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Risk Management in Residential Projects

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Abstract

The construction industry faces numerous risks, particularly in residential projects with significant complexity and scale of operations. Effective risk management in these projects is critical to ensuring successful outcomes. This study focuses on identifying, assessing, and mitigating risks associated with residential construction. The industry faces various technical, socio-political, commercial, organizational, resource, financial, and safety risks. The research aims to highlight the importance of systematic risk management practices, which include identifying potential risks, evaluating their impact, and implementing strategies to manage them. The study employs a comprehensive methodology, involving literature reviews, surveys, and data analysis, to understand the prevailing risk management practices and propose improvements. The findings emphasize the need for a proactive approach to risk management, integrating it into the early stages of project planning and execution. The study concludes that adopting robust risk management frameworks can significantly enhance project performance, reduce uncertainties, and ensure timely and within-budget project delivery.

Keywords: *Construction Industry, Risk Analysis, Risk Management, Residential Projects.*

1. Introduction

Risk management is the process of recognizing, evaluating, and mitigating threats to an organization's assets, profits, and activities. These hazards originate from various sources, such as financial instabilities, legal responsibilities, technological problems, strategic management mistakes, accidents, and natural calamities.Risk management is the systematic process of analyzing, identifying, and handling risks within projects. Given the complex nature of the construction sector, the adoption of risk management becomes essential. With the increase in vertical construction over recent years, especially high-rise buildings, the occurrence of risk factors intensifies, highlighting the need for risk management. Risks within construction projects include various aspects such as environmental, locational, socio-economic, construction-related, and land acquisition risks [1-3].

1.1. Objectives

- To study and examine the hazard elements linked with construction endeavors.
- To evaluate and assess the hazards associated with each task within construction projects.
- To study Quantify the seriousness and prioritize the likelihood of the most probable hazards in the construction procedure.
- To investigate and contrast the results derived from varied analytical approaches and ascertain the predominant risk elements.

1.2. Need for Study

Understand various risks that can affect residential projects, including financial, legal, environmental, and construction-related risks. Reduces the likelihood of budget overruns by planning for potential contingencies. Identifies safety risks for

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workers and future residents. Ensures that the project remains financially viable and profitable. Ensures that risks affecting the quality of construction are identified and mitigated, shown in Figure 1.

1.3. Research Methodology

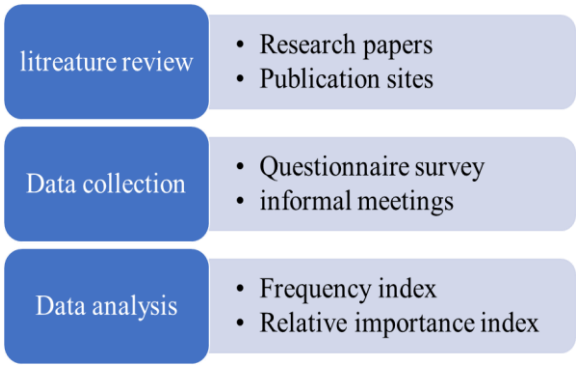

Figure 1 Research Methodology

2. Literature Review

A literature review is a form of writing in an academic curriculum that analyzes current knowledge in a particular area of study. An examination of literature entails assessing and appraising the theory on the chosen subject area. Every research paper provides novel insights and various elements such as their study approach, research techniques, data collection, and analysis. A literature review presents much more than a summary of pertinent sources. The process of reviewing includes critiquing individual sources as well as integrating these sources to formulate your research project, shown in Figure 2.

3. Data Collection

For this thesis, both qualitative and quantitative data were gathered. As a result, the data is divided into primary data and secondary data. The primary data was made up from a literature review. The secondary data was gathered using a questionnaire survey of construction professionals and stakeholders to support the core data's viability. This questionnaire covers risk management of residential project factors. The survey was crafted on the principle that the questions needed to be straightforward, concise, and comprehensible for the participants, while also being easily interpretable by the researcher. This method of scale is used for surveying with the Likert scale from very low, low, medium, high, and very high. The questionnaire survey is in two methods:

- Floating the physical copies of the questionnaire
- Floating the Google form questionnaire

After the validation 29 factors for risk of residential projects. from these factors data collection was done by questionnaire survey.

