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Maximization of Delay Factors in the Construction Projects

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Abstract: ***Construction delays area unit distinctive one in every of the largest issues construction corporations face presently on a daily basis. The analysis presents the results of the questionnaires survey conducted to identify and conclude the relative importance index of the required factors tributary to construction delay in construction project. thus chances of construction delay in constructions comes area unit minimize and prune the numerous effects on fully totally different project throughout this study forty one dissimilar factors of Construction delay were elite once the past review of literature area unit heavily stricken by causes of construction delay if anybody doesn't is attentive to that area unit the factors that causes delay then they cannot be succeeded. There are a unit several factors induced in delay of project a number of factors known as: lack of funds, changes in drawing, lack of effective communication, poor project management. it's thus counseled that adequate construction budget, timely issue drawings and data, sensible project management skills ought to be main focus of project procurance method..***
Keywords: Delay, Causes of delay, Effect of delay, Relative important index, Reliability, Coefficient Alpha

I. INTRODUCTION

Delay could be a state of affairs within which a project because of some causes associated with the contractor, client, client's authority or different causes has not been finished in written agreement or in agreement amount. Delays area unit insidious typically leading to time overrun, cost, disputes, litigation, and complete abandonment of comes. Few comes may be found that the concern of not finishing the project on time isn't the main concern of the relevant project manager. Therefore time performance is one among the key measures of the project success. As a number of the causes of the development delays may be controlled throughout the life cycle of the project, a big resource saving may be achieved by distinguishing and managing higher these causes. Delay is classed into two types: Non-excusable & Excusable. Once the contractors area unit accountable for the explanation behind the delay, referred to as non-excusable delay. Excusable delay is any classified as paid and non- paid delay. finishing comes on time is Associate in Nursing indicator of potency, however the development method is subject to several variables and unpredictable factors, that result from several sources. These sources embrace the performance of parties, resources availableness, environmental conditions, involvement of different parties, and written agreement relations. However, it's seldom happen that a project is completed inside the required time.

II. OBJECTIVES

The main objectives of this study include the following:

A. To identify the causes of delays in construction projects.
B. To identify the approaches for solving the problems regarding delay.
C. To minimize the effect of delay in construction project.
D. To test the importance of the causes of delay between two groups.

III. METHODOLOGY

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. Thecritical 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; kmaraswamy 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= Σ 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. 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.

C. Analysis of Data

Total sixteen 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 sixteen 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.

D. Applicability of Test Results to Construction Industry

In order to ensure the applicability of test results i.e significant delays identified, to building construction industry Cronbach's alpha test is applied due to the small data size. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A “high” value for alpha does not imply that the measure is unidimensional. In statistics (classical test theory), Cronbach's α(alpha) is the trivial name used for tau-equivalent reliability(ρτ) (as a (lowerbound) estimate of the reliability of a psychometric test. Cronbach's alpha will generally increase as the intercorrelations among test items increase, and is thus known as an internal consistency estimate of reliability of test scores. Because inter correlations among test items are maximized when all items measure the same construct, Cronbach's alpha is widely believed to indirectly indicate the degree to which a set of items measures a single unidimensional latent construct. It is easy to show, however, that tests with the same test length and variance, but different underlying factorial structures can result in the same values of Cronbach's alpha. Indeed, several investigators have shown that alpha can take on quite high values even when the set of items measures several unrelated latent constructs.

Table 1: Cronbach’s Alpha**(α)** Conversion

Cronbach's alpha(α)	Internal consistency
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

