iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** XI **Month of publication:** November 2018

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue XI, Nov 2018- Available at www.ijraset.com

Analysis of Risk Factors in Construction Projects

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Abstract: ***The final methodology of this study depends totally on the survey form that was collected from the native building contractors of various sizes by mail or by personnel meeting. a radical literature review is ab initio conducted to spot the danger factors that have an effect on the performance of industry as an entire. The survey form is intended to probe the cross-sectional activity pattern of construction risks industry. The form ready for the pilot survey was developed by seeing the relevant literatures within the space of construction risk management***
Keywords: Risk Management, Construction Projects, Risk Assessment, Risk Factors,

I. INTRODUCTION

A variety of sudden events might occur in construction comes and plenty of of them will cause losses to the parties concerned. Such unsure events or set of circumstances that have a control on action of 1 or additional of project's objectives, square measure usually referred to as risks. The most of technology work is performed beneath contract. A contract provides a "self-contained statement of obligations as between its own parties". The analysis has conjointly known many factors chargeable for time and value overruns some inside the management of the enterprises and a few on the far side their management. The contracts square measure very important to the success of a project is very important tough, pricey and protracted proceedings. The contract documents are often used as a tool to manage risk by allocating risks to the assorted agencies through the assorted contracts between them. it's vital for all the agencies that they're aware in the least times of the extent of risk exposure or the risks that they need to manage. If this awareness is lacking then it should cause variety of disputes, disagreements and disruptions. One in every of the most important reasons of disagreement and conflict is insufficient and defective contract documentation and conjointly inappropriate contract arrangements and an unreasonable burden of risk being allotted to at least one of the parties by the contract [4]. this study aims to spot the key issues in sure important areas of a construction contract, that if not attended properly have the potential to become major roadblocks within the progress of the project within the gift work, two case studies of infrastructure comes in metropolis and Pune town of geographic region state, India, are referred. The study includes identification, classification of assorted risks in a very given set of contract documents and on basis of qualitative risk analysis verify severity of those risks, suggests ways to mitigate risks in construction comes from the client's and contractor's read purpose

II. BACKGROUND

There are unit numerous analysis papers on the risks management in construction comes in numerous countries and numerous ways for managing risk. throughout literature study, S.Q. Wang [1] proposes Risk management framework for construction comes in developing countries, D. W. Stam [6] proposes Project risk Management by suggesting a necessary tool for managing is exposed in order that a aware call may be taken on the way to manage the risks." It conjointly include; numerous risks; agencies concerned, their roles; exposure of comes to risk; effects of project section on risk. Getting in Construction is additionally mentioned and also the contract documents essential area unit noncommissioned and their significance is corn. The bridge between the 2 topics of getting and Risk is then mentioned and also the qualities of a "good" construction contract area unit noncommissioned.

III. TYPES OF RISK

Risks may be viewed as business, technical, or operational. A technical risk is that the inability to create the merchandise which will satisfy necessities. Associate degree operational risk is that the inability of the client to figure with core team members. Risks square measure either acceptable or unacceptable. an appropriate risk is one that negatively affects a task on the non-critical path. Associate degree unacceptable risk is one that negatively affects the crucial path. Risks square measure either short or long run. A short risk has a right away impact, like dynamic the wants for a deliverable. A semi permanent risk has an impression someday within the distant future, like cathartic a product while not adequate testing. Risks square measure viewed as either manageable or unmanageable. A manageable risk is one you'll support, like a minor demand amendment. Associate degree unmanageable risk is

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not possible to accommodate, like a large turnover of core team members. Risk factors for this study are classified into five categories namely.

A. Administrative aspect
B. Financial aspect
C. Manpower
D. Technical aspect
E. Resources

IV. RESEARCH METHODOLOGY

For this research, a questionnaire survey method has been adopted to find the impact of critical factors that leads to delay on resource related in the Indian construction sector drawing from various international researchers mentioned above in particular (Sambasivan and Soon 2007). A questionnaire survey was conducted of construction professionals representing various stakeholders involved in construction projects in India.

