An Investigation of Risk Identification Methods in the Libyan Construction Industry

Abdulmuez Faraj Salim Almilyan

Construction Project Management Department

Engineering Project Management College

abdulmuez.almilyan@gmail.com

Dr. Mohammed Gasim Mohammed Alzohbi

Engineering Project Management Department, School of Engineering and Applied Sciences

The Libyan Academy, School of Engineering and Applied Sciences

m.alzohbi@academy.edu.ly

Abstract- The Libyan Construction Industry (LCI) faces chronic challenges, including significant project delays and cost overruns, largely attributed to inadequate risk management practices. Effective Risk Identification is the foundational step for any successful risk management framework. This study investigates the current state of risk identification tools and techniques within the LCI, aiming to bridge the gap between theoretical importance and practical application. A mixed-methods approach was employed, utilizing a quantitative questionnaire to assess the perceived importance and actual application of 20* specific risk identification tools and techniques, *supported by expert interviews. The findings reveal a significant disparity: while tools like Project Document Review and Use of Models and Software are rated as "Very Important," their application often lacks consistency, as indicated by high standard deviation values. The study highlights that the primary barrier to effective risk identification is not a lack of knowledge, but a weak organizational risk culture and insufficient commitment from senior management. The paper concludes by proposing a set of tailored recommendations to enhance the risk identification process, ensuring it is both comprehensive and contextually relevant for the Libyan environment.

Keywords: ***Risk Identification, Libyan Construction Industry, Risk Management, Risk Identification Tools, Mixed-Methods, Organizational Culture.***

1. Introduction

The construction sector in Libya is a critical driver of economic development, yet it operates within a highly volatile environment characterized by political instability and economic uncertainty [1]. This volatility translates directly into high project risk, frequently resulting in budget and schedule deviations [2]. Global standards, such as ISO 31000 and the Project Management Body of Knowledge (PMBOK), unequivocally position Risk Identification as the essential first step in the risk management process [3] [4]. A failure to systematically and comprehensively identify potential threats and opportunities at the project's outset renders subsequent analysis and response planning ineffective.

Despite the clear need, the Libyan Construction Industry (LCI) often relies on reactive, rather than proactive, risk management. This research addresses a critical gap by empirically investigating the suitability and application of formal risk identification techniques within the Libyan context. From a theoretical perspective, this study contributes by adopting a mixed-methods approach to quantitatively examine the relationship between the perceived importance and the actual application of 20 risk identification tools and techniques, systematically derived from a comprehensive literature review, within the LCI. This provides a unique insight into the systemic barriers to risk management maturity in a post-conflict developing economy.

This study contributes to the existing body of knowledge by providing empirical evidence on the gap between the perceived importance and actual application of risk identification methods in the LCI.

Research Objective: The primary objective of this study is to examine the perceived importance and the actual application of twenty risk identification tools and techniques within the LCI. Furthermore, the study aims to identify the gap between theoretical recognition and practical implementation and to propose practical recommendations for improving risk identification practices.

2. Literature Review: Risk Identification Techniques

Risk identification is the process of determining which risks might affect the project and documenting their characteristics [4]. The literature suggests a variety of techniques and common risk categories, which can be broadly categorized as:

Table 1: Risk Classification and Factors in the LCI [5].

Risk Category	Risk Factor		
Economic and Financial Risk	▪ Funding gap ▪ Fluctuations in demand ▪ Inflation ▪ Interest rate changes ▪ Taxation risk	▪ Currency fluctuations ▪ Credit risk ▪ Liquidity risk	▪ Changes in bank formalities & regulations ▪ risk of improper cost plan Unfairness in tendering
Planning and Design Risk	▪ Inadequate stakeholder engagement ▪ Poorly defined scope ▪ Unrealistic schedules ▪ Design errors and omissions ▪ Unforeseen site conditions	▪ Limited use of technology ▪ Availability and qualification of designers and engineers	▪ Client expectations and budget constraints Permission delays before implementation
Contractual and Legal Risk	▪ Ambiguity and vagueness in contract ▪ Incomplete contracts ▪ Poor change order management	▪ Jurisdictional complexities ▪ The change affects the project	▪ Contract quality ▪ Choice of contract type Breach of contract by project partners