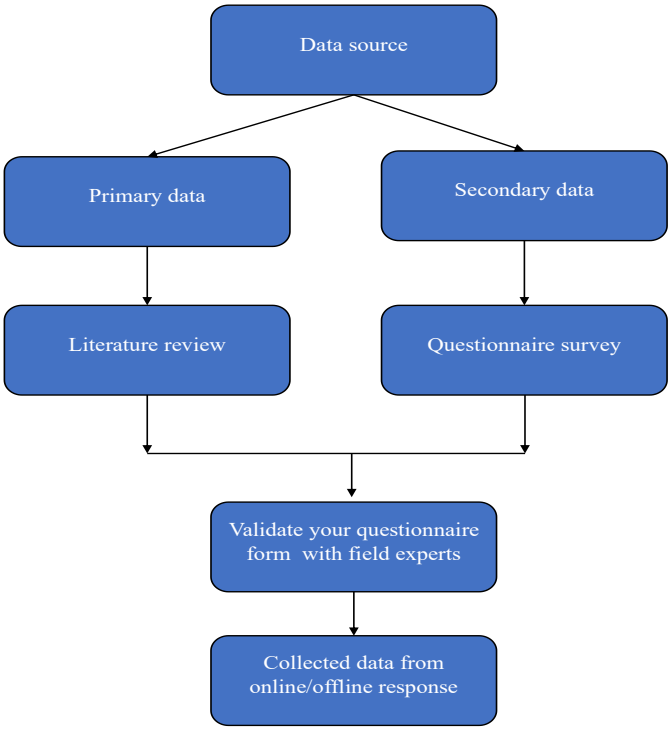

Figure 2 Methodology of Data Collection

3.1. Questionnaire Design

This survey was done to find the opinion of the Project manager, Contractor, Site engineer, and Consultant. The objective of the research is to explain to the respondent that the result of the questionnaire would be used to identify and analyze the factors affecting the risk management of residential projects. Likert scale is used to find the respondent review, Table 1.

Table 1 Questionnaire Design

1	2	3	4	5
Very low	Low	Medium	High	High very

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3.2. Sample Size Collection

Below is the Cochran formula equation employed for gathering sample size, which determines the number of responses required for the questionnaire survey. This formula is calculated as follows:

$$n_{0=} \frac{z^2 pq}{e^2}$$

Z = Z value is found to be a Z-table Confidence level (90%)
p = Sample proportion (For Infinite Universe – 50% - 0.50)
q = 1 – p (0.50)
e = Correction error 12%

$$\text{F.I. } (\%) = \sum \left[a \times \left(\frac{n}{N} \right) \right] \times \left(\frac{100}{5} \right) \%$$

As per the equation, the minimum sample size should be 50.

4. Data Analysis

4.1. Introduction

The data gathered from the questionnaire survey was analyzed using two of the standard methods. The first is frequency analysis and the second is RII relative importance analysis using SPSS software [4-6].

4.2. Frequency Index

The Frequency Index (FI) method remains a quantitative tool accustomed to assessing and prioritizing risks or issues based on their occurrence frequency. It is commonly applied in fields such as project management, construction, and safety analysis to identify the most prevalent risks and allocate resources effectively. This method is only used when samples are collected with the Likert scale. The data analysis is conducted based on the following equation:

$$\text{F.I. } (\%) = \sum \left[a \times \left(\frac{n}{N} \right) \right] \times \left(\frac{100}{5} \right) \%$$

F.I. = Frequency index
a = weight of Likert scale
n = no. of response on a scale
N = no. of respondents
In the analysis using help with spss software.
The scale is divided into 5 ranks as follows:
Very low-1
Low-2
Medium-3
High-4
Very high-5

4.3. Relative Importance Index

The Relative Importance Index (RII) method is a statistical tool accustomed to assessing and ranking variables or factors based on their perceived importance. It is widely used in fields like project management, construction, and social sciences to prioritize issues, risks, or criteria by gathering and analyzing respondents' ratings, Table 2. This method is only used when samples are collected with the Likert scale. Answers provided by the responders are transformed into the relative importance index which is carried out with the help of the equation shown below,

N5= Count of participants for very low
N4= Count of participants for low
N3= Count of participants for medium
N2= Count of participants for high
N1= Count of participants for very high
A = (Highest weight) = 5
N = Total number in the sample = 51
Relative importance index = ∑W / (A*N)

$$\sum \frac{W}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

4.3.1. RII Testing of Questionnaire Result

The bar chart displays the Relative Importance Index (RII) values for various factors, presumably affecting a particular domain such as project management or construction. Each factor is represented on the x-axis, with its corresponding RII value on the y-axis. The chart appears to compare the perceived importance of these factors based on survey data. According to the responses gained by the questionnaire survey, the risks are ranked according to their possibility of occurrence. From the below-shown figure 3, it is observed that the most likely to the lowest likely risks are ranked from the calculation of likelihood. The result shows that the most likely risk to occur is Falling heavy objects with 0.76 and the lowest risk to occur is war which is ranked with 0.39. This data is given from a questionnaire survey and data analysis using IBM SPSS software.