A. Questionnaire Design

The questionnaire was designed based on critical factors were identified that contributed to the causes of delays. A questionnaire survey was developed to assess the perceptions of various construction professional of the relative importance of causes and the effects of construction delays. The questionnaire was designed into two sections: Section A; section B. Section A is to obtain the requested background information about the respondents. Section B is to obtain the information on factors that contribute to the causes of delays in construction projects from the perspective of construction professionals. A total twenty eight resource related factors were identified under three broad categories namely manpower related, material related and equipment related issues. The critical factors are listed in Table 1. A five point Likert scale (1 very low, 2 low, 3 moderate, 4 high, 5 very high) was adopted where respondents were asked to rank the importance and impact of a particular factors on delay in one of their selected projects. Descriptive statistics techniques namely Relative Importance Index (RII) has been used to highlight the relative importance of critical factors as perceived by the respondents (Assaf et. al, 1995; Faridi and El-Sayegh, 2006; Iyer and Jha, 2005; Kumaraswamy and Chan, 1998).

B. Data Analysis

The data analysis will be done by relative importance index technique used to determine the relative importance of the various cause of factors. The same method is going to be adopted in this study. The five-point scale ranged from 1(very low important) to 5 (very high important) will be adopted and will be transformed to relative importance indices (RII) for each factors as follows:

$$RII = \sum W / A*N$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 4 (0 not inclusive), higher the value of the RII, more important was the causes of delays. The RII was used to rank the different uncertainty factors that cause delay. These ranking made it possible to cross-compare the relative importance of the uncertainty factors as perceived by the respondents.

Tables 1: Numerical conversion for the rating attributes

α , β	
Ratting Attributes	Numerical Conversion
0	0.0
1	0.2
2	0.4
3	0.6
4	0.8
5	1.0

After obtaining index score for each factor, standard deviation and coefficient of variation of each factor is also determined. Subsequently, ranking of factors is done based on Index score.

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V. RESULT AND DISCUSSION

A. *Analysis of Data*

Total fourteen respondents have filled up the questionnaire. Subsequently for analysis of responses following steps are followed:

1) Responses were converted into numerical values based on their rating attributes. A sample is shown in Table
2) After that mean of numerical values of all twenty eight responses is determined
3) Then, Standard deviation and coefficient of variation for each risk factor is determined
4) Afterwards, Index Score for each risk is calculated by using RI Method.

Table 2: Conversion of response into numerical values (Questionnaire 1)

S.N0.	Risk Factors	Frequency of Occurrence (a)	Severity of effect (b)	S=(a.b)
1	Employer's direct supervision in project management.	0.8	0.6	0.48
2	Lack of employing computerized software in project management	0.2	0	0
3	Absence of administrative experience in business administration	0	2	0
4	Lack of applying all specifications agreed upon by the adviser and contractor	0.6	0.8	0.48
5	Lack of sufficient administrative Cadre for project management	0.6	0.4	0.24
6	Continuous change in laws, particularly income tax law	0.4	0.4	0.16
7	Inability to execute the project within specified timetable.	0.4	0.8	0.32
8	The contractor does not pay worker wages in due time.	0.4	0.4	0.16
9	Inability to control project financial affairs.	0.6	0.4	0.24
10	Construction prices are low.Competition in pricing projects	0.6	0.4	0.24
11	Laws of employing foreign manpower are rigid.	0.6	0.4	0.24
12	Necessary technical skills are not available.	0.6	0.6	0.36
13	Low productive efficiency of the worker.	0.6	0.4	0.24
14	There is minimum attention to workmanship.	0.8	0.6	0.48
15	Design bureaus are not monitored.	0.6	0.8	0.48
16	Recurring design errors.	0.4	0.4	0.16
17	Errors in the inventory of quantities.	0.4	0.4	0.16
18	Supervising the project is not done properly.	0.2	0.4	0.08
19	Many modifications on designs are made during project's execution	0.2	0.6	0.12
20	There are many fake and not original varieties of materials	0.4	0.6	0.24
21	There are no regular tests for materials used in projects.	0.4	0.6	0.24
22	Absence of basic materials in the project.	0.2	0.8	0.16
23	Scarcity of resources sometimes, especially basic resources.	0.2	0.8	0.16
24	Agreed-upon technical specifications are not realized.	0.4	0.4	0.16
25	The contractor takes into account the resource of lowest price.	0.6	0.4	0.24
26	Heavy equipment is not maintained periodically	0.2	0.6	0.12

