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A Study of Risk Management Approaches in Construction Projects in Bihar

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Abstract: ***The goal of the study is aimed to obtain an overall comprehension of risk, its influence on the construction sector, and the procedures that are needed to manage it. This study aims to identify the risk variables that have an overall negative impact on construction project performance, analyze them using the right tools and techniques, and provide a framework for risk management. Along with discussing the instruments and techniques used to handle risk in construction projects, the impact of risk on project assessment is also looked into. The main approach of the study is based in large part on the survey questionnaire that will be distributed by mail or in person to the various construction project managers and construction contractors of varying sizes. The survey's questionnaire was developed after looking over pertinent construction management literature. Leveraging the SPSS software, the replies were analysed using bar charts.***
Keywords: Risk Management, Project Management, SPSS.

I. INTRODUCTION

The systematic process of detecting, evaluating, and minimizing hazards related to a construction endeavour is referred as risk management. It entails taking proactive steps to spot potential hazards, assess their potential effects, and make plans to reduce or eliminate them. A coordinated and economical method of employing the materials and resources in order to reduce potential hazards as well as monitoring and regulating unfavourable occurrences that might happen may be included in this. Construction projects can be incredibly difficult and uncertain. Uncertainty and risk could potentially have negative effects on construction projects. In order to effectively manage uncertainty and unforeseen events and to successfully complete projects, risk analysis and management remain a key component of project management for construction projects. Due to time and cost overruns in related construction endeavours, risk in the construction sector has come under scrutiny. Risk exists in every one of our activities; the degree of risk simply differs.

This study focuses on risk assessment and risk management of different risk factors in construction projects and will cover the related previous literature on risk management, development of questionnaire for personal interviews and form being circulated on emails and suggestions related to risk management practices in construction projects. As new risks may arise and the project context may change over time, risk assessment in construction projects is a continuous procedure, making regular review and updates of the risk assessment essential to ensure the accuracy and relevance of risk information. This ongoing assessment aids in the implementation of risk management strategies and the maintenance of effective control over risks as the project progresses.

II. CONCEPT OF RISK ASSESSMENT AND RISK MANAGEMENT

The idea of risk assessment in construction projects is methodically locating, investigating, and assessing any hazards that could have an impact on the project's goals. It is a proactive procedure that seeks to comprehend the type and scope of risks in order to facilitate efficient risk management.

This proactive approach improves the endeavour's capacity to recognise and deal with risks promptly, reducing the possibility of adverse impacts, and expanding the project's whole success rate. By carrying out an in-depth risk assessment, construction projects may acquire an in-depth knowledge of possible hazards, emphasize their focus and assets, and arrive at sound choices with regard to approaches to managing risks. As new risks may arise and the project context may change over time, risk assessment in construction projects is a continuous procedure, making regular review and updates of the risk assessment essential to ensure the accuracy and relevance of risk information. This ongoing assessment aids in the implementation of risk management strategies and the maintenance of effective control over risks as the project progresses.

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A. Project Risk

Project risk, in the case of construction projects, pertains to possible ambiguities or incidents that could have a negative impact on the accomplishment of the goals of the project. These dangers may come from a number of different places and may have an effect on a number of different elements of the construction project, such as timeline, price, workmanship, safety, and stakeholder satisfaction. Risks in construction projects can result through a variety of things, including bad design, poor construction techniques, poor site conditions, environmental considerations, compliance with regulations, workforce troubles, lack of materials, engineering difficulties, adverse economic situations, and unanticipated occurrences. If the proper choice is not made at the beginning, the sequences will be more expensive the riskier the activity is. There will be some risks which are controllable and few which are uncontrollable, these have to be categorised and studied before the start of the project. There are few uncontrollable risks like natural disasters which are unavoidable and effect great population.

