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Identification of construction risk techniques: A review

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Abstract

The construction project consists of multiple stages, independent and overlapping events and activities, and includes various parties, including decision-makers, consultants, owners, and project implementers. Completing a construction project is a difficult and complex process that is hardly devoid of problems or obstacles. The presence of risks, which may be either beneficial or detrimental, is one such impediment. Negative risks, uncertainty is the beginning of the emergence of risks, which have effects and consequences that prevent the achievement of project objectives. Therefore, the success of the project is guaranteed if the risks are identified from the beginning of the project., to complete a project or even a building project. This article aims to focus on the concept of risk management in general, the extent of its emphasis, and how to apply it to projects. Specifically, the initial stage of risk management, called risk identification, was reviewed. Ninety-one studies were reviewed between 1990 and 2023, demonstrating the importance of identifying risks, which helps stakeholders manage the project using modern management methods.

I. Introduction

The construction project faces various challenges and difficulties and is somewhat dangerous which prevents it from being successful and as planned. These challenges may be in the form of various risks. These risks may result from internal or external reasons that directly affect the implementation of the project in general. Therefore, there must be processes or Methodologies that manage control over the project in case it is exposed to risks and diagnose the types of risks and methods of prevention and the extent of their impact on the stages of the project as a whole, which requires sufficient experience and knowledge to achieve this. It is important to implement risk management in every project to be highly efficient and planned in a practical manner during the project planning stage. Risk management identifies deficiencies or defects that have a harmful impact on the project, as well as creating a safe working environment for all those working on a project [1]. Risk management predicts the occurrence of positive and negative impact risks and determines the measures and procedures that are appropriate for each risk that is likely to occur [2]. A key part of construction projects is the formulation of a risk management program; it poses a

challenge to participants in completing construction projects to limit or reduce the impact of risks [3]. All construction projects must have a system that manages expected or unexpected risks to guarantee the effective implementation of the task and thus achieve a successful project [4]. To achieve a profitable project and achieve stakeholder satisfaction, there must be dynamic risk management that eliminates negative risks [5]. Many studies have focused on the various stages that make up a risk management system. The first stage, risk identification, is the most fundamental because it involves investigating potential risks and determining what kind of risks they are. This serves as a safety valve for both the risk management process and the project as a whole. Identifying and evaluating potential risks is one of the procedures for managing project risk [6]. If a risk is not acknowledged, it cannot be measured or addressed, and trying to reduce risks in projects becomes difficult. Construction projects worldwide start with the first stage of risk identification [7]. It is necessary to identify many of them precisely, and the lessons can be learned may only become clear at a certain stage. This requires developing comprehensive strategies to address them effectively [8]. Identifying risks and ensuring they are taken into account helps ensures that risk management is implemented correctly, Hence the project objectives are achieved [9]. Identifying risk variables and predicting their occurrence is extremely important by determining the probability of their existence and their effects on the project and identifying strategies and methods to reduce their effects on construction projects [10]. If there are not many changes identified through studies at the beginning of the project, it becomes easier to achieve the goal and ensure the sustainability of construction projects [11]. Identifying risks requires that there be a discussion between the project parties concerned, which has a major role in determining the features of risks and the reasons behind their occurrence [12]. The process of identifying risks is not an easy matter, as this process requires an integrated system of team members specialized in risk management and consultants who have the ability to plan the project first and then investigate the negative risk factors before the positive ones. This is achieved by using specialized techniques and tools to implement and monitor the identification risk system. It is the first step on which the rest of the steps or stages of risk analysis, response, and control are based. This research paper focused on the importance of risk management, specifically the stage of identifying risks in a fundamental way. A comprehensive review of previous studies from different countries was conducted that dealt with the concept, importance and tools that were used to evaluate risks in Construction projects. Identification risk important in construction project for several key reasons including: prevent cost increase improve quality of project and enhance decision making. Fig. 1 illustrates the systematic literature review used in the study.

