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AN INNOVATIVE STRATEGY FOR RISK MANAGEMENT IN BUILDING WORK IN EMERGING COUNTRIES: INDIAN SUBCONTINENT

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Abstract:
The concept of risk management is very young, and emerging country construction sectors lack a basic risk management system. The construction sector in this nation has a poor reputation for managing risk and is known for its high risk-taking. However, because of the heightened competition and development activity, it is progressively becoming more significant. This goal has led to the investigation of the risk management techniques applied in India building projects through a survey-based study. Twenty-two contractor firms operating on one hundred different projects provided data for the purpose of achieving the goal. The investigation shows that the local environment has only partially adopted risk management. The findings also show that successful risk management and project outcomes are more highly correlated. The results demonstrate the value of risk management strategies, their application, implications, and impact on building project success from the contractor's point of view, thereby persuading the project's principal players to adopt risk management.
Keywords: risk control, building projects, achievement of goals, and the viewpoint of the builder

1.0 Introduction

The construction business is known for being high-risk and having a poor track record in managing risks (Shen et al., 2001). Construction projects are inherently dangerous, as stated by Wang et al. (2004). Project success in the construction business is mostly dependent on the level of risk (Kartam and Kartam 2001). The more parties involved in a contract, such as contractors, subcontractors, suppliers, owners, and designers, the higher the level of risk (Iqbal et al., 2015). Implementing risk management strategies can reduce this amount of risk (Aleshin 2001; Iqbal et al. 2015).
Construction industry projects vary in size (small, large, medium) and have variable levels of risk (Hwang et al. 2014). Oftentimes, inadequate risk management leads to poor industrial performance (Iqbal et al., 2015). Large-scale infrastructure projects often incur substantial financial losses due to the significant budgets involved, which are attributed to the many risks associated with these megaprojects (Deviparasath 2007). These losses must be recognised and reduced. Risk management, as defined by PMI in 2017, involves the process of identifying and mitigating risks.
Several systems for risk management have been created by different scholars. Iqbal and colleagues (2015) created a risk management framework to assess the importance of various hazards and the efficacy of risk management approaches used in building projects. Aleshin (2001) developed a framework for practical risk management recommendations for joint projects in Russia. Choudhry and Iqbal (2012) identified and prioritised common risks, management techniques, the current status of risk management system implementation in organisations, and barriers to effective risk management in the construction industry. Wang et al. (2004) developed a risk management framework focusing on risk identification, methodologies, risk appraisal, and effective mitigation measures. Furthermore, a risk model called the Alien Eyes' Model was presented, illustrating hierarchical levels of risk and the interplay between the dangers. Shen (1997) presents a risk management model that identifies crucial hazards and their mitigation plan from the contractor's point of view. Furthermore, there are few analytical methodologies accessible to evaluate the significant hazards in the Hong Kong building business. Bing and Tiong (1999) introduced a thorough risk assessment model to detect and evaluate

hazards in joint venture projects. This model is efficient in pinpointing crucial risk elements and offers a method to assess these risks more effectively.
Project management involves applying skills, tools, techniques, and knowledge to project activities while focusing on meeting stakeholders' expectations (Hwang et al., 2014). The construction sector is one of the most overlooked sectors in India (Hameed and Woo 2007). Conducting risk analysis and implementing risk management strategies are essential components of project management. Risk is the characteristic of a system that pertains to the potential for various results (Jaafari 2001). Risk is an occurrence that can influence an organization's goals and perhaps hinder its performance by causing low productivity, subpar quality, and budget escalation (Akintoye and MacLeod 1997; Loosemore et al. 2012). Risk management is regarded the most crucial aspect of construction management execution (Tang et al., 2007).
The main focus is on the triple constraints of the project, which include time, money, and quality, as well as the integration, communication, human resources (HR), and procurement process. It aids in shaping the future direction of projects by identifying possibilities and uncertainties (Borge 2001).
The framework aims to identify and evaluate all risks that the project may face in order to make informed decisions on how to manage them (Zou et al. 2007; Flanagan and Norman 1993; Barber 2005). Previous study has extensively covered risk management, with minimal to no focus on India's standpoint. Insufficient risk management techniques in India's construction industry lead to delays and budget overruns in many projects. There is a significant requirement to provide training and education to personnel regarding risk management procedures in the construction sector. This research intends to create a framework to study risk management strategies and their impacts on generating future benefits for building projects in India.
The research presented here examines the risk management techniques implemented by contractor organisations in India's construction industry. The research aims to:
(i) Research, identify, and priorities risk management techniques,
(ii) Identify and priorities project success factors in the construction industry,
(iii) Apply effective understanding of risk management in construction projects,
(iv) Study and investigate the relationship between carrying out effective risk management and the success of construction projects in India.
The primary objective is to assist contractor firms in managing their future and ongoing projects by emphasizing the implementation of risk management methods and evaluating the impact of risk management on the success of construction projects.
The structure of this study is as follows: Section 1 talks about how risk management came to be, what it means, and what has been done in the past. a suggested arrangement for risk administration is given. We talk about the risk management methods used in the present investigation. There are leads to and an argument.

