial crisis, political instability, and COVID-19 pandemic. It examines risks across four key phases of risk management, identification, analysis, evaluation, and monitoring and control, to develop an updated risk register validated through Structural Equation Modelling (SEM).

In risk identification, key general factors were fluctuating material costs ($\beta = 0.844$), legal regulations ($\beta = 0.813$), and health and safety issues ($\beta = 0.812$). During risk analysis, incomplete risk coverage ($\beta = 0.606$) emerged as significant. For risk monitoring and control, risk escalation ($\beta = 0.799$) and reputational damage ($\beta = 0.788$) were critical general risks impacting project outcomes. Phase-specific risks included budget overruns, supply chain instability, and payment delays in identification. In analysis, political interference ($\beta = 0.814$), misallocation of resources ($\beta = 0.806$), and reduced productivity were key. Risk evaluation was dominated by quality delays ($\beta = 0.869$) and mitigation failures ($\beta = 0.848$). In monitoring and control, lost opportunities ($\beta = 0.745$) highlighted the need for adaptive responses to crisis challenges. These consistently strong standardized regression weights underscore the need for evidence-based, context-specific strategies to enhance project resilience and improve risk preparedness, particularly during crises and periods of uncertainty.

The study reveals important behavioral and contextual dimensions that classical risk management (CRM) frameworks alone fail to capture. Operational realities such as overconfidence bias, inefficiencies, and political interference transcend the traditional linear phases of risk management, highlighting the necessity for a more adaptive and integrated approach. Findings indicate that risk assessment significantly influences project outcomes, with participants recognizing that construction projects in Sri Lanka are more vulnerable across all risk management phases than previously acknowledged. In response, this study proposes a novel, triangulated framework that enriches CRM by incorporating behavioral and systemic insights, advocating for a dynamic, context-sensitive risk management model tailored to the complexities of crisis-prone construction environments.

This study offers several important strengths that contribute both to academic knowledge and practical risk management in the Sri Lankan construction industry. First, it addresses a significant research gap by focusing on the post-financial crisis and political instability context, providing timely and locally relevant insights often missing in literature based predominantly on developed economies. The mixed-methods approach, combining comprehensive content analysis with robust SEM, enhances both the depth and rigour of the findings. Furthermore, the study draws on a large, diverse sample of construction professionals from Colombo, the epicentre of Sri Lanka's construction activity, ensuring strong empirical grounding and practical relevance. The development of an updated, context-specific risk register tailored to current challenges offers a valuable tool for industry stakeholders. Finally, by employing theory triangulation, the research enhances internal validity and reduces bias, resulting in credible and actionable recommendations that can guide effective risk management and resilience-building in volatile environments.

6.1. Theoretical implications

By aligning CRM's four key elements with operational variables, the study expands existing theories on risk management in construction and development. The triangulation of these criteria with operational variables provides a deeper understanding of how risk management processes can be systematically applied to identify and address risks in construction projects. Using a phase-based framework and Structural Equation Modelling, it highlights key risk interdependencies offering a more integrated and dynamic perspective on risk behavior in construction environments. Moreover, the results imply that the integration of CRM principles into risk management practices could offer a more comprehensive approach to managing complex risks, potentially enhancing the sustainability and success of such projects. The findings contribute to the refinement of risk management concepts, methodologies, and strategies. This is helpful for scholars in the management discipline to actively participate in further investigation, and the findings provide insights into both the development and refinement of risk management frameworks and the broader understanding of risk in the construction industry in the post-crisis.

6.2. Practical implications

Continuous updating is a necessity for identifying risk factors in the construction industry. The successful completion of projects involving mixed-use development is closely tied to the efficient use of risk assessment, evaluation, monitoring, and control procedures. Despite economic challenges, the Sri Lankan construction industry has the potential to prosper. The research findings offer valuable information for decision-makers who need to enhance their financial stability, reinforce their management of operational risks, guarantee compliance and governance, implement flexible strategic planning, include stakeholders, promote a culture of risk awareness, and urgently utilize technology to minimize risks. Through the incorporation of these tactics, organizations may effectively traverse the intricacies of a recuperating economy and establish resilience to withstand future crises.

6.3. Limitations and future direction

As a cross-sectional study, the findings reflect perceptions at a single point in time and do not capture evolving risk priorities or long-term project outcomes. The construction industry covers a broad spectrum of projects, from residential dwellings to large-scale infrastructure like power plants and highways, each involving significant financial investment and risk. The study's geographic focus on the Colombo District may restrict the applicability of results to other regions with different economic or infrastructural conditions. Future research should consider comparative studies across other provinces to examine regional variations in construction practices and risk exposure.

All data were collected from a single source at one time, increasing the potential for common method bias and inflated correlations. Additionally, this study employed a quantitative risk assessment approach. Further qualitative assessments are recommended to explore the nature and implications of key risks in greater depth.

Risks were identified using data drawn from participants with exposure to multiple country contexts, which may allow for broader extrapolation; however, the use of convenience sampling introduces selection bias and limits generalizability. Morgan's Table was used to determine sample size under the assumption of a large population, though the absence of exact figures affects precision. One of the key limitations of this study is the limited comparative analysis between the Sri Lankan context and other developing economies, despite relevant literature being reviewed. Future studies should consider stratified sampling to enhance representation across different professions and regions.

Moreover, the sample primarily consisted of young professionals accessible to the researcher, whose perspectives may not fully represent the broader construction industry. Participant responses may also reflect individual biases or limited project insight. Expanding the sample to include diverse roles and organizational levels is recommended.

Finally, while the study acknowledges the importance of interdependencies between risks, it offers limited analysis in this area. Future research should apply advanced modeling techniques, such as causal mapping or network analysis, to better understand the complex dynamics between interconnected risk factors in construction projects.

Data availability statement

The data supporting this study's findings are available in the following database.

https://doi.org/10.5281/zenodo.15733133.

Declaration of the use of AI

The authors declare that no AI-assisted technologies were used during any stage in the preparation of this article. However, ChatGPT was employed solely to enhance language fluency and readability. All content was carefully reviewed and edited by the authors, who take full responsibility for the integrity and accuracy of the published article.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssaho.2025.101748.

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