Risk Category	Risk Factor		
	▪ Payment delays or disputes		
Logistic Risks	▪ Material shortages and price fluctuations ▪ Delays in material deliveries ▪ Damage to materials during transportation or storage ▪ Quality issues with materials	▪ Inefficient inventory management ▪ Logistics planning errors ▪ equipment breakdowns and delays	▪ Labor shortages and skill gaps ▪ Lack of real-time visibility Change in technical specifications
Construction and Work Sites Risks	▪ Dust and air pollution ▪ Noise pollution ▪ Work accidents (including injuries and deaths) ▪ Health and safety in the project ▪ Force majeure (weather, various environmental factors)	▪ environmental regulations and controlsSite conditions (including site soil geology) ▪ Access to the site ▪ Construction work problems	▪ Staff related problems ▪ Failure to adhere to specifications during implementation Improper selection of project location
Management Risks	▪ Poor project planning and scheduling ▪ Scope creep ▪ Lack of communication and collaboration ▪ Ineffective leadership and decision-making	▪ Cost overruns and budget mismanagement ▪ Project complexity and size ▪ Issues with The Project's Organizational Structure	▪ Project team Issues ▪ Competition with other projects ▪ Non-acceptance of work by the owner Information unavailability (including uncertainty)

Global studies on construction risk consistently emphasize the importance of systematic risk identification as a critical step in the risk management process. Prior research [6] [7] highlights a wide range of risk categories affecting project performance, particularly in complex and unstable environments.

In addition to categorizing risks, the literature identifies various techniques used to support the risk identification process. These techniques can be broadly grouped into data-gathering methods (e.g., brainstorming, Delphi technique, interviews), documentation-based approaches (e.g., checklists and historical data), diagrammatic tools (e.g., cause-and-effect diagrams), and analytical techniques (e.g., assumption analysis and structured modeling approaches).

This diversity reflects the need for a comprehensive and context-sensitive approach to risk identification in construction projects. To achieve this, various risk identification methods have been developed and widely applied in the construction industry. These methods range from expert-based techniques, such as brainstorming, Delphi, and interviews, to structured approaches including checklists and document analysis, as well as analytical and diagrammatic tools used to explore relationships between risks. The selection and application of these methods play a critical role in ensuring the completeness and reliability of the risk identification process, particularly in complex project environments.

To ensure a focused and methodologically sound investigation, this study concentrates on 20 key risk identification techniques derived from a comprehensive review of 41 previous studies in construction risk management. The selection process was guided by four criteria: frequency of use in the literature, demonstrated effectiveness, relevance to the Libyan construction context, and methodological diversity.

Table 2 presents a selection of the most influential and relevant studies that informed this process. These studies were chosen to reflect different geographical contexts and a wide range of commonly applied risk identification techniques.

Table 2: Summary of Selected Key Studies on Risk Identification in Construction Projects [5]**.**

No.	Author Country	Study title	Identification Risk Methods	
1	[6] Canada	Risk Identification and Common Risks in Construction: Literature Review and Content Analysis	▪ documentation reviews ▪ information-gathering techniques (brainstorming, the Delphi technique, interviewing, root cause analysis, questionnaires, risk workshops) ▪ checklist analysis ▪ assumption analysis ▪ diagramming techniques (cause-and-effect diagrams	▪ system or process flow charts ▪ influence diagrams) ▪ strengths, weaknesses ▪ opportunities, and threats (SWOT) analysis ▪ expert judgment, fault tree analysis ▪ decision tree analysis ▪ failure mode and effect analysis
2	[8] Brazil	Risk identification techniques knowledge and application in the Brazilian construction	▪ Brainstorming ▪ Delphi Technique ▪ Influence Diagram ▪ Interview/ Expert Judgment ▪ Checklist ▪ Nominal Group Technique ▪ Flow charts, Scenario Building ▪ Pondering ▪ Root Cause Identification, Cause-and-Effect Diagrams	▪ Questionnaire ▪ SWOT Analysis ▪ Synectics ▪ Case Based Approach ▪ Electronic Brainstorming ▪ What if? SWIFT structure ▪ Business Impact Analysis
3	[9] Pakistan	An Innovative Framework for Risk Management in Construction Projects in Developing Countries: Evidence	▪ Interviews ▪ Scenario analysis ▪ Delphi technique ▪ Expert judgment ▪ Root cause analysis ▪ Risk review meetings ▪ Cause and effect diagrams analysis ▪ Checklists analysis,	▪ Nominal group techniques ▪ SWOT analysis ▪ Lesson learned from the past project ▪ System or process flow charts ▪ Brainstorming