B. Risk Affecting Factors

The quantity and type of risks in construction projects might vary depending on a number of factors. It's essential to comprehend these elements if you want to manage risks effectively. The following are certain significant factors that can affect project risks in the construction sector:

1) *Project Intricacy:* A construction project's complexity, comprising its scale, magnitude, degree of design complexity, and technology needs, can have a big impact on the risks associated. Since they frequently have more interconnections, unpredictability, and possible failure spots, complex projects generally have higher risk characteristics.
2) *Project Timeline:* A construction project's length might affect how exposed workers are to risks. The market surroundings, legislative changes, material price variations, and unexpected occurrences that may happen over a protracted period of time are usually more susceptible to longer-duration projects.
3) *Contract Arrangements:* The structure and commitments set forth in a construction project's contracts can influence accountability and distribution of risk.
4) *History:* The technique has not been perfected over time, making fresh ventures riskier. When a comparable project has been completed successfully many times previously, the chances of completing the present project successfully are similarly increased.
5) *Stakeholder Dynamics:* Risks may be affected by the dynamics of the parties who participate in the construction project. Risks may be reduced by collaboration, open communication, and consensus among stakeholders..
6) *Employee Experience and Knowledge:* When the staffs working on project have no prior experience and expertise in construction project field, there is high probabilities of error and wrongdoing in the process. It finally results with high cost, more time required with compromised quality.
7) *Efficient Management System:* The management team working on a project must work as a whole with good intercommunication system will lead to an efficient work environment results in successful completion of project. I there is any miscommunication, it leads to problematic scheduling and resource allocation which ultimately leads to delays and effects the cost and productivity.
8) *Issues of Environmental Safety and Health:* It is essential that construction projects adhere to all applicable health, safety, and environmental requirements. Neglecting to handle these factors may result in monetary, fiscal, and social repercussions. The risks of injury to workers, damage to the environment, and the improper disposal of dangerous substances must be mitigated.

C. Determination Of Risk

The literature on risk assessment often divides into two categories: qualitative analysis and quantitative analysis. Data-driven (quantitative) methods may be used to find risk variables, and qualitative approaches like interviews, mind maps, and checklists can also be useful. Quantitative analysis is used to evaluate and assess construction project risks using more advanced methodologies and procedures. Decision tree analysis, cost risk analysis, and Monte Carlo simulation are just a few of the quantitative approaches used in quantitative risk analysis to try to assess the frequency and severity of hazards. Modelling the construction project's exposure is made possible via the use of quantitative risk analysis, which also provides numeric values for the likelihood of occurrence and potential effect of the identified risk variables. In qualitative risk analysis, risks are evaluated and prioritized using expert opinion and qualitative standards rather than quantitative measures. Without putting a monetary value on the risks, this study aids in comprehending their nature and possible effect.

Risks can be evaluated more subjectively via qualitative analysis, with an emphasis on the importance and consequences of each factor. Stakeholders in a project might arrange hazards in order of importance and provide resources accordingly

D. Source Of Risk

Alterations or mistakes in the design
Inaccurate estimation
Unclear or unattainable project objectives
Budget based on incomplete data
Contractual problems
Unskilled workforce
Legislature problem
Social and Political circumstances
Natural calamity

III. ADOPTED METHODOLOGY

In this paper, the general prospective which has been considered is the aspect of risk management and finding the different risk factors with respect to the types of construction risk.

A. Methodology

The methodology which is being adopted in this project is described below:
Brain Storming: Primary studies to get the general idea of possibility of risk and uncertainty
Survey Design: Design a survey for Personal Interview to get data for qualitative study
Conduct Survey: visits sites of different construction projects and take personal interview of related individual.
Study the Survey: List the different risk factors on the basis of personal interviews and study of previous related works.
Prepare questionnaire: For different risk factor with their scale Likert and Impact Likert and circulate it amongst the stakeholder via mail.
Data Interpretation: Study and analyse the response of the questionnaire which were circulated
Results and Discussion
Conclusion

B. Material

The data which are being used in this research are of two types:

1) Qualitative data

Questions which are identified to understand the approach as a basic are:

a) Knowledge of Risk
b) Process of Risk Identification
c) How important is the risk management
d) What is risk assessment?
e) Who are the people responsible for an effective risk management procedure?
f) Is there any course on risk management which you have studied?
g) What is your attitude with regards to risk?
h) You response to risk in a project? etc.

2) Quantitative Data

On the basis of study of previous works regarding risk management and conducting personal interviews at sites, there were numerous factors of risk were identified. Then to study their scale of occurrence and impact of various risk factors on construction project a questionnaire were prepared.

a) *Risk Rating:* A Likert scale of 1-5 was used in questionnaire. This scale is a kind of psychometric response scale in research survey. The respondents were required to select the option of different risk factors on the basis of their relative effectiveness of each of the scale occurrence of risk factor and their impact on the construction project.