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

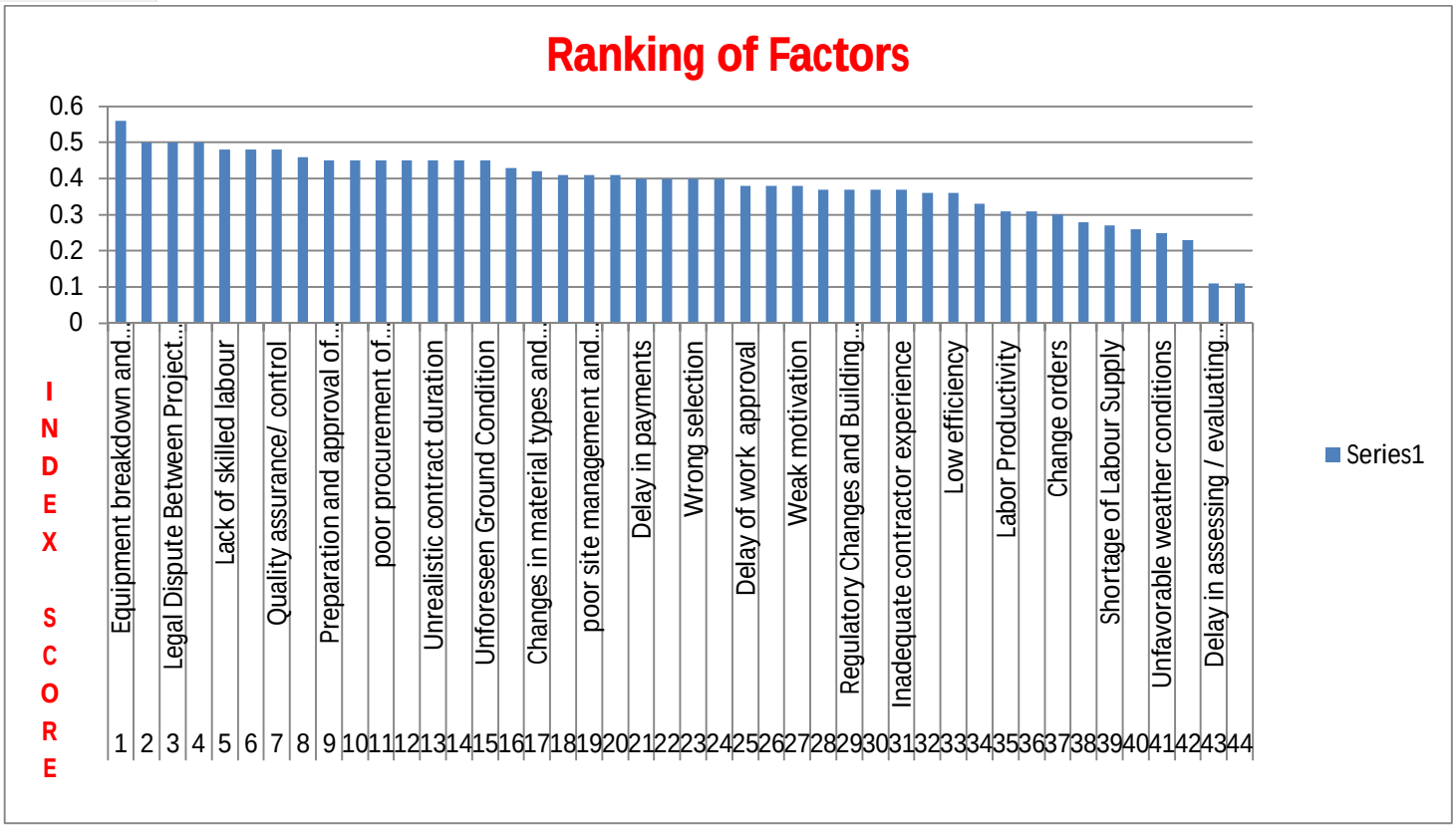
DELAY FACTORS		NA	Very Small	Small	Normal	Large	Very Large
S.NO	CATEGOREY	0	1	2	3	4	5
A	CAUSES OF DELAY						
1	Delay in assessing / evaluating major changes in the scope of work	0					
2	inadequate site investigation		0.2				
3	Delay in reviewing and approving design changes			0.4			
4	Delay in performing inspection and testing			0.4			
5	Delay in preparing interim payment certificates				0.6		
B	CONTRACTOR RELATED						
1	Financial indiscipline /dishonesty	0					
2	Inadequate contractor experience			0.4			
3	Incompetent project team		0.2				
4	Inappropriate construction methods			0.4			
5	poor site management and supervision				0.6		
6	poor procurement of construction materials			0.4			
7	Absenteeism				0.6		
C	CONSULTANT RELATED						
1	Contract Management	0					
2	Preparation and approval of drawing			0.4			
3	Quality assurance/ control		0.2				
4	Waiting time for approval of tests and inspections	0					
5	Inadequate supervision to contractor		0.2				
6	Delay of work approval			0.4			
7	Late issue of instruction				0.6		
5	Delay in the approval of contractor submission by the engineer			0.4			
D	CLIENT RELATED						
1	Change orders			0.4			
2	Delay in payments				0.6		
3	Changes in material types and specifications during construction		0.2				
4	Slow decision making	0					
5	Unrealistic contract duration			0.4			
6	Delay in approving design documents				0.6		
E	LABOUR RELATED						
1	Shortage of Labour Supply	0					
2	Labor Productivity		0.2				
3	Equipment Availability and Failure		0.2				
4	Weak motivation			0.4			
5	Lack of skilled labour			0.4			
6	Presence of Unskilled Labor				0.6		
F	EXTERNAL RELATED						
1	Unfavorable weather conditions			0.6			
2	Regulatory Changes and Building Code				0.8		
3	Problems with Neighbors				0.8		
4	Delay in manufacturing materials			0.6			
5	Legal Dispute Between Project participants		0.4				
6	Unforeseen Ground Condition	0.2					
G	PLANT / EQUIPMENT RELATED						
1	Equipment shortage		0.2				
2	Wrong selection			0.4			
3	Low efficiency		0.2				
4	Equipment delivery problem				0.6		
5	Inadequate skill of operators				0.6		
6	Equipment breakdown and maintenance problem			0.4			