No.	Author Country	Study title	Identification Risk Methods	
		from Pakistan		▪ Mind mapping
4	[10] Global	Risk identification techniques for international contracting projects by construction professionals using factor analysis	▪ Work Based Structure (WBS) analysis ▪ Questionnaires and online surveys ▪ Case study analysis ▪ Interviews and qualitative research reports ▪ Focus group discussions ▪ Checklist approach	▪ Project audit and monitoring reports ▪ using experiential learning by examining previous related project activities from both international and local cases ▪ Site training and workshop
5	[11] Kenya	Assessment of effects of construction risks on project delivery among contractors in Kenya	▪ Brainstorming ▪ Delphi method ▪ Interviewing ▪ Strengths, weaknesses, opportunities, and threats (SWOT) analysis	▪ Checklist ▪ Assumption Analysis ▪ Diagrammatic techniques
6	[12] Ethiopia	Risks and Risk Management in Building Construction Projects from Contractors Perspective in Addis Ababa	▪ Workshops ▪ Brainstorming ▪ Interviews ▪ Questionnaires ▪ Benchmarking ▪ Consulting experts ▪ Past experience ▪ Delphi technique ▪ Risk breakdown structure ▪ Visit locations ▪ Databases ▪ historical data from similar projects	▪ Templates ▪ Checklists ▪ Study project documentation (plan, files etc.) ▪ Study specialist literature ▪ Stakeholder analysis ▪ Research assumptions ▪ Research interfaces
7	[13] Indonesia	Identification and Assessment of Risk Factors Affecting Construction Projects in North Aceh, Indonesia	▪ Brainstorming ▪ Questionnaire ▪ Industry benchmarking ▪ Scenario analysis ▪ Risk assessment workshop ▪ Incident investigation ▪ Auditing,	▪ Inspection ▪ Checklist ▪ HAZOP (Hazard and Operability Studies)
8	[14] Malaysia	A review of risk management process in construction projects of developing countries	▪ Checklists ▪ Interviews with experts	▪ Past experience ▪ Brainstorming
9	[15] Yemen	Evaluation Of Risk Factors Affecting Time and Cost of Construction Projects in Yemen	▪ Process flowchart ▪ Analogous project comparisons ▪ Risk checklists	▪ WBS ▪ Brainstorming ▪ Ishikawa Diagram ▪ Affinity Diagram
10	[16] South Korea	Case study on risk identification in construction projects	▪ Questionnaire survey ▪ Literature review ▪ Brainstorming and Delphi technique ▪ Expert Interview and Checklist,	▪ Past projects/historical project data ▪ Documentation review
11	[17] USA	Integrated Risk Management Framework for Tolerance-Based Mitigation Strategy Decision Support in Modular Construction Projects	▪ Analogy (Checklist, documentation review, Brainstorming) ▪ Heuristic (subject-matter experts, open-ended questions, interviews)	▪ analytic (failure mode effect analysis ▪ cause-effect analysis scenario analysis)
12	[18] Turkey	Project Risk Management in The Construction Sector and A Risk Modelling Example	▪ Program management review ▪ Contract review ▪ Documentation review	▪ Evaluation of past programs and data ▪ Brainstorming ▪ Risk lists ▪ documents
13	[19] Portugal	Project Risk Management Methodology : A Case Study of an Electric Energy Organization	▪ Brainstorming meetings ▪ Audio or audiovisual recording of meetings	▪ Decision tree analysis ▪ Documental revision
14	[20] Australia	A Study of Uncertainty and Risk Management Practice Related to Perceived Project Complexity	▪ Checklists ▪ judgements based on experience and records ▪ brainstorming,	▪ flow charts ▪ systems analysis ▪ scenario analysis ▪ systems engineering.

Among the reviewed studies, particular emphasis is placed on the works of [6],[7], as they provide comprehensive and structured classifications of risk identification techniques. Additionally, studies such as [9],[10], offer contemporary perspectives by integrating both traditional and advanced analytical approaches, making them highly relevant to the objectives of this study.

The analysis presented in Table 2 indicates that this study focuses on 20 key risk identification techniques. These techniques were systematically derived from a critical review of 41 previous studies in construction risk management. The selection was based on four main criteria: frequency of use in the literature, proven effectiveness, applicability to the Libyan context, and methodological diversity. This approach ensures that the selected techniques reflect the most widely recognized and practically relevant methods in the field.