2. Methods of Investigation

The following section outlines the research methods used in the present investigation. It begins by comprehending how to manage risks. A review of the literature has been performed on risk management, including its methodologies and recent discoveries in the field. A questionnaire was prepared using a 5-point Linker scale after doing a literature research and discussing with senior management in the construction sector. The document had three main sections: the respondent's basic profile, questions on the investigation of risk management objectives, and questions concerning the success criteria (PSF, i.e., project success factors). 270 respondents completed the surveys in person at face-to-face meetings over field connections. The target demographic included the contractor businesses registered with the India’s Engineering Council (PEC). The firms are classified as CA, CB, C1, C2, C3, and C4 according to their tendering limit, as shown in Table 1. This study primarily focused on construction projects such as bridges, flyovers, buildings, infrastructures, roads, and dams.

The target market comprises project managers, deputies project management, senior site professionals, and organizing architects from various constructions organizations.

Table 1: IEC (India Engineering Council) Categories and tender Limits for Companies.

PEC Categories	CA	CB	C1	C2	C3	C4
Tendering Limit	No Limit	2000 M	1000 M	500 M	250 M	100 M

Various responders are working on distinct initiatives falling under diverse categories of certification inside the IEC. The majority of samples were obtained from organizations categorized as CA and CB, accounting for 34.4% and 32.2% of the total, respectively, as shown in Table 2. Furthermore, 58.5% of the individuals surveyed had extensive experience, exceeding 20 years. The obtained data is deemed credible and exact based on their expertise. 35.6% of replies were gathered from deputy project managers and 21.5% from project managers, affirming the quality and trustworthiness of the data. 41.1% of the samples were obtained from infrastructure projects, and 47.1% of these projects had a cost above 300 million rupees.

Table 2 illustrates the characteristics of companies, respondents, and initiatives.

No of Samples (N = 270			
Characteristics	**Category/Range**	**N**	**%**
Contractors	CA	93	34.4
	CB	87	32.2
	C1	66	24.4
	C2	5	1.9
	C3	14	5.2
	C4	5	1.9
Position in Job	Senior Engineer	37	13.7
	Planning Engineer	79	29.3
	Deputy Project Manager	96	35.6
	Project Manager	58	21.5
Type of Project	Buildings	83	30.7
	Infrastructure	111	41.1
	Motorways and Highways	66	24.4
	Dams and Bridges	10	3.7

Table 2. Cont.

No of Samples (N = 270)			
Characteristics	Category/Range	N	%
Experience	<5	4	1.5
	5–9	15	5.5
	10–20	93	34.4
	>20	158	58.5
Project Cost	≥5 M	9	3
	10 M<-----< 100 M	54	19.9
	100 M ≤----≤ 300 M	79	29
	≥300 M	128	47.1

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3.0 Proposed Foundation for Risk administration

The following subsection outlines the suggested risk management arrangement. The suggested framework focuses on examining risk management via the risk management technique, which includes risk identification, risk assessment, and reaction, as well as problem-solving for discovered and evaluated hazards, known as risk mitigation.

It is necessary to implement the risk management cycle outlined in the research to ensure the achievement of the goal.