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INTERVIEW NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total	Mean(m)	SD(s)	C.O.V=(s/m)
Employer's direct supervision in project management.	0.48	0.36	0.36	0.12	0.24	0.08	0.64	0.24	0	0.12	0.12	0.12	0.04	0.36	3.28	0.23429	0.06	0.25609756
Lack of employing computerized software in project management	0	0.16	0.08	0	0.24	0.16	0.36	0.48	0.24	0.36	0	0.08	0.16	0	2.32	0.16571	0	0
Absence of administrative experience in business administration	0	0.04	0.04	0.04	0	0.36	0.48	0.32	0.16	0.16	0.08	0.04	0.04	0.04	1.8	0.12857	0.02	0.15555556
Lack of applying all specifications agreed upon by the adviser and contractor	0.48	0.36	0.36	0.16	0.36	0.64	1	0.12	0.24	0.04	0.12	0.12	0.04	0.48	4.52	0.32286	0	0
Lack of sufficient administrative Cadre for project management	0.24	0.08	0.16	0.16	0.32	0.36	0.64	0.48	0.08	0.36	0.16	0.08	0.08	0.16	3.36	0.24	0.04	0.16666667
Continuous change in laws, particularly income tax law	0.16	0.08	0.04	0	0.04	0.04	0.24	0.36	0.8	0.24	0	0	0	0.04	2.04	0.14571	0.06	0.41176471
Inability to execute the project within specified timetable.	0.32	0	0.32	0.48	0.24	0.64	0.32	0	0.36	0.48	0.48	0.64	0.36	0.04	4.68	0.33429	0.14	0.41880342
The contractor does not pay worker wages in due time.	0.16	0.24	0.48	0.16	0.24	0.64	0.64	0.48	0.24	0.16	0.16	0.16	0.04	0.64	4.44	0.31714	0.24	0.75675676
Inability to control project financial affairs.	0.24	0.12	0.24	0.12	0.04	1	0.64	0.48	0.16	0.08	0.08	0.36	0.04	0.16	3.76	0.26857	0.04	0.14893617
Construction prices are low.Competition in pricing projects	0.24	0.64	0.48	0.16	0.12	1	0.8	0.48	0.08	0.16	0.16	0.064	0.04	0.64	5.064	0.36171	0.2	0.55292259
Laws of employing foreign manpower are rigid.	0.24	0.24	0.24	0.08	0.24	0.04	0.64	0.08	0.08	0.08	0.08	0.16	0.04	0.16	2.4	0.17143	0.04	0.23333333
Necessary technical skills are not available.	0.36	0.36	0.36	0.08	0.04	1	1	0.04	0.08	0.08	0.08	0.24	0.36	0.24	4.32	0.30857	0.06	0.19444444
Low productive efficiency of the worker.	0.24	0.16	0.16	0.24	0.36	0.64	0.24	0.36	0.24	0.24	0.24	0.16	0.36	0.24	3.88	0.27714	0	0
There is minimum attention to workmanship.	0.48	0.64	0.64	0.36	0.12	0.64	0.8	0.36	0.36	0.36	0.48	0.04	0.48	0.48	6.24	0.44571	0	0
Design bureaus are not monitored.	0.48	0	0.48	0.16	0.16	0.64	0.8	0	0.32	0.36	0.32	0.04	0.08	0.48	4.32	0.30857	0	0
Recurring design errors.	0.16	0.32	0.16	0.08	0.24	1	1	0.08	0.24	0	0.08	0.08	0.24	0.16	3.84	0.27429	0	0
Errors in the inventory of quantities.	0.16	0.4	0.16	0.24	0.16	0.64	0.48	0.16	0.12	0.24	0.32	0.24	0.04	0.16	3.52	0.25143	0	0
Supervising the project is not done properly.	0.08	0.36	0.12	0.12	0.36	0.64	0.64	0.36	0.24	0.48	0.24	0.16	0	0.24	4.04	0.28857	0.08	0.27722772
Many modifications on designs are made during project's	0.12	0.24	0.08	0.16	0.16	1	0.8	0	0.24	0.24	0.24	0.16	0	0.24	3.68	0.26286	0.06	0.22826087