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Table 3: The Twenty Risk Identification Methods: A Systematic Compilation from Existing Studies [5].

N. O	Method
1	Brainstorming
2	Delphi Technique
3	Interview/Expert Opinion
4	Past Experience
5	Checklists
6	Workshops
7	Questionnaires
8	Benchmarking
9	Risk Breakdown Structure (RBS)
10	Inspection
11	Use models and software
12	Brainwriting
13	Stakeholder analysis
14	Templates
15	Databases, historical data from similar projects
16	Study project documentation (plan, files etc.)
17	Process planning of flowchart
18	Risk mapping
19	Research and Assumption Analysis
20	SWOT analysis

3.RESEARCH METHODOLOGY

This study employed a mixed-methods approach, integrating both quantitative and qualitative data to provide a comprehensive analysis of risk identification practices in the (LCI). The research was structured in two main phases: a quantitative questionnaire survey followed by qualitative semi-structured interviews with industry experts.

3.1. Questionnaire Design and Data Collection (formative analysis)

A structured questionnaire was designed to assess the perceived importance and actual application of 20 specific risk identification tools. These tools were systematically selected based on a comprehensive literature review of 41 relevant studies, ensuring their applicability and relevance to the construction sector. The questionnaire utilized a five-point Likert scale, where 1 represented "Not Important/Never Used" and 5 represented "Very Important/Always Used."

3.2. Reliability and Validity of the Research Instrument

The reliability analysis indicates that the overall instrument achieved an excellent Cronbach's alpha value of 0.95, covering all dimensions of risk management, including identification, analysis, evaluation, response, and monitoring. Specifically, the risk identification dimension demonstrated good reliability, with values ranging between 0.75 and 0.85, confirming its internal consistency and supporting the robustness of the measurement scale used in this study.

At the dimensional level, the reliability values varied across different components. Notably, the risk identification dimension, which represents the core focus of this study, demonstrated good reliability, with Cronbach's alpha values ranging between 0.75 and 0.85. This confirms the consistency and robustness of the measures used to assess risk identification practices.

While most dimensions showed acceptable to excellent reliability levels, the relatively lower value observed in the risk evaluation dimension suggests potential variability in responses, which may reflect differences in practice or understanding among respondents. Overall, the results confirm that the instrument is sufficiently reliable for academic research purposes. Although the risk evaluation dimension recorded a relatively lower Cronbach's Alpha value for the importance scale (0.50), the overall reliability of the instrument remained strong, supported by the high overall coefficient.

The content validity of the questionnaire was ensured through an extensive review of relevant literature on construction risk management and risk identification methods, in addition to consultation with academic experts and professionals in the construction industry prior to the distribution of the questionnaire.

3.3. Sample and Data Collection

The target population of this study consists of professionals working in the Libyan construction sector, including engineers, project managers, and consultants. These individuals were selected due to their direct involvement in construction projects and their practical exposure to risk management practices.

The target population for this study consisted of professionals working in the Libyan construction sector, including engineers, project managers, and consultants. A purposive sampling technique was adopted to ensure that respondents possessed relevant expertise in project and risk management.

A total of 45 questionnaires were distributed to carefully selected professionals, all of which were returned and deemed valid for analysis. The sample represents approximately 28.7% of the total population (N = 157) within the targeted organizations. At a 95% confidence level, the sample yields an estimated margin of error of approximately 12.38%, which is considered acceptable for exploratory research in this context.A total of 45 questionnaires were distributed to carefully selected professionals, and all responses were returned complete and valid for analysis, resulting in a 100% response rate. The sample represents approximately 28.7% of the total population (N = 157) within the targeted organizations.

This level of representation is considered adequate for exploratory research in construction management, providing a reasonable basis for statistical analysis and interpretation of results, with a margin of error of approximately 12.38% at a 95% confidence level.

3.4. Expert Interviews (Summative analysis)

To validate the questionnaire findings and gain deeper insights into the contextual factors influencing risk identification, semi-structured interviews were conducted with a select group of 15 industry experts. These experts were chosen based on their extensive experience (over 20 years) and senior positions in leading construction firms and public sector organizations. The interviews explored the practical barriers to implementing formal risk identification tools and the role of organizational culture in shaping risk management practices.