Table No. I
Likert Scale And Their Significance

Scale Likert	Significance	Impact Likert	Significance
1	Rare	1	Very low
2	Occasional	2	Low
3	Somewhat Frequent	3	Medium
4	Frequent	4	High
5	Regular	5	Very High

IV. ANALYSIS AND DISCUSSION

Various risk factors which were obtained from the questionnaire survey, personal Interviews and study of previous related works, the construction project risk is categories in seven broad categories:

1) Technical risk
2) Managerial risks
3) Legal risks
4) Financial risks
5) Logistical risks
6) Socio-Political risks
7) Environmental risks

Various risk factors with their scale and impact are tabulated with its corresponding bar chart, minimum, maximum, mean standard deviation and variance as obtained from SPSS statistical tools.

A. Analytical Study And Result Of Survey

TABLE NO. II
AGE OF THE RESPONDENTS

Sl. No.	Age group	No. of Respondents	%
1	25-30years	4	14
2	30-35years	13	46
3	35-40years	8	29
4	above 40 years	3	11
Total		28	

The table gives us the information about the age group of all the respondents, 14% of the respondents are 25-30years, 46% are of age 30-35years, 29% are of age 35-40years and 11% are of age more than 40years. Therefore majority of them are from 30-35years of age.

TABLE NO. III
EXPERIENCE PF THE RESPONDENTS

Sl. No.	Experience	No. of respondents	%
1	Less than 1 year	2	7
2	1years to 5years	9	32
3	5years to 10 years	12	43
4	10 year to 15 years	4	14
5	More than15year	1	4
	Total	28	

From the above table, we can observe that 7% of respondents have experience less than 1year, 32% have experience of 1 to 5 years, 43% have experience 5to10 years, 14% have experience 10-15years and 4% have experience more than 15 years. Therefore respondents with 5to10years of experience have majority with 43% in a construction project.

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B. Comprehensive Analysis And Result Of Survey

In total, forty five construction professionals received the questionnaire, out of which 42 responded back of which twenty-eight provided a useful response. Thus, 93% of respondents responded, which is regarded as a satisfactory response in this kind of poll. The project manager, deputy project manager, quality control engineer, store and inventory manager, site engineer, or contractor completed every questionnaire survey. Since it was challenging to schedule a direct one-on-one meeting with the project management, even email replies were welcomed. Problems with subcontractors, shortage of time, skilled labour and an increase in inflation were the main issues that construction professional were worried about.

Lack of training and technical kills in available local labours is the risk factor which has maximum scale of occurrence other than this the construction company takes into consideration the lowest-cost resource, reduced work quality when there are time restrictions are the few risk factors which have maximum scale of occurrence.

Interference of local population and leadership while rehabilitation and resettlement before execution of work is the risk factor which has maximum impact on project, other than this lack of training and technical kills in available local labours , lack of regular testing materials at site and batching plant re the risk factors which has maximum impact over project.

On the basis of different risk factors, technical risk has the more number of factors which influences the project most whereas Socio-Political risks and Environmental risks has the least number of factors which influences the project.

Overall ranking of different risks factors and their scale and impact which are identified are listed in Table IV and Table V.

Table IV
Descriptive Statictics Of Scale Of Risk Factors

Ranking	RISK FACTORS	N	Mean	Std. Deviation
1.	Lack of training and technical kills in available local labors	28	3.39286	0.994030
2.	The construction company takes into consideration the lowest-cost resource.	28	3.39286	1.165532
3.	Reduced work quality when there are time restrictions	28	3.35714	0.869835
4.	Failure to complete the job by the deadline stated	28	3.25000	1.265643
5.	The employee does not adhere to the set working hours.	28	3.25000	1.004619
6.	Lack of regular testing materials at site and batching plant	28	3.25000	0.927961
7.	Workmanship is not given any consideration.	28	3.25000	1.142609
8.	Unavailability of material on time	28	3.17857	0.983327
9.	Progress on the job cannot be paid in cash.	28	3.17857	1.090483
10.	Contractor increases his workload on several projects at once	28	3.14286	1.078898
11.	Lack of transparent financing methods	28	3.10714	0.956045
12.	Lack of local workforce training facilities	28	3.07143	1.152407
13	Interference of local population and leadership while rehabilitation and resettlement before execution of work	28	3.03571	1.170063
14.	Rules governing public safety are not followed	28	3.03571	1.373887
15.	Poor inter-employee communication within the same organization	28	3.03571	0.961563
16.	Timely availability of construction equipment and their maintenance	28	3.00000	0.720082
17.	Inaccurate calculation of quantities and costing	28	2.96429	1.346660
18.	Uncertain planning because of the project's intricacy	28	2.96429	0.922241
19.	Of the abundant resources in India, there is no permanent rule.	28	2.96429	1.170063
20.	Inefficient inventory control at store department	28	2.92857	1.051580
21.	Gaps between requirements and implementation brought on by a misinterpretation of the drawings and specifications	28	2.89286	1.065947
22.	There are no ongoing evaluations of materials.	28	2.85714	0.970463
23.	Undefined Scope of working	28	2.85714	0.803432
24.	Contractual Risk: Issues related to contract formation, interpretation, and performance can lead to legal disputes.	28	2.85714	1.007905