INTERVIEW NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total	Mean(m)	SD(s)	C.O.V=(s/m)
Delay in assessing / evaluating major changes in the scope of work	0	0	0.2	0.4	0	0.8	0	0.2	0	0	0	0.2	0	0	0	0	1.8	0.1125	0	0
inadequate site investigation	0.2	0.4	0.6	0.6	0.2	0.2	0.2	0	0.2	0.2	0.2	0	0.4	0.2	0.4	0.2	4.2	0.2625	0	0
Delay in reviewing and approving design changes	0.4	0.2	0.8	0.2	0.4	0.6	0.4	0.4	0.4	0.2	0.2	0.4	0.6	0.4	0.6	0.4	6.6	0.4125	0	0
Delay in performing inspection and testing	0.4	0.6	0.8	0	0	0	0.6	0.6	0.4	0.4	0.4	0.2	0.2	0.4	0.4	0.4	5.8	0.3625	0	0
Delay in preparing interim payment certificates	0.6	0.6	0.4	0	0.6	0.2	0.4	0.6	0.6	0.6	0	0.4	0.4	0.6	0.6	0.6	7.2	0.45	0	0
Financial indiscipline /dishonesty	0	0.4	0.8	0.2	0.2	0	0.2	0.2	0.6	0.2	0.4	0.6	0	0.6	0.2	0	4.6	0.2875	0	0
Inadequate contractor experience	0.4	0.6	0.6	0.6	0.6	0.2	0.4	0.4	0.4	0	0.2	0.4	0.4	0	0.4	0.4	6	0.375	0	0
Incompetent project team	0.2	0.6	0.4	0.6	0.2	0.4	0.6	0.6	0.2	0.6	0.4	0.6	0.2	0.6	0.6	0.6	7.4	0.4625	0.2	0.432432432
Inappropriate construction methods	0.4	0.4	0.2	0.2	0.4	0	0.2	0.4	0.2	0.4	0.2	0.2	0.6	0.4	0.4	0.4	5	0.3125	0	0
poor site management and supervision	0.6	0.2	0.6	0	0.6	0.2	0.4	0.6	0	0.2	0.6	1	0.2	0.2	0.6	0.6	6.6	0.4125	0	0
poor procurement of construction materials	0.4	0.6	0.6	0.6	0.2	0.6	0.4	0.6	0.4	0.4	0.6	0	0.4	0.6	0.4	0.4	7.2	0.45	0	0
Absenteeism	0.6	0.2	0.4	0.2	0.2	0.2	0.6	0.4	0.6	0.6	0.4	0.6	0.6	0.4	0	0.6	6.6	0.4125	0	0
Contract Management	0	0.2	0.6	0.8	0.6	0.6	0.2	0	0.4	0	0.6	0	0	0.6	0.4	0.4	5.4	0.3375	0.2	0.592592593
Preparation and approval of drawing	0.4	0.6	0.4	0.6	0.8	0.4	0.4	0.2	0.6	0.2	0.4	0.6	0.4	0	0.6	0.6	7.2	0.45	0.1	0.222222222
Quality assurance/ control	0.2	0.4	0.6	0.8	0.6	0.8	0.6	0.4	0.2	0.4	0.6	0.2	0.6	0.6	0.4	0.4	7.8	0.4875	0.1	0.205128205
Waiting time for approval of tests and inspections	0	0.4	0	0.6	0.2	0	0	0	0	0	0	0	0	0.4	0.2	0	1.8	0.1125	0	0
Inadequate supervision to contractor	0.2	0.6	0.6	0.2	0.6	0.2	0.2	0.2	0.4	0.2	0.2	0.4	0.2	0	0.4	0.2	4.8	0.3	0	0
Delay of work approval	0.4	0.4	0.4	0.6	0.6	0.2	0.2	0.4	0.6	0.4	0.4	0.2	0.2	0.2	0.6	0.4	6.2	0.3875	0	0
Late issue of instruction	0.6	0.4	0.6	0	0	0.4	0.4	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	6.2	0.3875	0.1	0.258064516
Delay in the approval of contractor submission by the engineer	0.4	0.6	0.6	0.8	0.2	0.2	0.6	0.4	0.6	0.6	0.6	0.2	0.6	0.4	0.6	0.6	8	0.5	0.1	0.2
Change orders	0.4	0.6	0.4	0	0	0.2	0.2	0.2	0.2	0.6	0.6	0	0	0.6	0.4	0.4	4.8	0.3	0	0
Delay in payments	0.6	0.4	0.6	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.6	0.4	0.4	6.4	0.4	0.1	0.25
Changes in material types and specifications during construction	0.2	0.6	0.4	0.2	0.6	0.2	0	0.6	0.6	0.6	0.6	0.4	0.2	0.4	0.6	0.6	6.8	0.425	0.2	0.470588235
Slow decision making	0	0.4	0.6	0.4	0.2	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.4	0.2	0.6	0.6	7.2	0.45	0.3	0.666666667
Unrealistic contract duration	0.4	0.6	0.6	0.2	0.4	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.6	0.4	0.4	0.4	7.2	0.45	0	0
Delay in approving design documents	0.6	0.6	0.4	0.2	0.6	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.2	0.2	7.8	0.4875	0.2	0.41025641
Shortage of Labour Supply	0.6	0.6	0.2	0.4	0	0	0.4	0.2	0	0	0.6	0	0.4	0.4	0.6	0	4.4	0.275	0.3	1.090909091
Labor Productivity	0.2	0.4	0	0	0.4	0.4	0.2	0.4	0.2	0.2	0.4	0.2	0.6	0.6	0.4	0.4	5	0.3125	0.1	0.32
Equipment Availability and Failure	0.2	0.4	0.4	0.2	0.6	0.2	0.6	0.4	0.2	0.4	0.6	0.4	0.4	0.4	0.2	0.4	6	0.375	0.1	0.266666667
Weak motivation	0.4	0.6	0.4	0	0	0.4	0	0.6	0.6	0.4	0.4	0.2	0.6	0.6	0.4	0.6	6.2	0.3875	0.1	0.258064516
Lack of skilled labour	0.4	0.4	0.6	0.6	0.2	0.2	0.4	0.6	0.4	0.6	0.6	0.6	0.6	0.6	0.4	0.6	7.8	0.4875	0.1	0.205128205
Presence of Unskilled Labor	0.6	0.6	0.4	0.2	0.2	0.6	0.6	0.4	0.6	0.4	0.4	0.6	0.2	0.4	0.6	0.4	7.2	0.45	0.1	0.222222222
Unfavorable weather conditions	0.4	0	0.6	0	0.6	0	0	0.2	0	0	0.6	0	0	0.6	0.6	0.4	4	0.25	0	0
Regulatory Changes and Building Code	0.6	0.2	0.4	0.4	0.4	0.2	0.2	0.4	0.4	0.2	0.4	0.2	0.4	0.6	0.4	0.6	6	0.375	0	0
Problems with Neighbors	0.6	0.6	0.2	0	0.6	0.2	0.4	0.4	0.4	0.4	0.4	0.2	0.6	0.4	0.2	0.4	6	0.375	0.1	0.266666667
Delay in manufacturing materials	0.4	0.4	0	0.4	0.2	0.4	0.4	0.6	0.6	0.4	0.6	0.4	0.4	0.4	0.4	0.4	6.4	0.4	0	0
Legal Dispute Between	0.2	0.6	0.4	0.2	0.4	0.6	0.6	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	8	0.5	0.2	0.4