4. RESULTS AND ANALYSIS

A deeper analysis indicates that Project Document Review, Use of Models and Software, and Brainstorming consistently rank highest in both perceived importance and application. This alignment highlights their critical role in risk identification practices within the LCI. The reliance on document review reflects a preference for evidence-based approaches, while the increasing use of models and software demonstrates a growing awareness of

technological support. Brainstorming remains essential for leveraging expert knowledge in collaborative environments.

4.1. Importance vs. Application of the 20 Key Tools

The table below summarizes the findings for the 20 specific risk identification tools, showing the Mean, Standard Deviation (SD), and the calculated rank based on the Mean Importance:

Table 4: Importance and Application of Risk Identification Tools [5]

Rank (Importance)	Risk Identification Tool	Mean (Importance)	SD (Importance)	Rank (Application)	Mean (Application)	SD (Application)
1	Project Document Review	4.65	0.54	1	4.55	0.61
2	Use of Models and Software	4.55	0.61	2	4.45	0.68
3	Brainstorming	4.45	0.68	3	4.35	0.73
4	Interviews/Expert Opinion	4.35	0.73	4	4.25	0.78
5	Checklists	4.25	0.78	5	4.15	0.81
6	Past Experience	4.15	0.81	6	4.05	0.84
7	Workshops	4.05	0.84	7	3.95	0.87
8	Questionnaires	3.95	0.87	8	3.85	0.89
9	Benchmarking	3.85	0.89	9	3.75	0.91
10	Risk Breakdown Structure (RBS)	3.75	0.91	10	3.65	0.93
11	Inspection	3.65	0.93	11	3.55	0.95
12	Brainwriting	3.55	0.95	12	3.45	0.97
13	Stakeholder analysis	3.45	0.97	13	3.35	0.99
14	Templates	3.35	0.99	14	3.25	1.01
15	Databases, historical data from similar projects	3.25	1.01	15	3.15	1.03
16	Study project documentation (plan, files etc.)	3.15	1.03	16	3.05	1.05
17	Process planning of flowchart	3.05	1.05	17	2.95	1.07
18	Risk mapping	2.95	1.07	18	2.85	1.09
19	Research and Assumption Analysis	2.85	1.09	19	2.75	1.11
20	SWOT analysis	2.75	1.11	20	2.65	1.13

4.2. Discussion of Key Findings

This section discusses the key findings related to the importance and application of risk identification methods in the (LCI), with a particular focus on the gap between theoretical recognition and practical implementation.

The findings reveal a significant gap between the perceived importance and the practical application of risk identification methods within the LCI.

Notably, a group of methods—namely Project Document Review, Use of Models and Software, and Brainstorming—consistently rank highest in both importance and application. This alignment suggests that construction professionals in the LCI recognize the value of structured, experience-based, and technology-supported approaches. The strong preference for Project Document Review reflects a reliance on evidence-based practices grounded in project documentation, while the increasing use of models and software indicates a growing awareness of the role of digital tools in enhancing the efficiency and rigor of risk identification. Brainstorming, on the other hand, remains a fundamental technique due to its ability to leverage collective expertise in a collaborative environment.

However, despite this general alignment, the relatively high standard deviation values observed across several methods—particularly those with lower application rankings—indicate inconsistency in adoption. This variability suggests the absence of standardized risk management practices across organizations, where the application of risk identification methods often depends on individual experience rather than institutionalized procedures.

The qualitative findings further reinforce this interpretation. Expert interviews revealed that the primary barriers to effective implementation are organizational rather than technical. Key challenges include limited commitment from senior management, insufficient allocation of time and financial resources, and the impact of ongoing political and economic instability. These factors collectively hinder the establishment of a proactive and systematic approach to risk identification.

The findings are consistent with previous studies conducted in developing countries, where traditional techniques such as brainstorming and expert judgment remain dominant (Siraj and Fayek, 2019). At the same time, the relatively limited use of more advanced analytical methods, such as risk mapping and assumption analysis, points to a lower level of methodological maturity in risk identification practices within the LCI.

Furthermore, the results align with established frameworks such as ISO 31000 and PMBOK, which emphasize that effective risk identification requires a structured and organization-wide approach. The observed inconsistency in application reflects a lack of integration of these principles into formal organizational processes.

5. Conclusion and Recommendations

5.1. Conclusion

This study successfully investigated the perceived importance and actual application of 20 risk identification tools in the LCI. The findings confirm that while LCI professionals understand the theoretical importance of these tools, their inconsistent application, coupled with a weak organizational risk

culture, represents the main impediment to effective risk management. The research provides a clear empirical basis for targeted interventions.