25.	Continuous changes in management process being adopted	28	2.82143	0.862965
26.	Environmental rules regulations and protection acts	28	2.82143	1.248809
27.	The employer fails to make timely wage payments to the employees.	28	2.82143	0.818923
28.	Market fluctuation regarding material cost	28	2.82143	0.818923
29.	Improper understanding of government regulatory and permitting	28	2.82143	1.090483
30.	As projects are carried out, several design alterations are made.	28	2.75000	1.040833
31.	Rush bidding of construction project	28	2.75000	1.109721
32.	Change in laws, regulations during course of construction	28	2.75000	1.142609
33.	Numerous design modifications are made once projects are going on.	28	2.71429	0.975900
34.	Design plans cannot be carried out as intended.	28	2.67857	1.020297
35.	Lack of proper conversation between different stakeholders involved in construction project	28	2.60714	1.065947
36.	Environmental factors (excessive rain, temperature rise etc.)	28	2.16502	0.841503
37.	Change of government during construction period	28	1.94951	0.603947
38.	Accessing the site is difficult.	28	1.77956	0.653544
	Valid N (list wise)	28		

- *Result:* The frequency of various risk variables in risk management for construction projects might change based on the particular project, its location, and a number of other factors. As the survey's findings are discussed, I can provide you a broad conclusion based on a questionnaire survey of several risk variables and their frequency of occurrence as seen in the construction sector. Risk factors like Lack of training and technical skills in available local labours, the construction company takes into consideration the lowest-cost resource and reduced work quality when there are time restriction, have maximum scale of occurrence which can be identifies as frequent factors. Most of the factors which are identified comes under the somewhat frequent category of scale of occurrence. The factors which have been identified as occasional are few like environmental risk, socio-political risks with risk factors like environmental factors (flood, earthquake etc.), Change of government during construction project and assessing the site is difficult.

TABLE V:
Descriptive Statistics Of Impact Of Risk Factors

Ranking	Risk Factors	N	Mean	Std. Deviation
1	Interference of local population and leadership while rehabilitation and resettlement before execution of work	28	3.82143	0.862965
2	Lack of training and technical kills in available local labors	28	3.67857	0.983327
3	Lack of regular testing materials at site and batching plant	28	3.64286	0.826160
4	Unavailability of material on time	28	3.57143	1.026114
5	Workmanship is not given any consideration.	28	3.57143	1.069045
6	Environmental factors (excessive rain, temperature rise etc.)	28	3.57143	1.033820
7	Design plans cannot be carried out as intended.	28	3.53571	0.881167
8	Inaccurate calculation of quantities and costing	28	3.50000	1.000000
9	Reduced work quality when there are time restrictions	28	3.50000	1.036375
10	The construction company takes into consideration the lowest-cost resource.	28	3.46429	1.104943
11	Numerous design modifications are made once projects are going on.	28	3.46429	1.035737
12	Failure to complete the job by the deadline stated	28	3.39286	1.030616