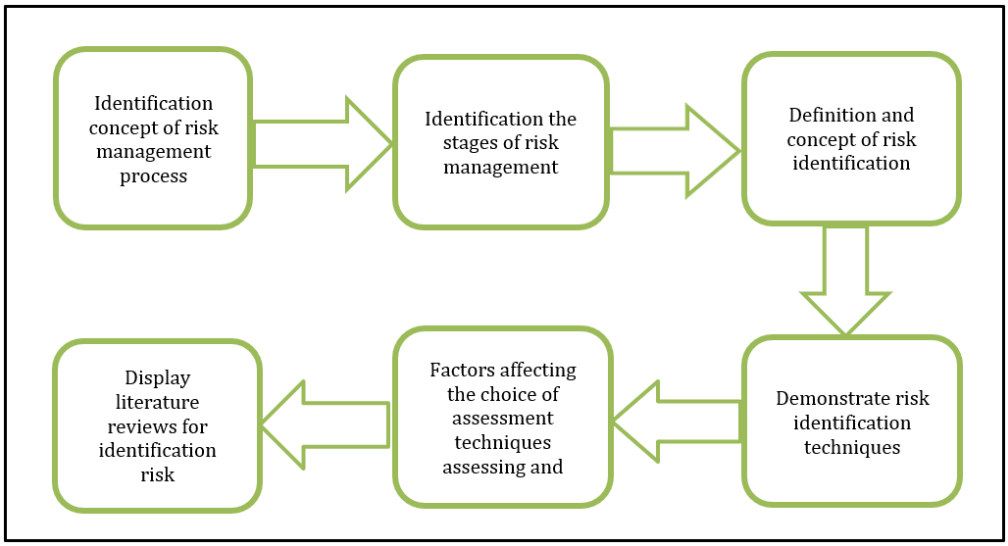

Fig. 1. Study methodology.

2. Risk management

Project experts are burdened with the heavy duty of confronting dangers. In order for managers and team members to effectively deal with and eliminate risks, a thorough grasp of the idea of risk management is necessary. One of the fundamentals of applying project management is risk management, which entails systematically analyzing risk areas to enhance the project's scope [13]. Risk management is the process by which a project's stakeholders decide to accept certain risks and then take steps to mitigate them, reducing the likelihood that they will materialize and impact the project in the future [14]. To ensure that construction projects are lively and sustainable, free of hazards that might compromise their success or continuation, risk management is the process of managing the environment in which risks are identified, evaluated, dealt with, and addressed [15]. The goal of implementing a risk management strategy is to get a clear understanding of potential dangers to the building project and to mitigate them as much as possible [16, 17]. Risk management is the process of making practical decisions that can be applied, taking into account all possibilities expected to occur, to obtain a satisfactory result for all parties of the project [18]. According to another study, it indicated that risk management is the sum of practical activities directed by management within the program that aim to absorb the possibility of failure of the program elements [19]. A systematic method used to identify risks, asses their impact, and determine appropriate strategies to address each specific of risk [20]. The goal of risk management is to maximize resource utilization by minimizing the likelihood and impact of negative outcomes by systematically identifying, assessing, measuring, and evaluating potential risks [21]. According to the most recent research, the basic framework is crucial for overseeing the project's most critical procedures [22]. A procedure that aims to accomplish and lessen the risks that a company faces is risk management [23]. To mitigate potential threats to the project's success, risk management is essential [24]. The presence of proactive management to eradicate risks and finish the project with all its needs is one of the ways that has been successful in many projects [25]. In construction projects, risk management is trying to spot dangers, investigating potential possibilities, and deciding how to deal with them [26]. Risk management is an approach to assessing, classifying and developing risks and suitable strategies to reduce them to a satisfactory level or eliminate them. Risk management should

be seen as a means to improve the project management process [27]. To maximize opportunities and eliminate threats that might lead to the project's loss or failure, risk management requires first establishing the kind of risk, which can be either positive or negative, and then analyzing the chance of the risk happening [28]. A decision-making process that incorporates a thorough risk definition and the development of processes to mitigate the effects and difficulties of risk occurrence [29]. Assessment, planning, and control actions are all part of risk management, with the goal of lowering acceptable risks or keeping them at a safe level [30]. Risk management is a complete set of activities aimed at dealing with any risk in order to maintain effective control over them in construction projects [31]. Several ideas about this procedure in building projects have been shown in the literature; it is a function of project management. An ideal strategy for efficient risk management is essential for construction projects in order to guarantee the highest quality integrated project completion.