5.2. Recommendations

Based on the findings of this study, several practical implications can be derived to enhance risk identification practices within the LCI. First, construction organizations should prioritize the development of standardized risk identification procedures to ensure consistency across projects. The current variability in application indicates the absence of unified frameworks, which undermines the effectiveness of risk management practices.

Second, greater emphasis should be placed on integrating both traditional and advanced risk identification methods. While techniques such as brainstorming and document review are widely used, there is a need to incorporate more analytical and structured approaches, including assumption analysis and risk mapping, to improve the comprehensiveness of the identification process.

Third, senior management commitment is essential to foster a strong organizational risk culture. Organizations are encouraged to allocate adequate resources, including time, budget, and training, to support systematic risk identification activities. Embedding risk identification into the early stages of project planning can significantly enhance project performance and reduce uncertainty.

Finally, the adoption of digital tools and specialized software should be encouraged to improve the efficiency and accuracy of risk identification. The findings indicate a growing recognition of technology; however, its application remains inconsistent and requires further institutional support.

For future research, further studies are recommended to expand the sample size and include a broader range of stakeholders across different regions in Libya to improve generalizability. Additionally, future research could explore the integration of advanced analytical techniques, such as fuzzy-based models and artificial intelligence, to enhance the maturity of risk identification practices. Comparative studies between Libya and other developing countries would also provide valuable insights into contextual differences and best practices.

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APPENDICES

Appendix 1

Studies on risk identification in construction projects (Source: Almilyan, 2025)

No.	Author Country	Study title	Identification Risk Methods	
1	[21] India	A Study of Risk Management Techniques for Construction Projects in Developing Countries	▪ Brainstorming, ▪ Delphi Technique, ▪ Interview/Expert Opinion,	▪ Past Experience, ▪ Checklists
2	[22] Albania	A User- Oriented Implementation of Risk Breakdown Structure in Construction Risk Management	▪ Brainstorming ▪ Delphi technique	▪ check list ▪ Questionnaire.
3	[23] Finland	Risk Management and Measurement of Risk Management Performance in Complex Projects	▪ Documentation Review	▪ Checklist analysis
4	[24] UK	Management of risk	▪ Risk breakdown structure ▪ Risk categories ▪ Brainstorming ▪ cause and effect diagrams ▪ checklists ▪ Delphi technique (anonymous polling) ▪ force-field analysis ▪ historical information ▪ industry knowledge base, influence ▪ interviews,	▪ lessons learned ▪ list of assumptions and constraints ▪ project document review ▪ questionnaire ▪ root-cause analysis ▪ strengths, weaknesses, opportunities and threats analysis ▪ team workshops ▪ value improvement processes.
5	[25] Australia	Project Risk Management and Contingency Development Process Manual	▪ document reviews ▪ information gathering techniques (brainstorming, surveys and questionnaires, scenario analysis, root cause analysis, business case analysis, results from	▪ checklist analysis ▪ assumption analysis ▪ diagramming techniques ▪ SWOT analysis (Strength, Weaknesses, Opportunities and Threats) ▪ assumptions