13	Contractor increases his workload on several projects at once	28	3.39286	0.994030
14	The employer fails to make timely wage payments to the employees.	28	3.39286	0.956045
15	Gaps between requirements and implementation brought on by a misinterpretation of the drawings and specifications	28	3.35714	1.161553
16	Rules governing public safety are not followed	28	3.35714	1.366647
17	Inefficient inventory control at store department	28	3.35714	0.951190
18	Change of government during construction period	28	3.32143	1.020297
19	Timely availability of construction equipment and their maintenance	28	3.32143	0.904866
20	Lack of transparent financing methods	28	3.28571	1.083791
21	Market fluctuations in material costs	28	3.28571	1.083791
22	Uncertain planning because of the project's intricacy	28	3.28571	1.013141
23	Undefined scope of working	28	3.28571	0.854493
24	Lack of local workforce training facilities	28	3.28571	0.937180
25	As projects are carried out, several design alterations are made.	28	3.17857	1.218790
26	Improper understanding of government regulatory and permitting	28	3.17857	0.862965
27	The employee does not adhere to the set working hours.	28	3.17857	1.090483
28	Poor inter-employee communication within the same organization	28	3.17857	0.944911
29	Of the abundant resources in India, there is no permanent rule.	28	3.14286	1.177388
30	There are no ongoing evaluations of materials.	28	3.14286	1.007905
31	Continuous changes in management process being adopted	28	3.14286	0.890871
32	Lack of proper conversation between different stakeholders involved in construction project	28	3.10714	1.227442
33	Environmental rules regulations and protection acts	28	3.10714	1.065947
34	Change in laws, regulations during course of construction	28	3.07143	1.086229
35	Accessing the site is difficult.	28	3.07143	1.051580
36	Contractual Risk: Issues related to contract formation, interpretation, and performance can lead to legal disputes.	28	3.07143	0.766356
37	Progress on the job cannot be paid in cash.	28	2.28571	0.809991
38	Rush bidding of construction project	28	2.07143	0.176399
	Valid N (list wise)	28		

- *Result:* It's necessary to keep in mind that the effects of risk factors might change based on the particulars of every construction project. Through proactive planning, the deployment of control processes, and regular evaluation throughout the project lifespan, effective risk management entails identifying, evaluating, and minimising these risks. The factors which have been identified as most important with regards to their impact as High are Interference of local population and leadership while rehabilitation and resettlement before execution of work, Lack of training of local labors, Lack of regular testing of materials at site and batching plant, Unavailability of material on time are few of them. Most of the risk factors have impact of medium severity. Rush bidding of construction project, progress on the job cannot be paid in cash are the few factors which have least impact which fall in low impact category.

C. *Categorisation of Risk Factor*

Table no. VI
Categorisation Of Risk Factors With Respect To Their Type Of Risk And Abbreviation Used

	RISK FACTORS	ABBREVIATION
TECHNICAL RISK	Design Risks	
	Lack of regular testing materials at site and batching plant	D1
	Inaccurate calculation of quantities and costing	D2
	Numerous design modifications are made once projects are going on.	D3
	Design plans cannot be carried out as intended.	D4
	Construction Risks	
	Lack of training and technical kills in available local labours	C1
	Workmanship is not given any consideration.	C2
	Gaps between requirements and implementation brought on by a misinterpretation of the drawings & specifications	C3
	There are no ongoing evaluations of materials.	C4
	As projects are carried out, several design alterations are made.	C5
Managerial Risk	Reduced work quality when there are time restrictions	M1
	Failure to complete the job by the deadline stated	M2
	The employee does not adhere to the set working hours.	M3
	Contractor increases his workload on several projects at once	M4
	Poor inter-employee communication within the same organization	M5
	Uncertain planning because of the project's intricacy	M6
	Inefficient inventory control at store department	M7
	Continuous changes in management process being adopted	M8
	Rush bidding of construction project	M9
	Lack of proper conversation between different stakeholders involved in construction project	M10
Legal Risk	Of the abundant resources in India, there is no permanent rule.	Le1
	Rules governing public safety are not followed	Le2
	Contractual Risk: Issues related to contract formation, interpretation, and performance can lead to legal disputes.	Le3
	Improper understanding of government regulatory and permitting	Le4
	Change in laws, regulations during course of construction	Le5
	The construction company takes into consideration the lowest-cost resource.	F1
	Progress on the job cannot be paid in cash.	F2
	Lack of transparent financing methods	F3
	The employer fails to make timely wage payments to the employees.	F4
	Market fluctuations in material costs	F5
Logistical Risk	Unavailability of material on time	Lo1
	Lack of local workforce training facilities	Lo2
	Timely availability of construction equipment and their maintenance	Lo3
	Undefined Scope of working	Lo4
	Accessing the site is difficult.	Lo5
Socio-Political Risk	Interference of local population and leadership while rehabilitation and resettlement before execution of work	S1
	Change of government during construction period	S2
Environmental Risk	Environmental rules regulations and protection acts	E2
	Environmental factors (excessive rain, temperature rise etc.)	E1

V. CONCLUSIONS

This analysis should help management locate the construction project-related activities that generate a risk and, as a result, give management a basis for making rational decisions about reducing risk to a predetermined level. These results are crucial for putting additional, efficient measures in place to guarantee that future development will go in the right direction. The project should be evaluated using risk management as a major technique. To manage risk effectively, construction contractors must make it a key component of their project management. Throughout the course of a project, risk factors should also be periodically examined and modified since both new risks and changes to current risks may occur.