2.1 Stages of risk management

Risk management is beneficial for many risk circumstances. This function is challenging and complicated since it needs an integrated system to manage risk systematically. As said, several studies have studied risk management phases:

- Divide the process into three basic parts: detecting, assessing, and evaluating risks and generating management strategies; distributing responsibility to the risk holder, who has expertise in controlling events before they happen, and estimating risk management expenses in relation to project priority [32].
- Risk management consists of three stages: identifying risks, assessing them, and developing appropriate responses to them [33].
- The risk management system includes policies, procedures and methodologies according to certain principles and rules, including assessing, analyzing ,reporting risks , developing plans and responses for each risk [29].
- Risk management includes six separate processes, including planning, identification, qualitative and quantitative risk analysis, risk response, and risk monitoring [34].
- Risk management consists of four stages: identifying potential risks in the project, Assessing the likelihood of potential risks, formulating procedures to avoid risks and developing measures to reduce risks [35].
- The risk management methodology consists of five main steps: developing a risk plan, risk identification, risk analysis, risk response and monitoring risks [37].
- The risk management process includes five main steps: Creating the approach, identifying risks, analyzing qualitative and quantitative risks, responding to risks, and controlling risk response [38].
- Risk management in a construction project includes four main stages: identification, assessment, analysis and response [39].
- Identifying and investigating risks, assessing risks, choosing a risk response Strategy, implementation and monitoring [40].

According to previous studies, the basic stages of the risk management process include six stages that operate as a single package, the primary goal of which is the success of the construction project and reducing the likelihood of project failure due to the various risks to which the project is exposed.

3. Risk identification

Construction project risk management begins with identifying and diagnosing hazards and opportunities. This stage is crucial because it determines risk analysis and reaction options. Risk identification was established to offer a thorough research view: to Give various definitions.

Project risk identification lists potential risks to manage [41]. Project managers and construction project risk management teams' expertise helps identify risks. Identifying, assessing and addressing risks contributes to avoiding project scheduling delays, enhancing and increasing work productivity, and thus reducing losses in the construction project. [42, 43]. Risk identification is the initial step of risk management, and failing to identify risk profiles might cost the project [44]. Risk identification involves assessing and treating risk profiles during response [45]. Construction project risk identification involves descriptively and continually identifying and categorizing the most important hazards [46]. Failure to identify hazards may compromise the risk management process and building project resources. Risk identification helps organizations manage risk by identifying the best and most important input data, improving process understanding, identifying risks and their effects, and informing decision-makers [47]. Risk management begins with identifying project hazards to mitigate their impact and make them evident to everyone [48]. The risk identification step is procedural. It has three phases. The first stage is done by the project team and risk management team, and the second by the whole team and key beneficiaries. All professionals execute the project's third phase. Not involved in prior phases [49]. Any project needs risk identification to reduce the damage caused by unanticipated hazards [50, 51]. Assess risks using these criteria: Project variables. External factors may not cause the project to lose or profit, but they impact the project as a whole [52]. Risk identification requires a concise explanation of the risks, their likely origins and outcomes, an evaluation of their impact, and the relevant administration creating early remedies to mitigate the risks [53].

Risk identification provides the foundation for analysis, evaluation, and control. It is considered more than just a tool for reducing risks, it is essential for achieving effective risk management.

3.1 Risk identification techniques

Identifying risks is the process of comprehensively understanding and being aware of the risks that may cause the project not to be completed or achieve its goals. At this stage, the characteristics and effects of the risks are determined. Once the risks are identified, it becomes evident that they can potentially be mitigated at least partially, regardless of whether they are minor or significant. The purpose of identifying risks is to establish a priority list of risks that must be seriously managed in the project because if they are neglected, it will cause problems in the subsequent stages [3, 53]. It is very necessary to develop a systematic approach followed by the project team and use identification techniques to address risks in the subsequent stages. The following serve as the most common risk identification techniques:

- Brainstorming: This method is often used with a group of consultants and specialists from different fields, rather than as a team, making it a crucial tool for risk identification. Its goal is to collect all kinds of project hazards in one place. All the important parties involved in the project have gathered here. There is only one person

in charge of briefing the participants on the many components and recording the variables. Since it necessitates an open conversation with the project teams and other participants, this risk identification approach seems to be well-structured. So, it's a chance to talk about the fact that risks are there, the damage they could do, and where they crop up [50]. By taking a candid and proactive stance, this method inspires all members of the project team to identify and discuss a large number of risks, both immediate and long-term. As a result, this method raises questions concerning how to identify hazards without being judgmental and without assigning blame [33, 54]. For the brainstorming session to be productive, it's important to have people included who are well-versed in risk management, particularly as it pertains to building projects.