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execution																		
There are many fake and not original varieties of materials	0.24	0.24	0.16	0	0.24	0.64	1	0.08	0	0.48	0	0	0.04	0.24	3.36	0.24	0	0
There are no regular tests for materials used in projects.	0.24	0.12	0.24	0.12	0.36	0.64	1	0.08	0.12	0	0.12	0.12	0.04	0.16	3.36	0.24	0.04	0.16666667
Absence of basic materials in the project.	0.16	0.16	0.12	0.12	24	1	0.48	0.32	0.32	0.48	0.32	0.16	0.04	0.12	27.8	1.98571	0.02	0.01007194
Scarcity of resources sometimes, especially basic resources.	0.16	0.24	0.24	0.32	0.32	0.64	0.8	0.48	0.36	0.24	0.16	0.32	0.16	0.32	4.76	0.34	0.08	0.23529412
Agreed-upon technical specifications are not realized.	0.24	0.12	0.12	0.16	0.64	0.64	0.48	0.36	0.08	0.16	0.16	0.16	0.04	0.48	3.84	0.27429	0.12	0.4375
The contractor takes into account the resource of lowest price.	0.12	0.12	0.12	0.24	0.4	0.36	0.8	0.36	0.32	0.36	0.24	0.24	36	0.08	39.76	2.84	0.02	0.00704225

S.N0.	Risks	Index Score(□)	S.D.(□□	C.O.V.(□□□□
1	Employer's direct supervision in project management.	0.234	0.06	0.256
2	Lack of employing computerized software in project management	0.165	0	0
3	Absence of administrative experience in business administration	0.128	0.02	0.155
4	Lack of applying all specifications agreed upon by the adviser and contractor	0.322	0	0
5	Lack of sufficient administrative Cadre for project management	0.24	0.04	0.166
6	Continuous change in laws, particularly income tax law	0.145	0.06	0.411
7	Inability to execute the project within specified timetable.	0.334	0.14	0.418
8	The contractor does not pay worker wages in due time.	0.317	0.24	0.756
9	Inability to control project financial affairs.	0.268	0.04	0.148
10	Construction prices are low.Competition in pricing projects	0.361	0.2	0.55
11	Laws of employing foreign manpower are rigid.	0.171	0.04	0.233
12	Necessary technical skills are not available.	0.308	0.06	0.194
13	Low productive efficiency of the worker.	0.277	0	0
14	There is minimum attention to workmanship.	0.445	0	0
15	Design bureaus are not monitored.	0.308	0	0
16	Recurring design errors.	0.274	0	0
17	Errors in the inventory of quantities.	0.251	0	0
18	Supervising the project is not done properly.	0.288	0.08	0.277
19	Many modifications on designs are made during project's execution	0.262	0.06	0.228
20	There are many fake and not original varieties of materials	0.24	0	0
21	There are no regular tests for materials used in projects.	0.24	0.04	0.166
22	Absence of basic materials in the project.	1.985	0.02	0.01
23	Scarcity of resources sometimes, especially basic resources.	0.34	0.08	0.235
24	Agreed-upon technical specifications are not realized.	0.274	0.12	0.437
25	The contractor takes into account the resource of lowest price.	2.84	0.02	0.007