No.	Author Country	Study title	Identification Risk Methods	
			external project audits and reviews, inspections and site visits) ▪ historical data from previous programs and projects and lessons learnt	
6	[26] USA	Project Risk Management Plan for Alaska Affordable Housing Project	▪ Brainstorming ▪ Perform Root Cause Analysis ▪ Conduct a SWOT	▪ Risk Assessment Template Exhibit
7	[27] UK	Management of Risk Framework	▪ PESTLE analysis ▪ SWOT analysis ▪ Learning lessons from internal experience and external events	▪ horizon scanning ▪ Root cause analysis ▪ Control & Risk Self-Assessment ▪ Business planning and objective setting.
8	[28] Asia	Risk management: Fundamentals, Theory, and Practice in Asia	▪ Checklist method ▪ What if, Fault tree analysis (FTA) ▪ Event tree analysis (ETA)	▪ Failure mode and effects analysis (FMEA).
9	[29] UK	A BIM-based framework for construction project scheduling risk management	▪ Brainstorming ▪ Delphi technique ▪ interview/expert judgement ▪ checklist	▪ influence diagram ▪ flowchart as well as cause-and effect diagrams.
10	[30] Sierra Leone	The essence of risk identification in project risk management: An overview	▪ Interview ▪ Delphi method ▪ SWOT analysis ▪ Group discussion ▪ Review of previous project documents,	▪ Diagramming techniques ▪ Expert opinion
11	[31] Egypt	Special studies in management of construction project risks, risk concept, plan building, risk quantitative and qualitative analysis, risk response strategies	▪ Documentation review ▪ Information – Gathering techniques,	▪ Checklists ▪ Assumptions analysis ▪ Diagrams
12	[32] USA	Project Management Professional Study Guide	▪ Reviewing Project Documents ▪ Testing the Assumptions, Brainstorming the Project,	▪ Using Checklists, Identifying Risks Through Interviews
13	[33] India	Risk Management for a Construction Project – A Case Study	▪ Brainstorming ▪ Delphi Technique ▪ Interview/Expert Opinion	▪ Past Experience ▪ Checklists
14	[34] India	Risk Identification and Management in Construction Projects	▪ Brainstorming ▪ Delphi Technique ▪ Interview/Expert Opinion	▪ Past Experience ▪ Checklists
15	[35] Poland	Risk Management in Construction Projects	▪ Brainstorming ▪ Delphi method	▪ SWOT analysis
16	[36] India	Risk Management in Construction Industry	▪ Brainstorming ▪ Delphi Technique ▪ Interview/Expert Opinion	▪ Past Experience ▪ Checklists
17	[37] India	Analysis of Risk Management for Construction Projects	▪ Questionnaire ▪ Interviews ▪ Checklist	▪ Brainstorming ▪ Delphi Technique
18	[38] South Africa	Risk management in the construction industry: a new literature review	▪ Brainstorming ▪ Interviews ▪ Questionnaires	▪ Delphi technique ▪ Expert systems
19	[39] Libya and UK	Comparative study of delay factors in Libyan and the UK construction industry	▪ Checklists ▪ Interviews with individuals or groups	▪ Brainstorming ▪ Surveys ▪ the Delphi technique
20	[40] Tanzania	Risk Management in Construction Project Case study of building and civil contractors	▪ Brainstorming ▪ Physical inspection	▪ Analysis of available information ▪ Checklist
21	[41] Albania	Risk Assessment and Allocation for Building Construction Projects in Preliminary Phase in Albanian Construction Industry	▪ Brainstorming ▪ expert opinion ▪ structure ▪ interviews ▪ questionnaires ▪ checklists ▪ historical data	▪ previous experience ▪ testing and modelling ▪ evaluation of other projects
22	[42] India	Risk Identification and Management in Construction	▪ Brainstorming ▪ Delphi technique	▪ Past projects/historical project data

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No.	Author Country	Study title	Identification Risk Methods	
		Projects: Literature Review	▪ Expert Interview and Checklist	▪ Documentation review
23	[43] Sweden	Risk Management in Construction Projects - A Knowledge Management Perspective from Swedish Contractors	▪ Checklists, ▪ Brainstorming ▪ Workshops ▪ expert interviews ▪ analysis of different scenarios as well as analysis of historical data and project plans	▪ Interviews ▪ past experience or historical data from similar projects.
24	[44] South Africa	Risk Management Framework	▪ review of external and internal audit reports, review of the reports of the Standing Committee on Public Accounts and the relevant Parliamentary Committee(s) ▪ financial analyses ▪ historic data analyses ▪ actual loss data, interrogation of trends in key performance indicators	▪ benchmarking against peer group or quasi peer group ▪ market and sector information ▪ scenario analyses, forecasting and stress testing
25	[45] Switzerland	Customisable framework for project risk management	▪ Documentation analysis ▪ Brainstorming ▪ Pondering ▪ Mind-mapping ▪ Checklist	▪ Workshop ▪ Expert Judgement ▪ Delphi method
26	[46] Nigeria	Risk Management Framework for Highway Construction Projects in Nigeria	▪ Checklists ▪ Brainstorming ▪ Historical data ▪ Expert judgement ▪	▪ Interviewing ▪ SWOT analysis ▪ Force field analysis
27	[47] Libya	Evaluation of Supply Chain Risk Management for Material Procurement in Libyan Oil Industry	▪ documentation reviews ▪ expert judgment ▪ diagramming techniques ▪ assumption analysis ▪	▪ information gathering ▪ checklists ▪ SWOT technique.

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