- Delphi technique: By using this method, project members are not in the same physical location and do not know each other. The other people involved in the project will not be consulted when you make your diagnosis. The facilitator, using the same pattern as in brainstorming, compiles a summary of the aspects that were uncovered. While this approach certainly has its uses, it really shines when it comes to establishing relationships between the probability of risk events occurring and the possible consequences of those risks that have already been recognized [44]. In this method, a group of risk management specialists work together to either come up with new hazards to consider or to assess the likelihood and severity of those risks that have already been found by earlier surveys. A benefit of this technology is that it allows group members to remain anonymous. After reviewing the answers, the risk manager compiles an estimate based on the predicted outcomes. The data is re-distributed so that the session may be repeated. Until a definitive decision is made, the process will be prolonged. The brainstorming method is more efficient and less costly than this approach [55]. As participants may have difficulties in understanding the questions and outcomes, another disadvantage of this method is the absence of teamwork and dialogue.
- Expert opinions: It can be called interviews, where experts conduct interviews with participants with experience and expertise in the project, to be a helpful factor in avoiding or solving similar and recurring problems. Interviews can be conducted with anyone in the project to form an idea and thus obtain a comprehensive list of potential risks [50]. An expert is a person who has prior knowledge in their field of specialization in general and has information and experience through which they can easily identify potential risks. Interviews are conducted with experts to assess risk criteria and severity and develop emergency measures to reduce their consequences. This step is considered the beginning and introduction to the quantitative analysis required to be performed later [56]. This technique requires time, so it is necessary to organize and set clear and unconfusing questions to obtain clear answers and information [57]. One of the negatives of using expert opinions is that experts' opinions are based on personal views that are not free of bias. A meeting is organized with an expert or a group of experts and questions are asked of them to obtain information through which risks can be identified and evaluated [44].
- Past experience: An analogy may be built based on prior experience with a comparable project in order to identify the components. Project similarities and differences may be better understood by comparing their attributes [33, 44]. To find out what risks are

involved in a project, you may look at comparable projects in the past or look at similar ones now. You can also do a risk analysis, look at lessons learned, or look at project assessments [6].

- Questionnaires: Risk identification questionnaires help identify project hazards. It involves compiling risk-related questions and sending them to the project manager and team. Questionnaire responses must be consistent and directly disclose and describe hazards and their impacts. A drawback of this method is that the findings are dependent on individual opinions [6, 44, 58].
- Risk register: Risk registers record risk information and management techniques in a common manner. Description, probable causes, ownership, likelihood, impacts, mitigation and rollback strategies, and status are recorded for each risk factor. It details secondary hazards, contingency strategies, and quantitative criteria. Checklists may hamper risk identification; hence, they should not be used to start the process [33, 59].
- Checklists: A fast and easy risk detection method. Implementation involves creating a checklist based on historical data from comparable initiatives and other sources [44]. Non-checklist items should be carefully examined. The checklist should also be reviewed after project completion to enhance it for future initiatives. It identifies danger by examining pre-determined crucial points for symptoms [57]. They are simple to use and grow over time with expert inputs and community experience.
- Influence diagrams: Impact diagrams show risks, their effects, and their linkages. It identifies dangers and their phases, making it a key risk parameter determination method [6]. Influence diagram—a network with nodes representing issue decision variables. The conventional influence diagram has utility, decision, and informative nodes. The contract of benefit and contract of chance have a probabilistic causal connection [44].
- Document review: Periodic, detailed project documentation reviews should consider all assumptions, plans, and project files. These may indicate project hazards [60]. This analytical method breaks down the process into its essential components. The contractor's first project ideas and proposals are carefully examined by evaluating project drawings and paperwork [9].
- Information–gathering techniques: These are data collection methods, including brainstorming, the Delphi method, conducting interviews, and analysis SWOT [9, 33].
- Cause-and-effect diagrams: These are Ishikawa or fishbone diagrams. This graphic identifies variables and links them to risks, their repercussions, and their impact on each other. The figure places risk outcomes on the right and causes on the left. The reasons are organized by their classification [44, 50].
- Outputs of risk-oriented analysis: This technique relies on identifying risks through analysis, including fault tree and event tree analysis. The top-down analysis includes events that lead to unwanted risks and have a negative impact on the project [61].
- Preliminary hazard analysis: This simple inductive analytical method identifies risks and dangerous situations that could cause damage. Specific task or system. It is used early in a project when design specifics are few or... Operation and this analysis will form the foundation for failure investigations. Fill out system design requirements.