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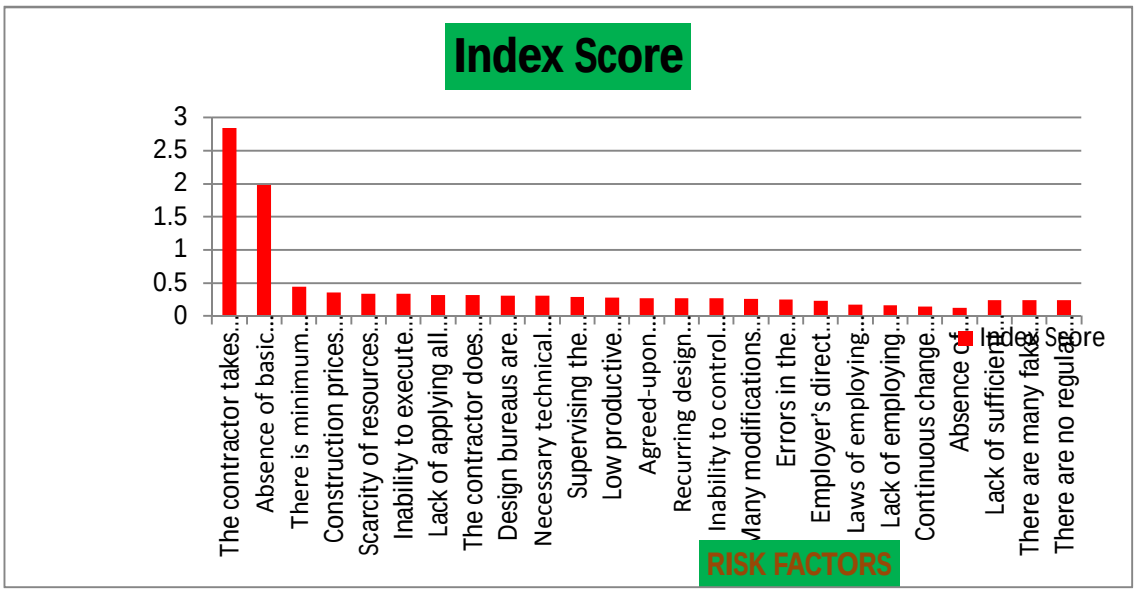
Table 6.3 Ranking of Risk

S.No	Risk Factors	Index Score	Rank order
1	The contractor takes into account the resource of lowest price.	2.84	1
2	Absence of basic materials in the project.	1.985	2
3	There is minimum attention to workmanship.	0.445	3
4	Construction prices are low.Competition in pricing projects	0.361	4
5	Scarcity of resources sometimes, especially basic resources.	0.34	5
6	Inability to execute the project within specified timetable.	0.334	6
7	Lack of applying all specifications agreed upon by the adviser and contractor	0.322	7
8	The contractor does not pay worker wages in due time.	0.317	8
9	Design bureaus are not monitored.	0.308	9
10	Necessary technical skills are not available.	0.308	9
11	Supervising the project is not done properly.	0.288	10
12	Low productive efficiency of the worker.	0.277	11
13	Agreed-upon technical specifications are not realized.	0.274	12
14	Recurring design errors.	0.274	12
15	Inability to control project financial affairs.	0.268	13
16	Many modifications on designs are made during project's execution	0.262	14
17	Errors in the inventory of quantities.	0.251	15
18	Employer's direct supervision in project management.	0.234	16
19	Laws of employing foreign manpower are rigid.	0.171	17
20	Lack of employing computerized software in project management	0.165	18
21	Continuous change in laws, particularly income tax law	0.145	19
22	Absence of administrative experience in business administration	0.128	20
23	Lack of sufficient administrative Cadre for project management	0.24	21
24	There are many fake and not original varieties of materials	0.24	21
25	There are no regular tests for materials used in projects.	0.24	21



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VI. CONCLUSION

It is required to carry out further for risk assessment and mitigation especially for large building construction projects based on a survey at national level, so as to frame detailed recommendations for professionals in the building construction industry. The construction companies need to include risk as an integral part of their project management. Decision making such as risk assessment in construction projects is very important in the construction management. The identification and assessment of project risk are the critical procedures for projecting success. This study determines the key factors of risk in construction industry. A total of 25 factors influencing risks in construction are analyzed through pilot survey which include experts of academic (Professors), governmental sectors and construction industry were interviewed, and 12 evaluation criteria were obtained as the key factor by interviewed experts. This approach provides a more effective, accurate and organized decision support tool.