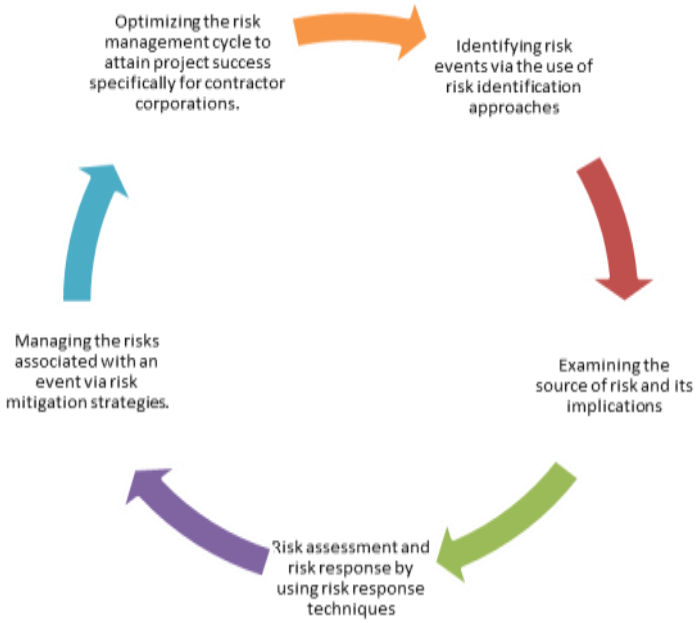

Figure1: Flow diagram to implement the risk management cycle

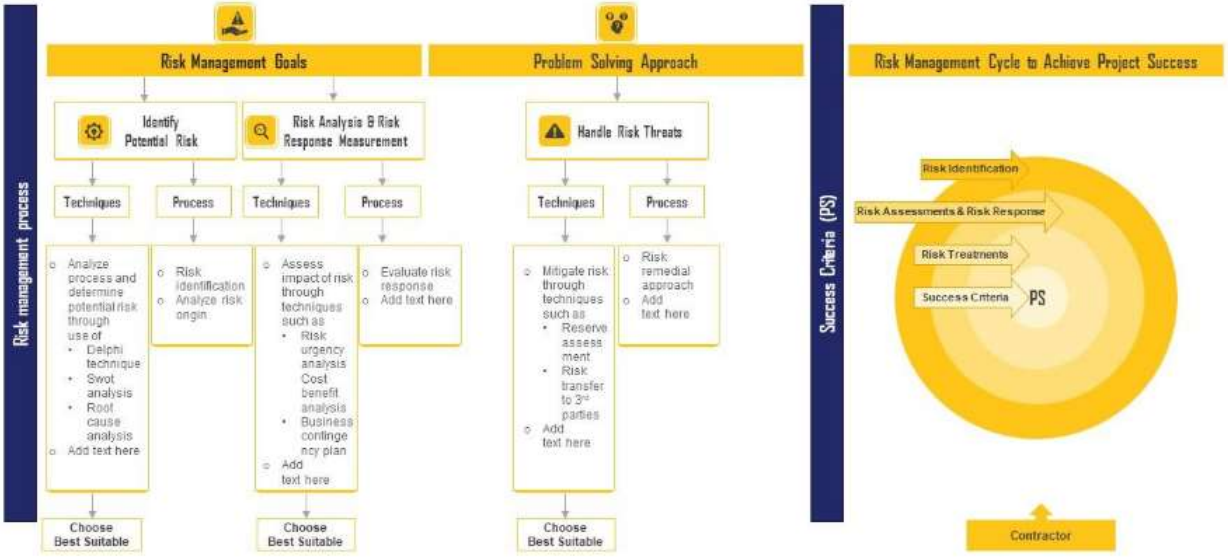

Figure 2 illustrates a proposed Risk Management System for the Construction company operations. In India, the builder plays a significant role in building projects. The contractor determines the use of the maximum budget and scope. The subcontractor has responsibility for managing the project timetable. Among stakeholders involved in a building endeavor, the contractor is the only organization that must address various risks throughout the project's life cycle (Khan 2013; Choudhry et al. 2012).

4. Methods for Analyzing Data

The researcher used IBM's Statistical Package for Social Sciences (SPSS) version 25.0 for data analysis. The study includes estimating the sample population mean, ranking techniques based on their means, and doing correlation analysis using Spearman rank correlation.

The analytical findings were deemed significant at the 0.05 level and highly significant at the 0.01 level. The ranking in this research was determined by the mean of a sample population. The ranking of risk management approaches and project success indicators was based on the mean values of the sample population. those that are greater were ranked as first, while those that are lower were ranked as last. The Spearman rank correlation test was used to assess the nonparametric relationship or direction between two variables according to the measurement scale, represented by the symbol (r-Rho). The null hypothesis (H0) was supported when there was no correlation between the variables. The hypothesis was rejected if the outcome was statistically significant at the 0.05 level or highly significant at the 0.01 level. An analysis was conducted to examine the relationship between efficient risk management and the outcome of construction projects (project success) to ascertain whether the efficacy of risk management impacts the success of a project

5. Conclusions and Discussions

Applying risk management approaches and understanding project success allows for a thorough study of the techniques used and demonstrates the link between the techniques and the advantages obtained.