Analyzing current systems to prioritize hazards and risks might be useful. Extra analysis or when circumstances preclude a more detailed method [36,62].

- Event tree analysis is a graphical representation technique. The sequence of events that follows the initial event can be applied qualitatively and quantitatively. This technique is used Modelling, calculation and classification related to risks are applied at any stage of the project or product and can be applied qualitatively or quantitatively [44, 62].

In order to identify and diagnose all possible risks that may affect a particular construction project, vital techniques can be applied. It is important to use the techniques used by the project team in a manner appropriate to the size of the project. Table 1 represents a compilation of techniques found in previous literature.

Table 1. Risk identification techniques.

No	Techniques	Advantages	Disadvantages	Author
1	Brainstorming	Generate a quick idea within a short time frame to reach the optimal solution.	Difficulty in organizing and managing large groups of expert participants.	[33, 50, 54]
2	Delphi technique	Collect expert opinions with complete freedom and without worry, as well as the flexibility to obtain a large number of answers with a wider range from different projects.	Its implementation takes time, which makes it inapplicable in identifying urgent risks that require quick solutions.	[44, 57]
3	Expert opinions	The ability to develop knowledge, identify and describe various risks, so that there is a comprehensive understanding of the type and effects of risks.	Some experts have biased opinions, making it difficult to obtain accurate information.	[44, 50, 56, 57]
4	Past Experience	It has high reliability and consistency due to experience in exploring various risks and focusing on risk management.	Although experts have highly competitive experience in identifying risks, this does not apply to all projects, i.e., experience alone is not relied upon.	[6, 33, 44]
5	Questionnaires	It helps save time as it is one of the most important criteria for the project's success, as well as the ability to cover various projects and ensure there is no bias in the answers.	Lack of sufficient seriousness on the part of participants, as some questions are answered hastily and without a clear and complete vision of the risks.	[6, 44, 58]
6	Risk Register	It is considered an effective tool for identifying risks, as there is a description of the details and type of each risk, which enables project managers and risk management to identify and track risks.	Risk register managers sometimes fail to adhere to a standardized risk measurement, and failure to record risk responses leads to a lack of understanding of the intersections between risks.	[33, 59]
7	Checklists	It enhances organizational efficiency in risk management by mitigating risks and developing contingency plans to limit their impact and prevent them from turning into greater risks.	If project risk management scenarios are not applied practically, they will not be effective in identifying risks.	[44, 57]
8	Influence diagrams	It comprehensively explains how risks are interconnected, assessed and managed through a diagram, with solutions and risk prioritization.	If the impact diagrams are not clearly represented, this leads to a decrease in the alignment of the risk management team, making it difficult to identify risks.	[6, 44]
9	Document Review	A proactive tool for identifying risks early before they escalate and pose a	If information is not properly collected and documented,	[9, 60]

No	Techniques	Advantages	Disadvantages	Author
		threat to the project.	including from project documents and previous risk logs, it is difficult to identify and assess risks.	
10	Information Gathering Techniques	It facilitates the comparison of risks through a detailed explanation of each risk and identifies risks from most to least risky.	The larger the scope of the project, the more difficult it is to collect information to diagnose risks, as it requires greater resources and planning, which is a waste of time.	[9, 33]
11	Cause-and-Effect Diagrams	It is relatively easy to understand due to the root cause analysis of risks and the identification of risks and potential causes through visual vision.	Provides guidance to help the risk management team develop procedures and solutions to mitigate risks.	[44, 50]
12	Outputs of risk-oriented analysis	Useful in identifying risks and how they financially impact the project.	It requires examining different scenarios that identify varying risks based on different variables or inputs.	[61]
13	Preliminary hazard analysis	Risk identification is done by referring to a risk analysis in similar projects, taking into account changes in the project environment.	It depends on the project team's experience as this technique is simple and unsystematic.	[62]
14	Event Tree Analysis	Risks are identified from the top down, which reduces the possibility of random and sudden risks occurring, thus reducing the loss in risk management.	Applying this technology within limits requires the use of integrated tools and programs with risk identification methodologies as well as creating a log that requires time.	[44, 62]

After reviewing previous research, examining various studies from around the world, and explaining the advantages and disadvantages of each risk identification technique, it is concluded that the best technique to use in projects to accurately and fundamentally identify risks is a risk register. This tool provides a description of each risk within key categories. This register is not used for a one use, but is subject to continuous updating when a potential risk occurs.