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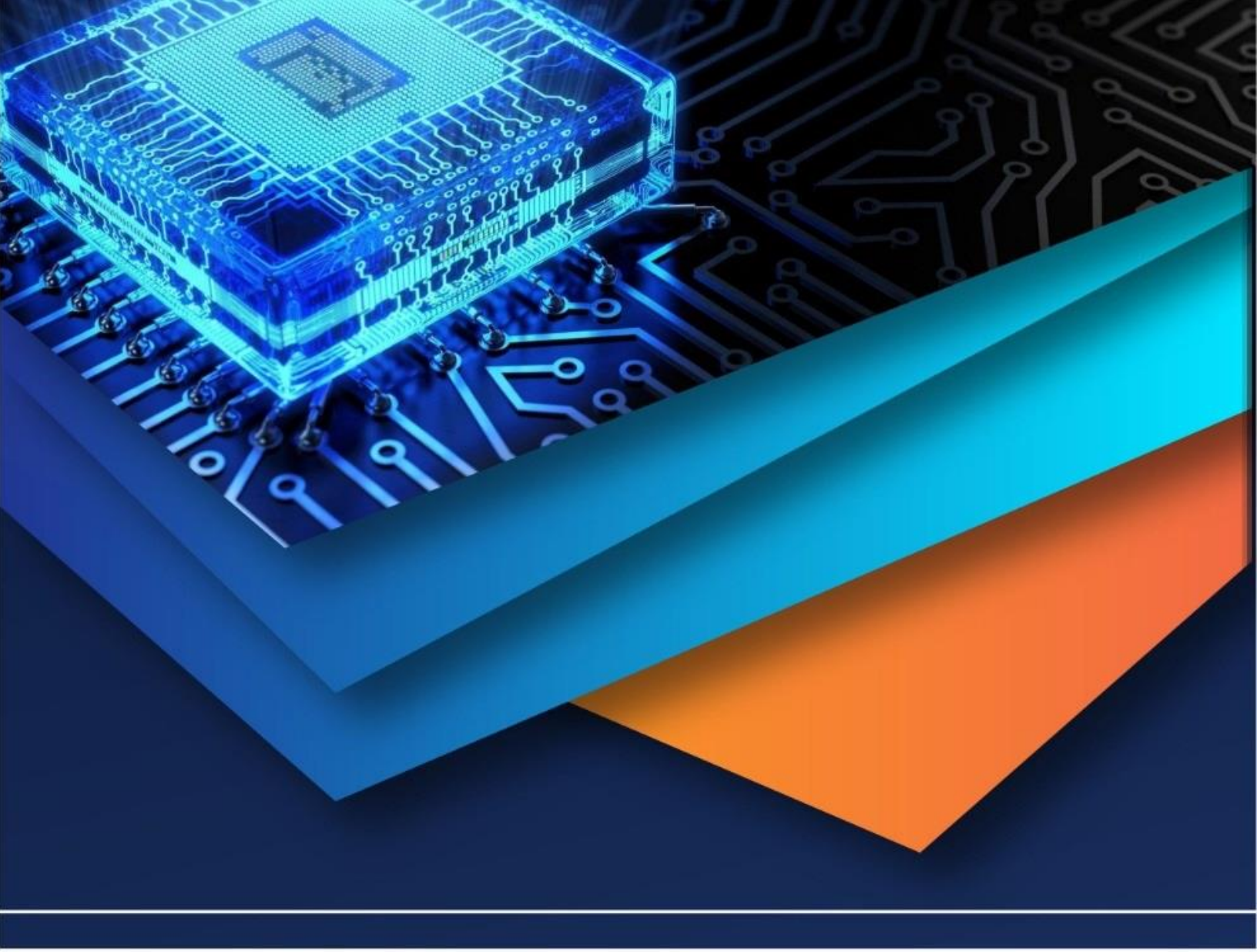

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