Project participants																				
Unforeseen Ground Condition	0	0.6	0.6	0	0.6	0.4	0.4	0.6	0.6	0.6	0.4	0.6	0.6	0.4	0.4	0.4	7.2	0.45	0.2	0.444444444
Equipment shortage	0.2	0	0.2	0.6	0.4	0	0	0.4	0	0	0.2	0.4	0.4	0.6	0.4	0	3.8	0.2375	0.1	0.421052632
Wrong selection	0.4	0.2	0.4	0.2	0.6	0.2	0.2	0.2	0.6	0.2	0.4	0.6	0.6	0.6	0.6	0.4	6.4	0.4	0	0
Low efficiency	0.2	0.4	0.6	0.8	0.4	0.2	0.4	0	0.4	0.2	0.6	0.2	0.4	0.4	0.2	0.4	5.8	0.3625	0.1	0.275862069
Equipment delivery problem	0.6	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.6	0.4	0.4	0.6	0.6	0.6	0.4	0.6	8	0.5	0	0
Inadequate skill of operators	0.6	0.4	0.4	0.2	0.6	0.4	0.6	0.6	0.2	0.4	0.4	0.4	0.4	0.4	0.6	0.4	7	0.4375	0.1	0.228571429
Equipment breakdown and maintenance problem	0.4	0.6	0.6	0.6	0.4	0.6	0.4	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.6	9	0.5625	0.1	0.177777778