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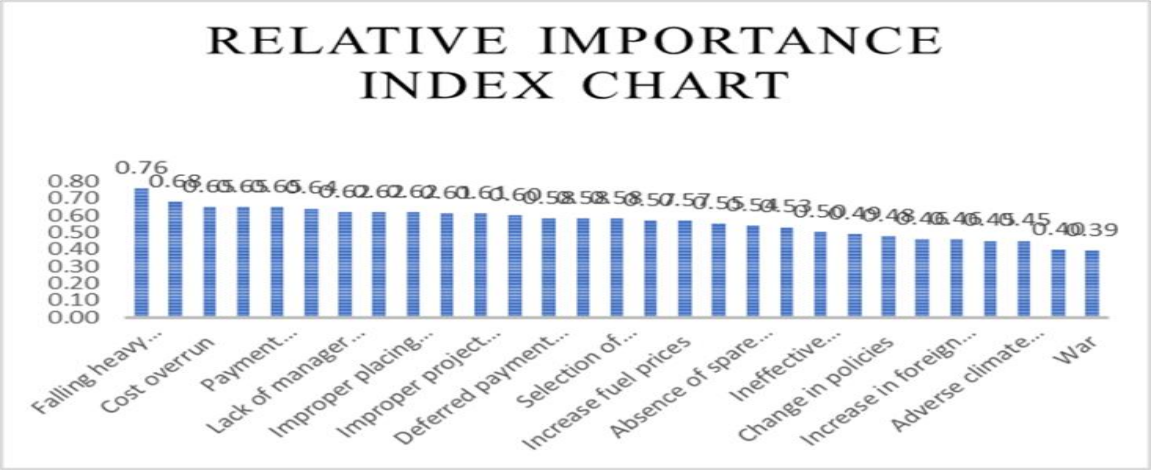

Figure 3 Relative Importance Index

Table 2 RII Results for All Factors

Questions	RII	Percentage %	Rank
Falling heavy objects	0.76	76	1
Fall from scaffolding or platforms	0.68	68	2
Cost overrun	0.65	65	3
Challenge with contractors and suppliers	0.65	65	4
Payment postponed by clients	0.65	65	5
Inadequate utilization of personal protective equipment (PPE)	0.64	64	6
Lack of manager on a construction site	0.62	62	7
Rise in interest rate	0.62	62	8
Improper placing of materials	0.62	62	9
Design cost overrun	0.61	61	10
Improper project schedule	0.61	61	11
Inexperienced staff	0.60	60	12
Deferred payment from suppliers	0.58	58	13
Placing concrete of extreme heights	0.58	58	14
Selection of material	0.58	58	15
Material unavailability	0.57	57	16
Increase fuel prices	0.57	57	17
Defective design	0.55	55	18
Absence of spare parts	0.54	54	19
Absence of skill operators	0.53	53	20
Ineffective contract drafting	0.50	50	21
Technology changes	0.49	49	22
Change in policies	0.48	48	23
Selection of contract type	0.46	46	24
Increase in foreign currency exchange rate	0.46	46	25
Political turbulence	0.45	45	26
Adverse climate condition	0.45	45	27
Wind load	0.40	40	28
War	0.39	39	29

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4.4. Top 10 Factors According to RII

Table 3. shows the Top 10 factors according to the RII method with relative importance index method result Falling heavy objects are first ranked with an RII value is 0.76. and Design cost overrun was ranked tenth and the RII value is 0.61.

Table 3 Top 10 Factor According to RII

Questions	RII	Percentage %	Rank
Falling heavy objects	0.76	76	1
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Inadequate utilization of personal protective equipment (PPE)	0.64	64	6
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Rise in interest rate	0.62	62	8
Improper placing of materials	0.62	62	9
Design cost overrun	0.61	61	10

Conclusion

In this research work the data collection was done by a quantitative approach where the questionnaire survey includes 10 major risk factors of residential buildings. The risk consider are 1) financial risk, 2) socio-economic risk, 3) project management risk, 4) design risk, 5) contractual risk, 6) safety-related risk, 7) plant and equipment risk, 8) environmental risk, 9) resource risk, 10) organizational risk. The risks of each activity are bifurcated into the 10 major risks. Based on the responses gathered from the Google Forms and physical copies. Two methods are used for analysis: 1) Frequency index method and 2) Relative importance index method. The outcomes of these methods are detailed in the following points. Cost overrun, falling heavy objects, falls from scaffolding or platforms, and challenges with contractors and suppliers are the top five risks identified by the relative important index (RII) method. The highest impact factor is falling heavy objects for risk management in residential projects. The lowest impact factor is war for risk management in residential projects [7].

Future Scope

The future scope of risk management in residential projects is anticipated to evolve significantly due to technological advancements and increasing demand for residential buildings. The future scope for risk management in residential projects involves embracing technological advancements, adapting to regulatory changes, focusing on sustainability, enhancing safety measures, and developing specialized training programs. By doing so, the construction industry can better manage the increasing complexity and scale of residential projects.

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