4. Factors influencing selection of risk identification techniques

When choosing and determining a technique for identifying and assessing risks, the following factors must be taken into account:

- How difficult the problem is and finding effective ways to evaluate it.
- The degree of uncertainty in identifying risks is based on the required information and what is required to analyze it.
- Availability of the required resources, including time, cost, expertise, data needs, and methods that provide quantitative outputs. When determining risks, the project location and external factors that may cause the project to fail must be taken into account [63].

5. Review risk identification techniques from previous research

Risk management professionals may predict future hazards by understanding risk identification methods and how to identify them based on the building project. Risk identification uses exploratory information from interaction approaches to forecast risk events. These technologies use statistics, machine learning, and AI algorithms. The literary evolution of these strategies during the 1990s is covered in the following subsections. Fig. 2 shows statistics for the studies reviewed.

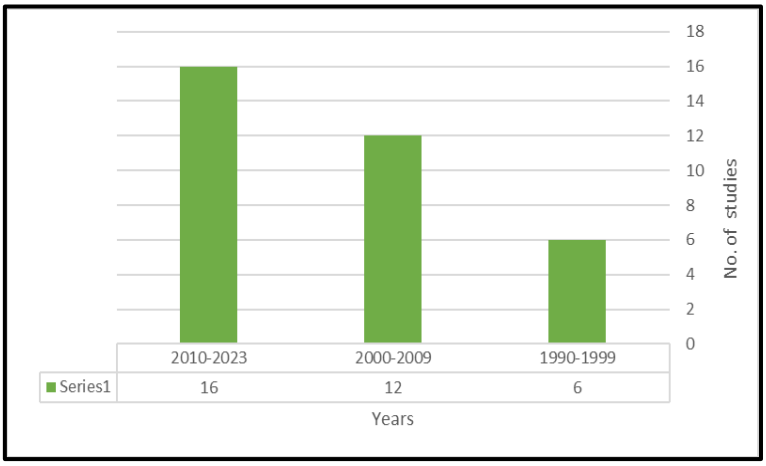

Fig. 2. Period for literature reviews.

5.1 Literature between 1990 and 1999

Researchers use many techniques and methods that fall under mathematical models and computer algorithms to predictively determine risk. They have begun to identify risks by developing the Risk Identification Tool for Specialized Systems RITES [64]. This system has helped risk managers, who have little understanding of this approach, in using it and ensuring that risk factors are clearly identified. It is suggested to use the trade-off approach to help identify project risks and their effects within the framework of risk management within the project. This approach gives positive and high results in identifying risks [65, 66].

Proposed hierarchical holographic modelling (HHM) to identify large-scale risks, which is implemented by identifying weaknesses in project managers' understanding collected from interviews and the program document [67]. Use a work breakdown structure to identify individual and cumulative risks with project documentation, scope, and project management plan [68].

5.2 Literature between 2000 and 2009

Suggested a project risk management software method for visually displaying hazards [69]. A co-occurrence network was utilized to detect hazards by linking nodes, and the most relevant axis was project risks [70]. They used component analysis to assess whether the observed variation between two values is connected to those not presently seen [16]. The Multi-Attribute Group Decision Making approach identified project hazards. Risks were categorized using the TOPSIS technique. The risks for the gas refinery plant project varied from unusual to practically definite, helping the project risk management prioritize events [71]. The researchers used computer algorithm models to integrate case-based reasoning with rule-based reasoning to eliminate expert opinion subjectivity in identifying future dangers [72]. Case-based reasoning is A branch of AI that solves new issues using old data. Such methods are applied to construction risk identification [73]. A 3D model with information, management, and logistics interfaces was offered as an integrated interface architecture. Risks were identified and diagnosed by [74] using many data sources. For software-intensive systems, [75] presented FMEA, FTA, and HAZOP safety engineering methods. This strategy gives clients a customizable framework so risk managers can use these methods to find project-specific risks. A risk identification model and technique were used to detect hazards when the project team lacked risk identification expertise [76]. Graphical

representation helped them organize expert brainstorming data [77, 78]. They advised combining system modelling and risk modelling to create a graphical strategy to record, detect, and characterize project security concerns [79]. Using logic diagram models, authors offer this value-focused process engineering (VFPE) method, which combines the project model's process and goal and uses logical certainty to link them. Complete risk.