This section discusses the results of applying three steps.

5.1. Risk Management Techniques

Risk management may be achieved by a systematic application of strategies that include identification, evaluation, reaction, and treatment. A detailed explanation has been rovided step by step.

5.1.1. Risk Identification Techniques

Risk identification approaches were ranked in order of frequency of usage based on their means. Respondents were asked to indicate the frequency with which they use on a scale of 1 to 5, with 1 indicating never used and 5 indicating always used.Table 3 displays the rating of risk identification strategies according to their effectiveness in examining the process of successful risk management. The risk detection approach "lesson learned from past projects" was chosen as the most often employed by respondents and scored first based on its mean score of 2.54. The "nominal group techniques" had a mean score of 2.31, ranking it as the 12th least significant in this category. The following techniques were identified with their corresponding means: "risk review meetings" (mean 2.51), "interview" (mean 2.50), "mind mapping" (mean 2.49), "cause and effect diagrams analysis" (mean 2.45), "checklist analysis" (mean 2.44), "expert judgement" (mean 2.43), "Delphi technique and SWOT analysis" (mean 2.40), "brainstorming" (mean 2.38), "root cause analysis" (mean 2.37), and "system or process flow charts" (mean 2.33). Risk identification is the first phase in risk assessment, including the identification and categorization of possible risk elements in building projects. Brainstorming,

historical data, interviews, questionnaire surveys, and workshops are often used strategies for identifying risks (Tang et al., 2007).
Table 3. Ranking of Risk Identification Techniques

Techniques	M	R
Interviews	2.5	3
Scenario analysis	2.33	11
Delphi technique	2.4	8
Expert judgment	2.43	7
Root cause analysis	2.37	10
Risk review meetings	2.51	2
Cause and effect diagrams analysis	2.45	5
Checklists analysis	2.44	6
Nominal group techniques	2.31	12
SWOT analysis	2.4	8
Lesson learned from the past project	2.54	1
System or process flow charts	2.33	11
Brainstorming	2.38	9
Mind mapping	2.49	4

5.1.2. Evaluation of Risks and Strategies to Address Risks
The risk assessment and risk response strategies were ranked in order of frequency of usage based on their means. Respondents were asked to indicate their use frequency on a scale of 1 to 5, with 1 indicating never used and 5 indicating always used.
Table 4 displays the ranking of risk assessment and risk response strategies according to their average scores, to analyze the effectiveness of risk management. The risk assessment method "expert judgment and WBS" was chosen as the most often utilized methodology by the respondents and rated first with a mean of 2.44. Additionally, the category "data gathering and representation techniques" had a mean score of 2.20, indicating it was considered less essential and placed 9th in this group. Other recognized strategies were "business contingency plan" (mean 2.39), "risk control plan" (mean 2.38), "risk immediacy evaluation" (mean 2.36), "cost–benefit analysis" (mean 2.34), "prioritizing the risk" (mean 2.29), using "risk index methodology based on anticipated value in cash (EMV)" (mean 2.28).
Table 4 illustrates the ranking of hazards and Risk Response Methods of Instruction.

Techniques	M	R
Risk index method & expected monetary value	2.28	8
Qualitative & quantitative analysis	2.38	3
WBS & expert judgment	2.44	1
Data gathering and representation techniques	2.2	9
Risk urgency assessment	2.36	4
Cost–benefit analysis	2.34	5
Prioritizing the risk	2.29	7
Consultation with experts & meetings	2.33	6
Risk management plan (RMP)	2.38	3
Business contingency plan	2.39	2

5.1.3. Methods of Reducing Challenges

Risk treatment approaches were ranked from most often used to least commonly utilized based on their averages. Respondents were asked to indicate the frequency of use on a scale of 1 to 5, with 1 indicating never used and 5 indicating always used. Table 5 displays the ranking of risk treatment strategies according to their average effectiveness in assessing the process of efficient risk management, taking into account the degree to which organizations used the risk treatment option in activities. The risk treatment strategy "decision making and mitigating the negative risk" was chosen most often by the respondents and placed 1st based on its mean score of 2.40. Additionally, the activity of "sharing the positive risk and variance and trend analysis" with a mean score of 2.28 was deemed less significant and rated 7th within this category. Additional strategies were "avoiding negative risks" (mean 2.37), "exploiting positive risks" (mean 2.35), "reserve analysis" (mean 2.32), "accepting positive risks" (mean 2.31), and "transferring negative risks" (mean 2.29). An analysis of the treatment process reveals that the construction sector in India's mostly favors "avoiding damage to the danger" (ranked 2nd) and " profiting from the risk" (ranked 3rd) above "shifting that risk" (ranked 6th).