Table 3. Ranking of Factors

S.No	Factors	Index Score	Rank order
1	Equipment breakdown and maintenance problem	0.56	1
2	Equipment delivery problem	0.5	2
3	Legal Dispute Between Project participants	0.5	2
4	Delay in the approval of contractor submission by the engineer	0.5	2
5	Lack of skilled labour	0.48	3
6	Delay in approving design documents	0.48	3
7	Quality assurance/ control	0.48	3
8	Incompetent project team	0.46	4
9	Preparation and approval of drawing	0.45	5
10	Delay in preparing interim payment certificates	0.45	5
11	poor procurement of construction materials	0.45	5
12	Slow decision making	0.45	5
13	Unrealistic contract duration	0.45	5
14	Presence of Unskilled Labor	0.45	5
15	Unforeseen Ground Condition	0.45	5
16	Inadequate skill of operators	0.43	6
17	Changes in material types and specifications during construction	0.42	7
18	Delay in reviewing and approving design changes	0.41	8
19	poor site management and supervision	0.41	8
20	Absenteeism	0.41	8
21	Delay in payments	0.4	9
22	Delay in manufacturing materials	0.4	9
23	Wrong selection	0.4	9
24	Wrong selection	0.4	9
25	Delay of work approval	0.38	10
26	Late issue of instruction	0.38	10
27	Weak motivation	0.38	10
28	Problems with Neighbors	0.37	11
29	Regulatory Changes and Building Code	0.37	11
30	Equipment Availability and Failure	0.37	11
31	Inadequate contractor experience	0.37	11
32	Delay in performing inspection and testing	0.36	12
33	Low efficiency	0.36	12
34	Contract Management	0.33	12
35	Labor Productivity	0.31	14
36	Inappropriate construction methods	0.31	14
37	Change orders	0.3	15
38	Financial indiscipline /dishonesty	0.28	16
39	Shortage of Labour Supply	0.27	17
40	inadequate site investigation	0.26	18
41	Unfavorable weather conditions	0.25	19
42	Equipment shortage	0.23	20
43	Delay in assessing / evaluating major changes in the scope of work	0.11	21
44	Waiting time for approval of tests and inspections	0.11	21



IV. CONCLUSION

The aim of this paper is to spot the crucial factors in construction comes as a result of delays ar thought-about to be major problem within the industry. Construction delay could be a crucial operate in construction comes. Avoid delay in reviewing and approving of fashion documents than the anticipated. Study concludes that there exist numerous factors poignant completion time of project and their impacts place construction comes at high risk that have effect on their performance. These causes are: delays in payment to contractor, info delays, poor project management, compensation problems, style changes, whether or not effects, labor strikes. Effects of those delays ar price overruns, time overruns, disputes and negative social impact. Previous literature has shown that causes and effects of the delays within the industry will vary from country to country because of variations within the geographical locations, environmental constraints, and techniques applied within the construction processes; it had been found that checklists, questionnaires, interviews with people or teams, group action, and Delphi techniques ar used as risk identification methodologies. Monte Carlo Simulation (MCS) is wide accustomed analyse the impact of attainable risks related to construction comes.