5.3 Literature between 2010 and 2023

To diagnose risks, they suggest a combined approach of Delphi and AHP techniques to identify future uncertainties that the project may face. Current situation [80]. Authors in [81] applied the Hierarchical Gaps Method (HGM) is a method that arranges tasks gradually, which helps in identifying risks in the project. The HGM method arranges a work breakdown structure for the tasks it enables risk managers to perform by identifying the gap between expected and practical indicators through which risks can be identified. During this time period, there has been an increase in the number of studies that combined various models and techniques to identify risks more efficiently in construction projects. Authors in [82] use integrated value reasoning techniques such as fuzzy systems and multi-criteria decision-making methods to clearly identify risks. They identified risks through the fuzzy system technique in the class of logic diagram models [83]. The Value Chain Dynamics Toolkit (VCDT) approach was used to propose a method for identifying risks in order to find new risks. The proposed approach used dynamic modelling of the system [84]. In order to achieve this, it first defines the objective of the risk analysis before identifying any potential additional risks. This model helped transfer knowledge of risks to Stakeholders. They use value-focused process engineering methods to detect risks and identify project risks [48]. Risks were identified using a cause-and-effect relationship [15]. A software tool Cognitive Work Analysis (CWA) technique, was used to identify human factors risks [85]. Another suggested Virtual prototyping (CVP) tool that implements multidimensional modelling and simulation of worker behaviour to pre-diagnose risk events that may occur in the construction project [86, 87]. Show the importance of prototypes to identify risks in the construction industry. Use SWOT analysis, A technique that helps risk managers identify risks, whether they are internal or external risks in the project [44]. Developed a model to identify risks from previous projects. This was done by conducting interviews with experts and looking at the circumstances in which certain problems occurred in the past that could occur in future development projects [51]. The proposed pairwise analysis for risk identification in the project used this analysis to predict either certainty or uncertainty of what happened while taking into account the impact of different risk variables in different environments [59]. Authors in [58] used the Work Breakdown Structure (WBS) to identify risks at each stage of the construction project. A study that used the agile approach to identify risks, how to explore them, and their impact on the project [88]. Authors in [89] used Risk breakdown matrix (RBM) that uses a work breakdown structure to diagnose risks expected to occur in projects. It has been proposed to use NLP to automatically identify risks in construction projects by reading the project plan [90]. Neuro-linguistic programming (NLP) is a type of artificial intelligence that enables computers to understand and use information to make decisions by reading... Read text or audio. In [91], the authors proposed an integrated model to identify risks by analyzing the progressive weight assessment ratio by applying the (SWARA) technique.

6. Conclusions

There are many studies that have discussed risk management in general, covering its concept, components, stages, characteristics, and features associated with each stage. This study focused on reviewing the literature related to the stage of identifying and evaluating risks.

- The methods currently used for risk assessment are brainstorming, checklists, flowcharts, the Delphi method, and the critical risk indicators method. These methods are the most commonly used in construction, as they rely on expert input to identify risks and how to address them. Each risk assessment method has its limitations, and existing risk assessment methods can be combined into new and effective methodologies that enable decision makers to implement risk assessment effectively and efficiently.
- Identifying risks helps in defining the criteria for understanding project risks in general. This, in turn, supports key construction stakeholders-including owners, consultants, contractors, and construction companies, adapting their approach to managing project risks at all stages.
- Risks are identified by applying identification techniques after periodically reviewing the data and the project life cycle. The review is conducted by the project risk management officials.
- Utilizing modern methods such as artificial intelligence and mathematical modelling to identify risks.
- There is interest in studying the risk identification phase. This study emphasizes the necessity of considering risk identification as an essential activity to complete the risk management process to successfully implement project activities and eliminate negative risks to the project.
- When determining risks, the kind of project must be taken into account. Observe standards and restrictions to achieve definite goals and use new methods to collect and analyze data and display the results in a useful way to decision-makers.

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