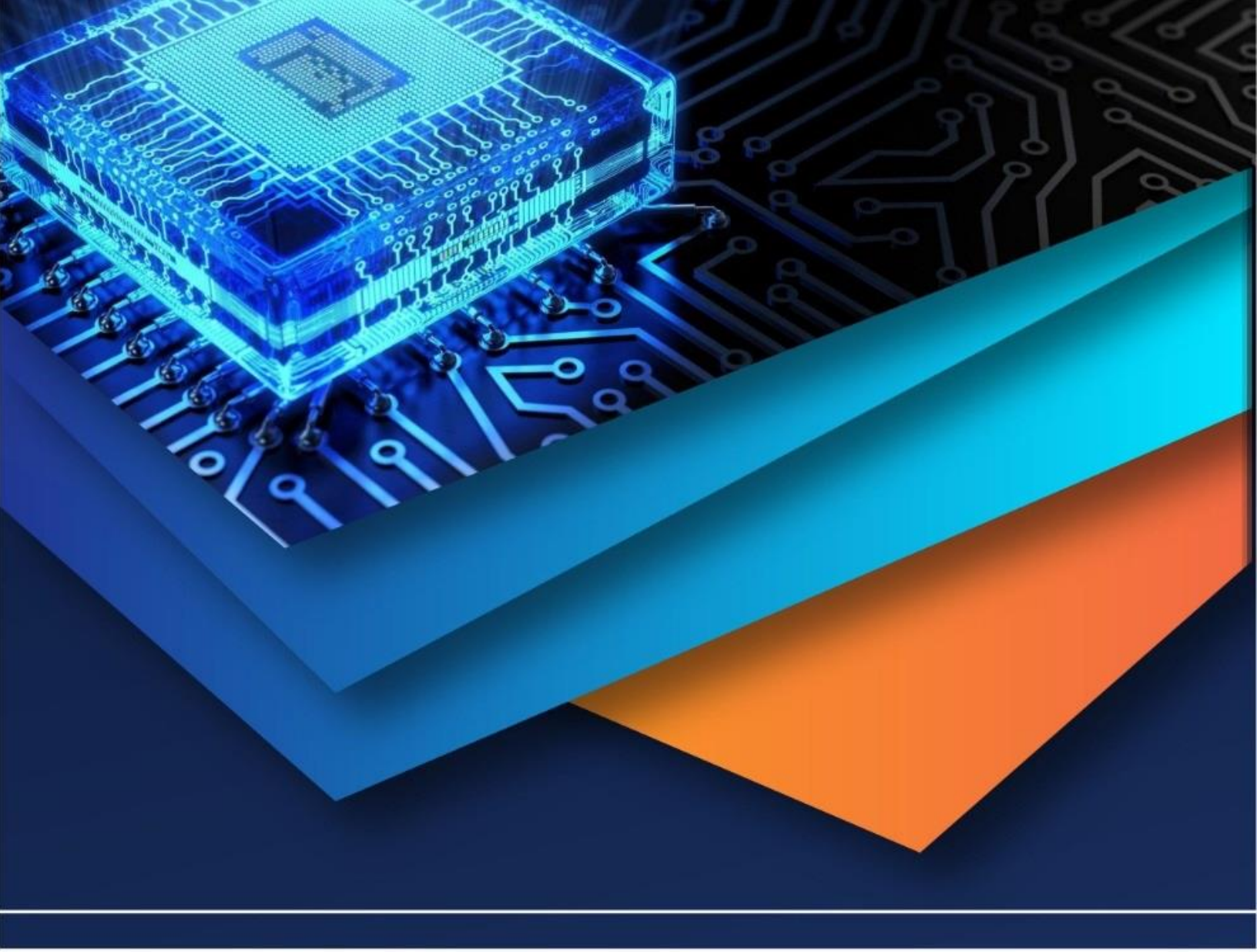
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Construction projects may manage risks efficiently, make informed decisions, and maintain a balance between risk and reward by establishing a risk-aware culture and encouraging open dialogue amongst project collaborators.

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