Decision making	2.4	1
Variance & trend) analysis	2.28	7
Mitigating the negative risk	2.4	1
Reserve analysis	2.32	4
Accepting the positive risk	2.31	5
Exploiting the positive risk	2.35	3
Avoiding the negative risk	2.37	2
Transferring the negative risk	2.29	6
Sharing the positive risk	2.28	7

5.2. Accomplishment of the Plan

The endeavor's success variables were ranked from most commonly used to less frequently utilized based on their meaning. Respondents were asked to indicate the frequency of use on a scale from 1 to 5, with 1 indicating never used and 5 indicating always used. Table 6 displays the project success elements ranked according to their means in assessing project success criteria. The project success element "no complaints and claims" with a mean score of 2.53 was chosen as the most significant by the respondents and rated first. The completion of the project within the timetable was rated as less significant with a mean score of 2.33 and was placed 7th in this category. The study also found that other significant criteria were meeting the overall project quality goals as per the baseline and targets (mean 2.47), confirming all technical specifications (mean 2.43), meeting all quality standards (mean 2.41), and fulfilling the project scope without any revisions (mean 2.37). The study on project success criteria revealed that the majority of building initiatives are deemed effective if they accomplish the project baseline, meet goals, and confirm all technical specifications (ranked 2nd and 3rd, respectively). Delay in completing most of the project resulted in increased total cost, ranking it 6th. In order to meet project goals and objectives, the project must adhere to the timeline, budgetary constraints, requirements for quality, and established scope as per PMI 2017.

Table 6 indicates the ranking of the Project Effectiveness Variables.

Project Success Factors	M	R
Fulfill scope/no changes in scope	2.37	5
The project is within the planned budget	2.33	6
Overall project quality objectives meet based on baseline and targets	2.47	2
Completion of project within schedule	2.29	7
Fulfill all quality standards	2.41	4

Confirm all technical specification	2.43	3
No complaints and claims	2.53	1

6. Conclusions and Proposals

The current research introduces a novel paradigm for handling risks in the buildings industry of India. A survey-based research was done to explore the risk management strategies used in building projects in India.

This research study aims to assess the impact of risk management in the construction sector of India's. It will assist contractor businesses in the construction sector in identifying deficiencies in effectively implementing risk management. An analysis of the risk variables associated with building mega-projects will create a competitive environment among project stakeholders, prompting contractors to enhance their risk management strategies. This endeavor drives the evolutionary process of shifting the thinking of all contractors towards adopting risk management methods to enhance productivity.

The primary results of the investigation are:

In India, the primary risk administration approaches used to evaluate hazards are:

(i) learning from earlier projects (mean 2.54)

(ii) risk review meetings (mean 2.51)

(iii) Delphi methodologies (mean 2.40).

The most often used risk assessment and analysis methods

The research reveals that project success factors include no complaints or regrets from customers (mean 2.53), achieving every goal of the project (mean 2.47), and following all technical specifications (mean 2.43). Meeting these criteria indicates a significant achievement in project success. Nevertheless, India's biggest contractors do not often see completing a project within time (mean 2.29) and avoiding modifications in scope (2.73) as effective elements for project success. The research shows a connection between risk management techniques and project success, indicating a strong link between good risk management and project performance.

The research examines various risk management strategies by analyzing the perspectives of the leading India'si contractors in the building sector. The research's findings provide project managers, assistant project managers, and senior project members the chance to oversee current and future projects of their contractor businesses by using the risk management approaches outlined in the report. The research reveals that the construction business in India has a poor degree of "risk identification" methods. There are no rapid mitigating measures in place in the event of a risk occurrence.

Future study might explore risk management techniques and their impact on project success in industrialized and developing nations. It is crucial to use a systematic strategy to risk management in India's's local environment to reduce individual and group risks. The risk management requirements in the building business need to be improved.

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