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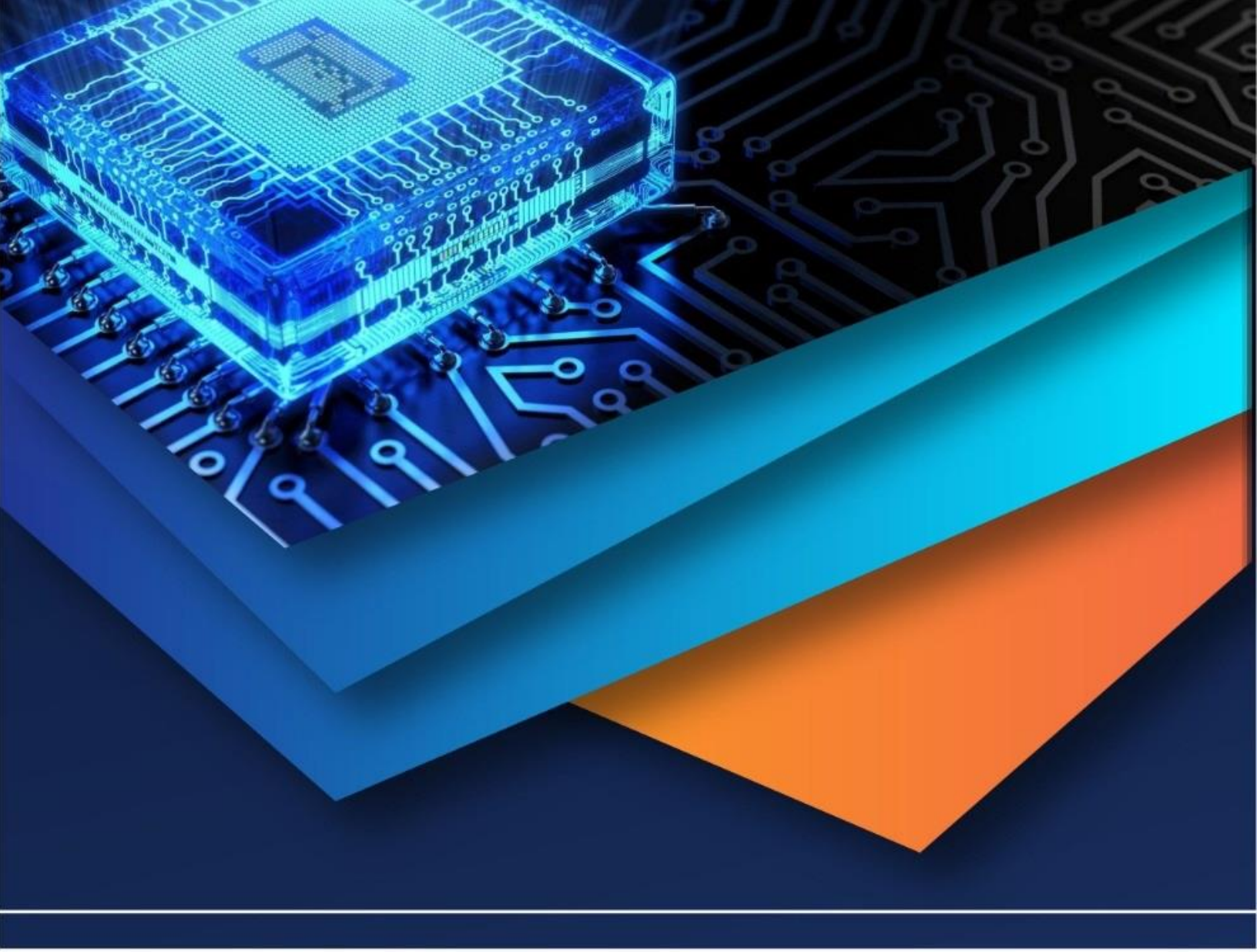

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